

Sefer HaIbbur

ספר העבור, "Book of the Intercalation"

(c. 1122)

by R. Avraham bar Hiyya HaNasi (אברהם בר חייא הנשיא), c. 1070–1136,
Barcelona

Translation by Scott Weisman



ARS ASTRONOMICA

2026

"Sefer HaIbbur (ספר העיבור, "Book of the Intercalation"), published in c. 1122, is in the public domain. All translations, original additions, including illustrations, commentaries, and summaries, are copyright.

The source text was obtained from HebrewBooks.org and is available at <https://hebrewbooks.org/21292>.

Translation © 2026 Scott Weisman. All rights reserved.

Licensed under [CC BY-NC-ND 4.0](#). Share with attribution; non-commercial; no derivatives.



Published by [Ars Astronomica](#)

Translator Version 2

Upright reason dictates that the recipients of the good, of whatever type and level of beneficence it may be, must show gratitude and blessing to the beneficent person in every way possible, commensurate with the value of the beneficence. And one who has benefited all the people of the world — for example, one who invented a new instrument for the good of the world, or a good book — it is fitting for every discerning person, out of the obligation of love of fellow beings, to at least purchase it, so that the man will profit and his heart will be encouraged thereby to invent yet more good instruments in the world. And similarly, all other wise-hearted people will likewise strive and exert themselves to invent good things and instruments needed for the repair of the world and its perfection.

And therefore, whoever says: "What do I need this new instrument for?" — he does not act well towards the world. For if not for the man who invented it, where would you be? And what would your city do? And more than this, if the man did not exert himself, what would the world do?

— R. Pinchas Eliyahu Hurwitz, *Sefer HaBris HaShalem* (1797)

If you find this translation useful, consider [supporting Ars Astronomica](#).

ArsAstronomica@protonmail.com

A note on the work

The earliest systematic Hebrew treatise on the science of the calendar, written in early-twelfth-century Barcelona. It sets out the astronomical and mathematical foundations of the Jewish calendar — the calculation of the new moon, the cycles that govern leap years, the reckoning of the seasons, and the interplay of lunar and solar time — and became the model that later calendar scholars copied for centuries. This translation makes a landmark of medieval science available in English.

A note on the translation process

This translation was produced with the [translation-pipeline](#). See the linked repository for details on the process.

This text is the product of a highly refined automated translation process. It has undergone only cursory human review and should not be treated as an authoritative or scholarly rendering. It is offered solely as a reference and reading aid — a way to make an otherwise inaccessible work approachable — and any passage of real consequence should be checked against the original source.

Acknowledgements

Translated with the assistance of Claude. The translator thanks the [Anthropic](#) team for making this work possible.

SEFER HA-IBBUR [ספר העבור]

(The Book of Intercalation)

By the ancient one, a righteous and upright man, **Rabbi Avraham bar Hiyya the Nasi**, of blessed memory [זצ"ל],

who lived in the year four thousand eight hundred and eighty-three since the Creation [4883 AM = 1122/23 CE].

[Margin: Copied and uploaded to the Internet — www.hebrewbooks.org — by Chaim, [year] תשס"ח [5768 AM = 2007/08 CE].]

This is the first book composed on the science of intercalation [חכמת העבור], and from it copied all the later authors who came after him — as did R. Yitzchak HaYisraeli [R. Isaac Israeli] in his book *Yesod Olam* [יסוד עולם, "Foundation of the World"] and his colleagues.

In it the author displayed the power of this science, and demonstrated its antiquity among the Hebrews by reliable proofs; and that in vain did the gentiles boast — for all the measures of astronomy [התכונה] and of intercalation [העבור] came into [their] hands from the mouth of the Hebrews, from their sages. Through it [this book] were explained many treatises that had been sealed and obscure down to this very day. It also contains tables [לוחות] that are numerous, exceedingly useful, and precious for every season and time.

[The text was] copied from the king's treasure-house [royal library] in Paris, the city of learning in France, and from the treasure-house of the Bodleian Library [אוצרות באדלי] in the renowned city of Oxford, in Britain.

Edited with great care, and printed for the first time

by

the young **Tzvi son of Yechezkel Filipowski** [צבי בן יחזקאל פיליפאווסקי].

At the printing house in the city of

LONDON the capital [לונדון הבירה]

"Take, please, *Torah* from his mouth" [קח נא מפי' תורה] — in the year of the sixth millennium [לאלף הששי].

The Editor's Introduction [הקדמת המבקר]

Many are the people of our day who bring forward old manuscripts before the altar of the press; yet there is no single approach agreed upon by them all. The first man prints the manuscript just as he finds it, adding nothing to it and subtracting nothing from it. This may be because, like a priest offering a sacrifice who does not scrutinize whether it is sound or defective, he therefore finds no blemish in it — the sort of man who likewise takes no care over the errors and mistakes added by the press; or it may be because he supposes that whatever he has found is holy. As has happened to many in our times, they rejoice when they find an old book to bring out into the light — and so the light becomes darkness for them!

The second man, too, makes no alteration within the manuscript, yet he does not refrain from commenting on certain passages obscure to him, which in his judgment are errors; and at times he states his conjecture in tentative language — "perhaps" [אפשר] or "it may be" [אולי] and the like, words that signal doubt — because he is afraid to touch the holy and pronounce in the language of certainty, lest he be reckoned a deceiver in the eyes of the scholars who in days to come will expose his folly.

The third is the one who corrects and alters, adding and subtracting according to his own first impression, without giving any indication of where he has departed from his exemplar [the manuscript before him], relying on his own intellect and understanding — even though at times it may turn out to be his folly.

And the last [type] is the most burdensome of them all: those who pay no heed whatever to the character of the book — for they have been struck blind, [going] only by the sound of those who whisper in their ears. Suddenly a craving seizes them, and they become "joiners of texts" [book-makers]; they scour the earth to make a breach, and they form schemes [literally, "create souls"] to lend a hand to print an old book — only in order to make of it trade and gain. Therefore they take no concern for the book itself, whether it comes out distorted, and they hand it over to others just as it is. As for those who print an old book out of love of wisdom: it commonly happens that, beneath the hand of the press, they do not grasp the book's proper sense; and what appears good in their eyes is at times in fact bad, while the bad they exchange for the good. This is an evil matter, which the One who gave these men over to mankind [has allowed them] to be afflicted with.

All these — the bringers-forward or the editors — give no thought to the fate of old manuscripts and the accidents that befall them from generation to generation. Surely you know, pleasant reader, that there is not one in a thousand among the extant manuscripts that was written in the very hand of the author himself. All of them are but second, third, and fourth copies — whether from the original manuscripts [or further removed]. You also know that even if a man copies a book from some printed book, he will not escape error and mistake. For who can perceive the errors? — especially in the matter of haplography [the skip, *הדילוג*], where they often leap from one word to a word resembling it. And how much more so if one copies the book from a manuscript whose lines are not straight and whose letters are long and short, whose appearance and form, with the passage of time, have turned reddish [faded to a rust color], and which are all but "fragments of the hand" and "fragments of the foot" [worn scraps]! On top of all this, the shapes of the letters have multiplied with their eras — for every scribe in differing lands and regions had his own manner in the forms of the letters; and even the work of their fingers [their handwriting] became distinct by kinds, into the hundreds. How, then, is it possible that any copyist — even if he be a swift scribe — should hit the mark and not err? And how much more so if the copyist does not understand the character of the book!

In truth, the deeds of these men are not like the deeds of the upright man in whom a spirit of wisdom stirs — for a different spirit is in him. He does not pursue gain; his soul does not chase after it. Rather, the inheritance of truth and righteousness is his whole desire — if his heart prompts him to bring forth a book from the depths of forgetfulness. He looks and considers, line upon line and rule upon rule; he will not rest and will not be still until he has revealed the author's hidden things by means of the hard places and many devices. Whatever is obscure he truly elucidates, and he is not ashamed to comment upon what concerns the reader, refining his path in all the work of his hands. Upon him let the blessings of heaven descend from above.

All this I have seen fit to set before you, my discerning reader, so that you may know how anxious I have been on your behalf — that you may learn the history of the book that lies before you, and what my labors with it have been. Do not imagine that, just because it is printed here in the form in which I found it in the libraries, the work of printing was therefore the whole of my task. Not so. The two manuscript copies that I found in Oxford and in Paris — even if they do not differ in their content — differ greatly in the order of their wording. By way of illustration, I set out before you here a few of these variant readings, that you may infer the rest from them:

In the Paris recension [בנוסח פאריז]	In the Oxford recension [בנוסח אוקספורד]
Page 74, line 19 [דף 74 שורה 19]: "which was customary in it, and the cold returns to its original state."	"And likewise the measure of the days — whether short or long, or [whether] the cold and the heat [are] short or long; and the cold returns to its original state."
Page 76, line 2 [דף 76 שורה 2]: "If it is not needed for the intercalation."	"But if in its composition it is not needed, then the intercalation reckoning is not [carried out]."
Page 76, line 19 [דף 76 שורה 19]: "But sayings have been corrupted regarding them, the reckoning."	"But some say it comes to it. (See the section on the reckoning.)"

Had I wished to print all the variants, the size of the book would have doubled — and this is not necessary, for the essential thing is the content of the book, not the form of its wording. Beyond these variants of wording, the two copies were further filled with errors and mistakes, with no soundness in them. And if I had not known and understood the science of intercalation as is required, I could not have brought out this precious book in any presentable form. Hear me now, my reader: here is a small chapter of this very book that came to light a few days ago, [printed] from the [edition] of R. Eliezer Ashkenazi in the *Sefer Divrei Chachamim* [(Metz, 5610 / 1850 — [מיץ ת"ר] — namely the seventh gate of the third treatise [מאמר השלישי]. And these are the errors that I found in its printing — though there are yet more of these errors found in the manuscript itself (see in this book):

Page 96, line 2 [דף 96 שורה 2]: for *tarmav* [תרמב] read *tarnav* [תרנב]. — Line 5: for *bad talach* [בד תלח] read *kad talach* [כד תלח]. — In the genealogies [בתולדות] [a word] is missing. — 13: *goach nyach* [גוח ניח]. Page 9, line 1: *ralah rala* [רלה רלא]. — 2: *lo* [לא] is missing. — 4: *ha-achadim* [האחדים] [a word] is missing. — 17: of the secret [של הסוד]. — 31: in order [על הסדר]. — 31: "but not" [ולא אלא]. — 26: *ve-shenei konnu* [ושני כונו]. — 28: of the documents [לשטרות] [a word] is missing. — 31: *ilu aval* [אלו אבל]. — 33: from the principle [מן העקר] [read] the principle, pen [העקר פן]. — 34: *hu chu* [הו חו]. — 36: *nav nag nav gimel* [נב נב ג], *nav nag nav nav* [נב נב נב נב]. — 37: to teach support [ללמד מעמד]. — And more like these.

[The above is Filipowski's list of compositorial errata; these are bare numeral/word citations keyed to scattered locations in his edition.]

And now you should know well that my labor was very great in setting this book aright, for nearly all the measures found in it were corrupted, and every number and figure, and all the tables found in it, I had to compute anew. I am confident that there is now no error at all in them, and that they may be relied upon in every respect. As for the matter of the wording: of the two copies I chose the better, the one that seemed right in my eyes — following in the footsteps of the [editors] whom I named first; and I placed no trust in the old copyists, for they did not compose the book themselves. Nor did they understand the essence of the book — so how could they have known the errors they made? And all the corrections I made, I am convinced they are sound; and had the author himself, of blessed memory, been alive, he would have agreed with my words, [saying] that his book was now printed as he had written it with his own fingers.

Know this too: some of the tables that the author of blessed memory had computed had already become obsolete long ago. So, in order to do a good service both for the author of blessed memory and for everyone who acquires the book, I have added new tables for the years to come — and they are all clean and pure, for they were tested seven times over [a sevenfold examination] and corrected with the utmost care, so that none who seeks them may stumble over them.

Life of the Author [תולדות המחבר]

The author of this book before us is the Rabbi R. Avraham bar Hiyya the Sephardi [ר' אברהם בר חייא הספרדי], known in everyone's mouth by the title *HaNasi* [the Prince]. He was alive at least until the year [4]883 of the fifth millennium [תתפ"ג 4883 = לאלף החמישי AM, i.e. 1123 CE], as appears from his book, page 112 — for there he says as follows: "And for this reason I made [the following]: In its colophon, one table in which I recorded the chronological markers of the years from the head of cycle 258 [מחזור רנ"ח] (which is the year 4883 [ד' אלפים תתפ"ג]) now coming upon us, for our good, in the year that comes upon us for good) until the end of cycle 278 [מחזור רע"ח]" — thus far his words. And that year, 4883 [תתפ"ג], he likewise took as an example in other places of this book, as on page 83 and on page 106.

We do not know with certainty the city of his birth, but it is very probable that he was born in the city of Soria [שוריא — Soria, in Castile], whose location lies at latitude 45 degrees [ברוחב מ"ה מעלות] in the land of Sepharad [Spain]; for he prepared a long table for the reckoning of the molad [מולד] adjusted to the meridian of this city. And even if his birthplace was not this city, it was in any case a city in which he resided — for so the authors of astronomical tables do: to

give an advantage and prepare special tables for the city of their dwelling. From the land of Sepharad he removed his tent to the land of Tzarfat [France], and there he was gathered to his people.

The author composed eight books, and these are they:

1. *Sefer Tzurat HaAretz* [ספר צורת הארץ — "The Form of the Earth"] [*Die Theoretische Astronomie*]

First printed by Sebastian Münster [סיבסטיין מונסטר] with a Latin translation, and a second time, in fuller completeness, at Offenbach [אופיבאך] in the year [5]480 [5480 = שנת הת"פ AM, i.e. 1720] by R. Yonatan in the *Sefer Yeshuah B'Yisrael* [במ"ח ספר ישועה בישראל]. That book comprises the whole science of astronomy and observation [התכונה והחזיון] according to the old system [(a)]. He composed it about the year [4]865 [התתס"ה], as appears from the reckoning of his motions [in the tables] in the eighth gate. It is divided into two parts: the first part is the one we have mentioned, comprising the whole science of astronomy and its causes, and most of the opinions that were current among the ancient astronomers — those not of Israel — concerning the astronomical measures, such as Ptolemy [תלמיוס — Ptolemy] and al-Battani [אלבטאני — al-Battānī] and others of the sages of Ishmael [the Arabs]. And the second part is the one called by the name:

2. *Sefer Cheshbon HaMahalachot* [ספר חשבון המהלכות] — "The Reckoning of the Motions" [*Die Practische Astronomie*]

It comprises the method of computation for the motions of the two luminaries and for the motions of the wandering stars [the planets], according to what he explained in the first part. He further added to it a collection of tables known by name:

3. *Luchot HaNasi* [לוחות הנשיא] — "The Prince's Tables" [*Astronomische Tabellen*]

In it there comes a collection of various tables in astronomy, and [tables] for the computations of the positions of the said stars [the planets], along with the method of using the tables — found beside each and every one of them. And in the manuscript before me there were likewise found certain elucidations and glosses from Ibn Ezra [מהראב"ע — R. Avraham ibn Ezra]. There is one in Paris [Oratoire 189].

[Footnote (a):] At the time of the author, the Hebrew term *tekhunah* [astronomy] had not yet been coined; in its place they wrote *chizayon* [observation]. And therefore HaNasi called the science of *Sefer Tzurat HaAretz* by the name "the science of the *chizayon* (vision)." [Hebrew: וע"כ קרא הנשיא את חכמת ספר צורת [הארץ בשם חכמת החזיון]

[Footnote (b):] So said HaNasi in the eighth gate, opening with the reckoning of the motions: "And the first table is engraved from the head of cycle 256 [מחזור רנ"ו = cycle 256], because the foundation of the computations arranged in this book — and their starting point — is the position of the stars at their mean motion at midday of the fifth [day], which is the New Year of the first year of cycle 256 [רנ"ו], namely the year 4865 [4865 = AM ד' אלפים ותתס"ה] *la-briat olam* [to the creation of the world], for those who reckon from BeHaRaD [מן בהר"ד — the molad of creation]. And from that day onward I arranged the mean motion of the stars in these tables, and the root engraved at the head of the tables for the motion of each star is its position on that fifth day at midday — by the meridian of Jerusalem the Holy City, which is distant about seven hours from the edge of the eastern extremity of the inhabited [world]" — thus far his words. From here the chroniclers believed that HaNasi lived in the year 4865 [ד'תתס"ה] (see *Me'or Einayim* [מאור עינים], ch. 23 [סכ"ג]). And it is most astonishing that the wise R. Azariah de' Rossi [עזריה האדומי — Azariah de' Rossi], after having seen the *Sefer HaIbbur* many times, did not see that it was composed about twenty years after the *Cheshbon HaMahalachot*.

At the head of the *Sefer HaIbbur* [ספר העבור] of the author, before [the section on] the motions, the author says as follows:

"Said Avraham bar Hiyya the Sephardi [הספרדי], may he rest in Eden: I begin in the name of the Lord, who sits enthroned upon the cherubim, to set forth the order of the reckoning of the motions of the stars. And I open and say: May the rock of my strength and my help be a help and a support to me, that I may complete the explanation of the form of the earth and the structure of the heavens that revolve about it, and the order of the motion of the stars set within them, and all the matters that are explained in them — in the first book of the work of observation [the *Tzurat HaAretz*]. And behold, I now come, with the help of my Creator and Possessor, in the second book, to fulfill the condition I imposed upon myself: to set forth the order of the reckoning of all the kinds of motions mentioned in the first book, according to their varieties. And I have poured out my supplication before the Merciful One, that He

support and uphold me in explaining this reckoning according to its way and its order, by the abundance of His mercies. This book is divided into large parts, which are the gates [שערים], and each and every gate of them is divided into chapters [פתחים, "openings"] according to the matters and the orders that that gate comprises. And I make mention at the outset of the topics of the gates in their order, so that they may be ready for everyone who needs them. And afterward I shall proceed to set forth the topics of each and every gate in its order, and I shall expound all the computations that depend upon that gate, as far as I am able, as the One who is on high will help me, with the help of God. And at the end of this book the explanation of the reckoning of the motions [will be given]. And in this way the Greek sage Ptolemy [בתלמיס היוני — Ptolemy the Greek], the chief of the sages of Greece in this craft, expounded [it] in the book he composed on the science of empirical inquiry — namely the book called the *Four Discourses* [ספר ארבע המאמרות — the *Tetrabiblos*, or here rather the *Almagest*] [?] — and upon him is there to rely. And you will find this reckoning expounded by many methods, in any one of which there is to be relied upon. And I have concluded my words here, [praising] my Creator who helped me; may His name be praised forever, Selah. And we shall go on and not be hindered."

And besides all this, it appears from the introduction to the *Tzurat HaAretz* that it was in the author's intention to write a further book on the science of empirical inquiry [astrology — אצטרולוגיא], for he says there: "And over and above all this, if God grants me [the strength] to complete the work of observation to its end, I shall turn my heart to expounding the craft of empirical inquiry, with God's help." And it is very possible that a book of his on this subject does exist — for the *Tzurat HaAretz* and the *Cheshbon HaMahalachot* were already finished by him before the coming of cycle 256 [מחזור רנ"ו], and he lived at least until the head of cycle 258 [רנ"ח]. And a witness to his belief in astrology is none other than his book *Megillat HaMegalleh* [מגילת המגילה], which we shall mention below. Yet who knows where its place is.

4. *Sefer Hegyon HaNefesh* [ספר הגיון הנפש] — "The Meditation of the Soul"

At the head of this book these words are found:

Sefer Hegyon HaNefesh ha-atzuvah [The Meditation of the Sorrowful Soul] — knocking at the doors of repentance, and upon its doors it stands

erect: four pillars [ארבעה עמודים]; The first pillar: the beginning of the world and its origin; and the order of its building and its structure. The second pillar: what is good for a man to do in this world all the days of his life. The third pillar: how the sinner may be saved from his wickedness, by his consolation and his repentance. The fourth pillar: the gathering-in of man and his passing; and the end of the world and its final state.

And at the head of the first pillar we further found the author saying: "The first pillar: the opening of the meditation, in the praises of God Most High. Said Avraham bar Hiyya the Sephardi: Blessed [is...]" etc.

[Footnote (*):] The manuscript before me was copied by Shmuel ben Moshe, scribe and judge [סופר ודיין] of the holy community of Prague the capital, on the eve of the Festival of Shavuot, [5]392 [5392 = שצ"ב AM, i.e. 1632 CE]. — From another manuscript, at whose end the following words are written: "The book is completed — namely the reckoning of the motion for *Nesi'enu* [our Prince] the great, R. Avraham, *ṣāhib al-shurṭa* [צה"ב אל שרטה — Arabic: "chief of the guard / of police," a title], son of HaNasi R. Hiyya, may his memory be a blessing, in the city of Barcelona [ברצלונה], in the year [4896 = ד'תתצ"ו = תת"צ AM, i.e. 1136 CE], on day 6 [Friday], the 22nd day of the Omer [כ"ב בעומר], at midday — that is the tenth of April by the months of the sun." — And it is possible that this first manuscript was copied during the lifetime of the author.

The last treatise of the *Megillat HaMegalleh* came to me from these matters, [transmitted] by the wise R. Yehudah Loeb Dukes [ר' יהודה ליב דוקעם], may his light shine. In the libraries of Oxford only the first pillar of the *Sefer Hegyon HaNefesh* was found, with no author named in it; and the compiler of the catalogue gave no notice of this matter. Now, the first pillar comprises general investigations into the work of Creation — but the investigations proceed without break, and are not divided into gates; and it is very hard to separate out any single topic. So for the reader's convenience I set down these lines below, [for him] to consider.

"And the firmament [הרקיע — *raki'a*] here is the form that is attached to the thin and pure part [of matter], freed from [gross] matter — a thing that is not corrupt and that does not change all its days. The verse says, 'Let there be a firmament in the midst of the waters' (Bereishis 1:6), to teach you that the firmament is fixed and set within the light — the bright light of the first day — and the light surrounds it on all its sides; and it is the place for [the forms] to be supported and to stand. And the

meaning of '[in the midst of] the waters' [המים] would be the form that comprises all the forms hewn from it. And it says, 'and let it divide' [the waters from the waters] (Bereishis 1:6), [meaning] that the firmament divides between the form that is not attached to any body at all — which is the light created on the first day — and the form that is attached to it, a fixed thing that does not stand in a single order: namely all the creatures formed on the third day [literally]. And the firmament stands between them, [attached] to a form that is attached to a fixed, enduring body that does not separate from it all the days of its standing. This is the reason for understanding this verse, where it is said 'between waters and waters.' And do not let the meaning of literal water [ממש מים] be understood from it — for in this matter we have no need to bring [the notion of literal water] to mind, since we find a straight path in the plain sense of the verse, [a sense] that follows the order of wisdom and knowledge and that does not depart from the usage of the language, as we have explained to you. And so the verse says, 'Praise Him, you heavens of heavens, and you waters that are above the heavens' (Tehillim 148:4) — as though it said: the form and the bright light that is above the heavens — and it is not speaking of literal water, as it has risen in the mind of most people who do not understand the way of wisdom. For had this been so [literal], it would have had to mention 'the waters that are beneath the heavens' just as 'the waters that are above the heavens' — and it did not do so. Rather, it mentioned the products of water, which are snow and vapor, to teach you that the waters mentioned above are not literal water but a pure, clean, and limpid form. And let no doubt enter your heart from what you find in the words of the Sages of blessed memory, that there are before the Omnipresent storehouses of water [אוצרות מים] to rain upon the earth — so that it should rise in your heart that there is literal water set in the firmament. Rather, know that there are before Him, may His name be exalted, storehouses of water and storehouses of wind and storehouses of snow and storehouses of hail and storehouses of vapor [literally "snow and smoke"], and storehouses of bread and storehouses of sustenance and storehouses of silver and gold — all of which come by His word and by His utterance, and are not present in [physical] body before us. And this is the opinion of the believers who understand His glory, which it is incumbent upon every person to rely upon; and it is the opinion of our Rabbis of blessed memory, who concede to it and teach it. And if you should see them [the Sages] producing an exposition [a *derash*] that, by

its plain sense or by its appearance, departs from the truth of this matter or the like, know that it was said in order to bring that idea near to the many opinions whose way is not to understand except by what is visible to their eyes, from the ways of this world" — thus far his words.

And at its end these lines are found:

The Hegyon is complete;	praise to God Most High;	who created all that exists.
and the hearts of those who love evil	He will remove and not diminish;	the Just One, His fountain.
and a pure, awesome heart	God will create for His people;	and He will send away all its iniquity.
the well from which manna is dug,	and his place He will lay bare;	to give drink to His flock.

5. *Sefer Megillat HaMegalleh* [ספר מגילת המגלה] — "The Scroll of the Revealer"

The name of this book according to the author himself, and according to the common usage of the Hebrew writers in Sepharad [Spain], is this: *Sefer Megillat HaMegalleh, Sod HaGe'ulah* [The Scroll of the Revealer, the Secret of the Redemption], in five gates [חמשה שערים]. In it R. Avraham reckoned the End [the messianic terminus] for the year 5118 [= שנת חמשת אלפים מאה ושמונה עשרה]. 5118 AM, i.e. 1358 CE].

The opening of the book according to the Oxford recension is this: "In Your name, O Merciful One [בשמך רחמנא]. I, Avraham the Sephardi, son of R. Hiyya, may the memory of the righteous be a blessing, hereby strengthen myself, in the mighty and awesome power of [Him who is] glorious, to compose a scroll [מגלה] that shall be a revealer [מגלה] of the secret of the redemption." And accordingly the vocalized title of the book is *Megillat HaMegalleh* [מְגִלַּת הַמְגַלֵּה]. — The opening of the book according to the recension that the scholar Geiger [גייגר] — Abraham Geiger] copied from the Munich manuscript is this:

"For I open with it and say: 'Blessed is the Lord, the God of Israel'" etc.
 "And after I have prefaced the praise of [Scripture], which is a place [where] it is a duty and a commandment to expound each matter on its own and to set it before every matter and word: I begin upon the matter

of the composition and say: every matter that is the root [of the thing] — which strengthens or upholds some good thing for Israel in this exile, or fortifies their heart in faith, or adds to them confidence and hope — it is good for a man to expound upon it and to occupy himself with it" etc. ... "How much more so, if Scripture should esteem it and oblige every person to expound upon it and to occupy himself with it, [namely] the reckoning of the End that we await..." "[He] strengthens all these good qualities..." "And if we see mighty men of wisdom, and authorities and great ones of the men of the faith who are before [us]..." "...investigated this matter, and reckoned its reckonings before their eyes, and yet in our iniquities they came to nothing and passed away — let this not hold [us] back. And every..."

[the matter] when you find that the reward of their work was set before them. To uphold the faith and to guard its principles, the early authorities occupied themselves with this subject... in many places in the words of our Sages of blessed memory. And so Rabbenu Saadia Gaon [R. Saadia Gaon] did when, in his commentary on the Book of Daniel and in many of his compositions... and many before him and after him likewise — such as the work he composed called *Sefer HaEmunot* [The Book of Beliefs and Opinions], also known as *Sefer HaGalui* [The Book of the Revealed]...

The purpose of the book is recalled at its outset. In the **first gate** he arranged for us several [chapters] drawn from the external science, treating the novelty of the question of time and its definition: that the days of the world have an end and a finish, just as they had a beginning. The **second gate**: on the novelty of the days of the world, their reckoning, and the computation of the End from the Torah. The **third gate**: with proofs and arguments for the resurrection of the dead from the weighing of reason and from the external science, and the strengthening of these proofs by sound signs from the Torah; and that the Holy Writings testify to the resurrection of the dead, and the exposition of the resurrection from the Torah. The **fourth gate**: on the exposition of the reckoning of the End and the time of the resurrection of the dead, from the Book of Daniel and from the rest of the Holy Writings. The **fifth gate**: on the exposition of the reckoning of the End, and most of the matters that passed in the earlier gates, drawn from the words of those who gaze at the stars [astrologers].

Third Gate, folio 45b: "And the one who says that no person can endure in the world without illnesses befalling him and without death ultimately reaching him — because the order of the world does not run on this principle, nor is our

structure founded upon it — is not speaking the words of a sage; for the order of the world is firmly fixed, and he is unaware of the root foundation of its principle. For you find that the physicians, who are masters of their craft and skilled in the regulation of their diet, in their food and drink and in all the body's needs, [hold] that men would be able to endure in this world all the days of their lives entirely without illnesses — robust and healthy in their full strength — and would not die the death of sickness but only the death of old age and decline. And it was the opinion of one of them that there might be among them one so [skilled] in his craft and in guarding his body that his body would be saved from death. He composed a treatise on this matter and on the regimen by which a man might be preserved from the time of his birth to the time of his death — a certain book that was current among the Greeks. He erred in his theory and held a famous error. And Galen [גאלינוס = Galen], the man knowledgeable in the science of medicine among the Greeks [ב' יון], mocked and derided this book, and said that its author did not understand the way of man's formation correctly. For he did not know that a man needs, in this world, to restore to his body and to fasten onto each and every limb of his limbs something that moistens his body and replenishes in it the moisture that has been lost from it through the heat of his body within, and also through the air that surrounds his whole body from without and dries up its moisture. And the substance that adheres must be of the same kind as the moisture passing from each and every limb. But the replenishments produced in the body from food and drink do not fill the whole deficiency, nor are they like in every respect to what is lost; rather they contain dregs and waste, and they cut off the moisture of the limb from it, and do not fill the whole deficiency — because the digesting faculty that is in the digesting body did not preserve it in full until its completion. Were a man able to restore to his body the like of the moisture passing from it, in its form and its measure, neither less nor more, the man would not die — and the words of the man who supposed in his heart that, by his craft, he would be saved from death would be true. But now, since the digesting faculty is not the mighty [faculty] — for at times it adds and at times it diminishes, without a proper measure — his words are nothing but vanity. Yet a man can correct this faculty and preserve it so that it not grow weak before its time, and so be saved from sickness all the days of his vigorous life, fitting to him according to the nature of his formation. These are the words of Galen."

You see from him that he concedes that, had HaKadosh Baruch Hu strengthened the digesting faculty in man and given it the full force fitting to it, man would endure in this world. And it seems to me that the words of Aristotle [אריסטו], chief of the Greek sages, were [to this effect]: since he investigated the comings-to-be and the passings-away that revolve in the world in the treatise he composed upon

this phenomenon, the inquiry compelled him to acknowledge that all forms and souls are destined to revolve and recur in the world — but that they do not return to the First Matter, because the root of matter has no form; and when one strips away the form it has put on, it is no different from the rest [of matter]. Had this man held the belief of the Torah, he would have had to know that He who forms the souls — and all the forms before Him — is able to recognize matter and to restore every form and every soul to the matter it first put on. I need not recall the words of the transmitters who said that the souls pass from body to body through all the kinds of living things until at last they return to the first body; for these are words of emptiness and great vanity. Yet, with all that, they do not deny the resurrection of the dead — since the return of the soul to the first body is, by their words, the resurrection of the dead itself, except that we expound it by the correct way. And if these are the words of the sages of the nations, who do not know the root of the world's creation except from the weighing of their reason and the ways of their theory and their experiments, which they covered with their craft — how much more fitting it is here that the words of Israel be [heard], who draw the waters of wisdom from its pure spring and receive them from the mouths of the prophets and from the Holy Torah! Surely it is fitting for them to acknowledge the resurrection of the dead and to believe that HaKadosh Baruch Hu, who gives life to man, is able to grant to his formation's nature a strength and power such that death will not pass over him. In this matter it is an obligation upon every God-fearing person who believes in the Torah of our God to have faith and to wait for Him, etc.

And here are for you words from the commentary of R. Saadia Gaon on the Book of Daniel, recalled in the fourth gate of the *Sefer Megillat HaMegalleh*:

And I saw in the commentary of Rabbenu Saadia of blessed memory on Daniel that "the people of this scripture [the Romans] destroyed the Temple and profaned it, and removed the daily offering" — by the hand of Titus [טִיטוֹס] the wicked. And he placed before himself all the verses that are [in Daniel], from "and those who are wise" up to... and he stumbled to refine, to clarify, and to ascertain concerning the kingdom of Greece [יוֹן] and Edom, and left to the kingdom of Ishmael only five verses, up to "and he shall plant the tents of his pavilion," etc. there. And Rabbenu Saadia of blessed memory [wrote], in his commentary on Daniel, that the word *hayamin* [הַיָּמִין, "the right hand"] here is not in the sense of the right that is opposite the left, but rather it is in the matter of *hayamim* [the days]; and *hayamin* stands here in place of *yamim* — this is the view of [R. Saadia]. [Marginal continuation in the column:] ...and the pushing he

gave it from "the righteous days," and your way is to wipe out kings that you find there — this was the view of Rashi.

The wise man, the Italian Lord of Mirandola [Pico della Mirandola, אדון מירנדולה], sometimes calls our author **R. Avraham the Spaniard** [ר' אברהם הספרדי], sometimes **the Nasi** [הנשיא, the Prince], sometimes **the Jew** [היהודי]; and to his understanding he was rabbi to R. Avraham ibn Ezra [אברהם אבן עזרא]. The author predicted that the time of the End of the redemption would fall in the period of the great conjunction of Jupiter [צדק] and Saturn [שבתאי] in the constellation Pisces [מזל דגים], just as it had happened at the redemption of Egypt; and according to his reckoning by the science of astrology [אצטרולוגיא] its time was [to be] in the year 5118 [$5118 = 18 + 100 + 5000 =$ ח"ה אלפים קי"ח AM; $5118 - 3760 = 1358$ CE] [?], as we have recalled. There is no doubt that, had the author been alive in those days, he would have justified his reckoning and excused himself by saying that only because of the people's iniquity was the decree altered and the appointed time of the End delayed — as he stated in his introduction, as recalled. Yet the sages who came after him already opened their mouths against him over such false beliefs as these, as did R. Azariah de' Rossi [עזריה האדומי = Azariah de' Rossi] in chapter 43 of his esteemed work *Me'or Einayim* [The Light of the Eyes], who said:

"All the more so, since the error of some of the sages — like R. Avraham bar Hiyya in his book *Megillat HaMegalleh*, and Don Isaac [Abarbanel, דון יצחק] in his *Sha'ar HaShamayim*, at the end of his commentary on Daniel — is great, in that they imagined in their souls that they could bring this hidden matter to light by the aid of the judgments of the stars and the great conjunctions of the host on high. But you, [know it is] not so: for Israel has no constellation [אין מזל לישראל] — neither over the whole nor over the part." And there R. Azariah remarked upon a statement by the author of the *Akedah* [Akedat Yitzchak], who says in gate 56 (folio 207, Pressburg edition) [דף ר"ז דפוס פרעסבורג]:

"There were already some among the sages of our people who sought from the upper conjunctions many reckonings, to find through them the cause of all the things that have passed over us since the beginning of the world — as did the rabbi, R. Avraham bar Hiyya the Spaniard, of blessed memory, in his book called *Megillah*, where he sought to draw out many judgments concerning the exile of Egypt and the End of its redemption, and concerning the conquest of the Land and the End of their exiles from it, both the first time and the second; and he said that he intended all this for the sake of Heaven, to break through and to transgress with those judgments toward the expected End. Yet in all that he wrote

concerning the judgments of past matters — behold, his mind sufficed to direct his reckonings and to bring them out properly, since he was relating in them what he had seen with his own eyes; but in all that we are pressed to decree and to judge about the future, no word will be fulfilled," etc.

6) THE BOOK OF INTERCALATION [הספר העבור / Sefer Halbbur]: This is the work before us. The author composed it in the land of France [צרפת] at the end of his days, in the year [completing] cycle 257 to the Creation [רנ"ז מחזור ליצירה]. After he completed it, he set his eye upon it a second time, went over it again, and corrected the text to his heart's desire; yet even so he did not pass over the first edition [מהדורא קדמאה]. For it was copied by another scribe in Spain in the year 236 of the sixth millennium [5236 = ... לאלף הששי AM; 5236 - 3760 = 1476 CE] — that is the second copy, hidden away in the treasuries of the Oxford library [אוצרות ספרי אוקספורד]. This fits with the truth of our statement that it came to us from Spain, and this is its proof: in every place where the author mentioned the Ishmaelite faith [המדיה הישמעאלית, the Ishmaelite creed/madhhab] disparagingly, the copyist was careful not to copy the words as written, fearing lest he stumble in the eyes of the [Muslim] authority and be punished for what he had written against the prophet of the Ishmaelites; but the copyist filled in all the words just as he found them written against the Christian [נגד הנוצרי]. For in those days the faith of the Ishmaelites ruled over all the land of Spain and its dependencies. And the reverse holds with the manuscript found in the Paris treasury [אוצר פאריז]: there the copyist was careful not to bring in the disparaging words found against Jesus [ישוע], head of the Christians, while, with no fear, he set his mouth against the Ishmaelite. For this reason the Paris-manuscript copyist did not copy at all the last gate of the Book of Intercalation, since it deals entirely with [refuting] the falsity of the Christian reckoning, proving with trustworthy proofs that one must not rely upon their tradition

This *Book of Intercalation* is exceedingly precious in its entirety. For besides the whole science of intercalation being found in it, in good taste and knowledge, it includes good and precious tables for those reckoning the eras [לחושבי זמני]; and through it many matters touching upon the plain sense of the verses and the dicta of our Rabbis of blessed memory will be further clarified, with surpassing dignity and worth. And of this, too, "your reading shall not be forgotten" [cf. Devarim 31:21] — a wise reader. For this author was the first who began to compose a book on the science of intercalation, and before him there was no book in this science; for he himself says so in his introduction (col. 4 [צד 4]), in these words:

"And had I found in the land of France a composition in the Holy Tongue [Hebrew] that expounded this whole matter to its end, and brought the proofs upon it in their fashion, I would not have entered into all this constraint. And likewise, had I found the compositions written in the Arabic tongue that came to my hand from the books of Spain — which complete this whole need — I would have translated them into the Holy Tongue as best I could, and would not have engraved any word in them under my own name." Thus far his words.

Behold, all the later authorities who came after him drew entirely from his source — like R. Isaac Israeli [יצחק הישראלי] in his honored work *Yesod Olam* [Foundation of the World], who recalled it countless times, and from it took all the foundations in the science of intercalation. The author of the *Ma'or* [HaKatan / R. Yom Tov of Seville] also mentions it at the end of a chapter [with the formula] "if they are not knowledgeable in the matter" — sometimes at length, sometimes briefly. The commentator on the Laws of Sanctification of the Moon [Kiddush HaChodesh], chapter 10, halacha 1, also wrote a complete discourse on the matter of the solar year according to the words of R. Adda bar Ahava, in the name of the *Berayta* called after his name (that of R. Adda); and that whole discourse is taken word for word from R. Avraham's *Book of Intercalation*, even though he did not cite it (*). From here, too, is a proof that the commentator himself saw the *Berayta* mentioned with his own eyes. The Ralbach [הרלב"ח = R. Levi ibn Habib], too, in his responsum in the *Kuntres HaSemicha*, wrote thus:

"This [matter], that our Rabbenu Hai Gaon [רבינו האי גאון] wrote in a responsum to a query, R. Avraham bar Hiyya the Nasi recorded in his *Book of Intercalation*; and the Ramban [הרמב"ן = Nachmanides] copied his words in full in the *Sefer HaZechut* [Book of Vindication]; and afterward the author of the *Sefer HaTerumot* [Ba'al HaTerumot], in the name of the Ramban, [recorded] that the year of the documents [shtarot] [continued] while the Sanhedrin and the semuchin [ordained judges] were intact — and that is the year of the reckoning." Thus far. And it is very possible that even the Ramban did not see the actual responsum of Rav Hai, apart from its transcription in the *Book of Intercalation*. R. Azariah de' Rossi, too, in his precious work *Me'or Einayim*, leaned many times, in most of his proofs and his objections, upon the words of the *Book of Intercalation*; and there is none who set his eye upon this celebrated book and did not see great light in it. If so, how great are its excellence and its worth!

[Footnote keyed to (*):]

[Footnote, set in smaller type:] For so he said at the head of the fourth gate, Discourse 3 [שער ד' מאמר ג]: "The measure of the year of the sun according to the

words of R. Adda bar Ahava, as a person understands it from his own reasoning — and as we saw expounded in the *Berayta* called by his name — is 365 days, 5 hours, 996 chalakim [מתקצ"ו חלקים], and 45 regaim [מ"ה רגעים]; which is to say, 365 days and six hours less 82 chalakim [פ"ב חלקים], plus a further 28 regaim, at 76 regaim per chelek [מע"ו רגעים בכל חלק]. This [confusion] led the scholar Slonimski [בלאניבסקי = Slonimski] into error, when he reckoned in his book *HaYonah* concerning the deduction [of the year], and likewise concerning the calculation of the tekufah, as it truly is. And so too erred the scholar Firsht [פירשט = Fürst]; for the commentator [of Kiddush HaChodesh] himself saw that *Berayta*, as the scholar Shadal [שד"ל = Samuel David Luzzatto] already remarked upon this error in *Orient* [באוריענט].

Behold now and gain insight, O understanding reader, into the wondrous matter now clarified for us by means of this *Book of Intercalation* — which I have entitled with the name **HaShavat Aveidah** [The Restoration of a Lost Thing] — and from that matter draw an inference to the rest.

הַשְׁבֵּת אֲבִידָה — HaShavat Aveidah (The Restoration of a Lost Thing)

For many days now our scholars have reckoned, as a matter of [settled] judgment, that the *Berayta* called by the name of Shemuel [שמואל, Samuel], mentioned in many places, was already lost to us, and there is none who tells its whereabouts. But after the *Book of Intercalation* of R. Avraham bar Hiyya the Nasi has fallen into our hands, no further doubt will remain that this *Berayta* is the very one made known to us under the name *Pirkei d'Rabbi Eliezer* [Chapters of R. Eliezer] — and no other. For so the *Pirkei d'R. Eliezer* were called by the name "*Berayta* of Shemuel" in the mouth of the Nasi R. Avraham, and in the mouth of R. Shabbethai Donnolo [רבי שבתי דונולו = Shabbethai Donnolo] — as the eye of every reader will judge concerning the truth of our words from all that we set before us:

[The following is a two-column synoptic comparison. The **right column** (read first) is headed "**HaNasi b'Sefer HaIbbur**" — the Nasi (Bar Hiyya) in the *Book of Intercalation*; the **left column** is headed "**Pirkei d'Rabbi Eliezer**." The columns are aligned section by section under the letter-headings א, ב, ג. The Hebrew page reads right-to-left.]

א (Aleph)

HaNasi in the Book of Intercalation
(right)

Second Discourse, Gate 2: And upon this measure, in the measure of the lunar month, we found the reckoning [to be] three hundred and fifty-four days and a third of a day [354 $\frac{1}{3}$ days], and 876 chalakim [= ותתע"ו חלקים 876], in the *Berayta* called by the name of Shemuel and of R. Eliezer ben Hyrcanus [אליעזר בן הורקנוס]; for so it is written: the lunar year [is] 8,000 [and] 504 hours [ח' אלפים ותק"ד שעות 8,504 = hours].

R. Eliezer ben Hyrcanus — the reckoning of the days of the moon [is] 354 days and a third [354 $\frac{1}{3}$], and all the hours of the lunar month [are] 708 hours and two-thirds of an hour [תש"ח 708 = שעות ושתי ידות שעה]; and all the hours of the lunar year [are] eight thousand 504 hours [שמונת 8,504 = אלפים תק"ד שעות]. And you see from this reckoning that the lunar month [is] 29 days and 12 hours and two-thirds of an hour [כ"ט יום וי"ב שעות 29 = כ"ט יום ושני שלישי שעה, 12 $\frac{2}{3}$ hours].

ב (Bet)

HaNasi in the Book of Intercalation
(right)

Ibid.: And in this *Berayta*, by the name of Shemuel, he wrote: One who wishes to know on which Shabbos the new-moon [head of the month] falls reckons from when the world was created, assigning [to each month] a day and a half and a third of a great

Pirkei d'Rabbi Eliezer (left)

Chapter 7: The reckoning of the days of the lunar year. The reckoning is three hundred and fifty-four days and a third of a day [354 $\frac{1}{3}$ days], [and 876 chalakim — ותתע"ו חלקים]; all the hours of the lunar year [are] 8,504 hours [ח' אלפים ותק"ד שעות].

[parallel to the right column above]

Pirkei d'Rabbi Eliezer (left)

Ibid.: All the days serve as the head of the molad of the moon, [counting] them backward [retrospectively, *l'mafrea*]. At the start of the night of the fourth day [Wednesday night], the head of the molad of the moon [is] at the hour of Saturn [בשעת שבתאי], 440

HaNasi in the Book of Intercalation
(right)

hour, [at] 12 [hours] to the day, for each and every month; for three months he assigns two days and two hours, [at] 12 [hours] to the day; for twelve months he assigns four days and four hours; for thirty-six months you go back one day, [and you are] found standing at the start of the night. (This text is according to the Oxford manuscript [כ"י אוקספורד].)

Pirkei d'Rabbi Eliezer (left)

[שנ"צ — the molad fraction is a textual crux: the printed letters give = שנ"צ 440, not the conventional 204] like the molad-of-tohu [ש"כמלח = the molad of the formless void]; and after three years of the small cycle [מחזור הקטן] it gives the day after it (the meaning [being] retrospectively, *l'mafrea*). At the start of the night of the 3rd [Tuesday night], the head of the molad of the moon [is] at the hour of Venus [בשעת נוגה]. (See there the whole matter, up to: the planet [שר] that begins the new-moon [ר"ח] of the moon is the planet that completes [it] at the end of the month.)

ג (Gimel)

HaNasi in the Book of Intercalation
(right) — *R. Shabbethai Donnolo*

In *Kerem Chemed* [כרם חמד, "Vineyard of Delight"], part 7, col. 61, [on] Iyov [Job] 9:9 [איוב ט ט]: I found (that is, R. Yosef Kara [ר' יוסף קרא] in the book of R. Shabbethai, who expounds in it the *Berayta* of Shemuel: "This firmament was made like a vault [כקובה], resembling a tent spread over the earth, as it is said, '[...] and he stretched them out [וימתחם]'..."

Pirkei d'Rabbi Eliezer (left)

Chapter 3: "And the ends of the heavens [וקצות השמים] [are] upon the waters of the Ocean [ואוקינוס]" — these are expounded, as it is said, "the One who lays the beams of His upper chambers in the waters" (Tehillim 104:3 [תהלים קד ג]). The structure of the heavens rises upward, [being] spherical like a tent spread over the earth, its edges spread below and its inside above...

[The two-column synoptic comparison continues from the prior page: the right column reproduces the cosmological passage of **Rabbi Shabtai Donnolo**, and the left column the parallel text of **Pirkei d'Rabbi Eliezer**. Both are quoted by the editor, R. Hirsch Filipowski, as part of his synoptic study. The two columns are transcribed here in parallel.]

Donnolo / Pirkei d'Rabbi Eliezer — parallel cosmological texts (continued)

Donnolo (right column):

"and as a tent to dwell in" (Yeshayahu 40:22), its ends [reaching down] to the earth, and its interior arching upward like the vault of the firmament. The whole earth, with the surrounding Ocean [אוקינוס] beneath it, is encircled round about, as is written in the book of the sages of the nations. (Yeshayahu 40:22)

There [p. 62]: And I have seen in the book of R. Shabtai [Donnolo], may the memory of the righteous be a blessing, who explains the *Baraita d'Shmuel* — "this firmament," and so forth: that the *tekufah* [תקופה] of Teves, which is the southeast — Shadal reads "the southwest" [שד"ל גורס מערב] — is elevated up to this firmament, and the height is rounded all around, opposite the shore of the Ocean on every side. This open height is joined to the firmament round about, from the southeastern edge to the southwest. This height is opened with windows in the east, and there are windows in the west [opposite] the place of the east. The *tekufah* of Teves, which is the southeast, up to the place of the east, and the *tekufah* of Tammuz, which is the northeast — there are 183 [קפ"ג] open windows; [there are] 91 [צ"א] [windows] from the southeastern corner of the *tekufah* of Teves up to the central east, the midpoint of the *tekufah* of Nisan; and 91 [תשעים] [windows] from the central east of the *tekufah* of Nisan up to the northeastern corner of the *tekufah* of Tammuz. And in the very middle, midway between the 91 windows of the southern[-eastern] corner and the 91 windows of the northern[-eastern] corner, there is a single window in the center, and its name is the Window of Nogah [Venus]. On the northern side of this window, on its northern side, there is one window whose name is *Te'alumah* [Hidden-place], and through it the light goes forth, as it is said, "and from the hidden place He brings out light" (Iyov 28:11 [source verse glyph reads 16 = יו]). The window in the southeastern corner of the *tekufah* of Teves is called *Bilgah*, and the window in the northeastern corner of [the *tekufah* of] Tammuz is called *Na'amon*.

At the *tekufah* of Tammuz the sun begins to rise from the Window of Na'amon. It goes on and circles and turns back, descending from north to south, window after window, ninety windows; and when it completes the ninety windows there is one window, and there is the chamber in which lodges the storm-wind that goes out — so there are 91 [צ"א] windows.

Chapter 6: And in 366 [שס"ו] degrees the sun rises and sets: 183 [קפ"ג] rise in the eastern quarter, and 183 [קפ"ג] descend in the western quarter, corresponding to

the days of the [solar] year. And through 366 [שס"ו] windows the sun goes out and enters: 91 [צ"א] days in the eastern southern corner, and 91 [צ"א] days in the northern corner; and one window in the center, named Nogah. At the *tekufah* of Tishrei it begins from the Window of Nogah and goes on and circles toward the southern corner, window after window, until it reaches the Window of Shabtai [Saturn]. It goes on and circles and turns back, window after window, until it reaches the Window of *Te'alumah*, through which the light goes out, as it is said, "and from the hidden place light goes forth" (Iyov 28:11 [recte 28:11; source reads 88 = פח, an impossible Iyov chapter, and verse glyph 16 = יו]). At the *tekufah* of Nisan it begins from the Window of *Te'alumah*, through which the light goes out, and goes toward the northern corner, window after window, until it reaches Na'amon. At the *tekufah* of Tammuz it begins from the Window of Na'amon and goes on and circles back, window after window, until it reaches the chamber-window, in which is the storm-wind that goes out, as it is said, "out of the chamber comes the whirlwind, and cold out of the scattering winds" (Iyov 37:9).

Just as it goes out in the east, opposite it in the west it enters; and the Divine Presence is always in the west. It enters and bows down before the Holy One, blessed be He, and says before Him: "Master of all the worlds, I have done all that You commanded me." And there is one window in the center of the firmament named *Mazrim*, through which [the sun] does not go out and does not enter, except once in a Great Cycle [מחזור גדול] — through it [the sun] went out on the day it was created. And in the west, at the *tekufah* of Tishrei and Teves, the sun goes and circles toward the southern corner and toward the waters of the Ocean between the ends of the heavens and the ends of the sinking earth, for the night is long and the road is great, until it reaches the window in the east through which it wishes to go out by night. [Continued below.]

[Donnolo column, lower portion:]

and adjacent to it, from the southern side, is the window named Nogah. **The *tekufot* of Tishrei:** the sun begins to rise from the Window of Nogah, and goes on and circles toward the southeastern corner, window after window, until it reaches the Window of Bilgah. **The *tekufah* of Teves:** it begins from the Window of Bilgah and goes on backward, ascending from south to north, window after window, until it reaches the Window of *Te'alumah*. **The *tekufah* of Nisan:** it begins to rise from the Window of *Te'alumah*, and goes on and circles, ascending upon the northeastern corner, window after window, until it reaches the Window of Na'amon. **The windows** that are on the eastern-northern side, their number is 91 [צ"א], and they are reckoned from the northeastern corner from the

Window of Na'amon up to the chamber-window; and this last one, named the chamber [חדר], is reckoned within the count of 91 [צ"א]. The windows that are on the eastern-southern side: they are reckoned from the southern corner from the Window of Bilgah up to the Window of *Te'alumah*, and this is [counted] within the 91 [צ"א]; and between the Window of *Te'alumah* and the chamber-window there is the window named Nogah. So their total is 183 [קפ"ג] windows. These are the gates of the sun — and the sun is the *chamah*. Every day it rises from one window and sets and enters by one gate in the west opposite the window in the east; and further — Shadal reads "and until" [שד"ל גורס ועד] — until the thickness of the window passes and rises to show the dawn in the settled world, as it is said, "and as the dawn rose" (Bereishis 19:15), and until it comes and goes on and is drawn out in the seat of the gate, there is dusk, as it is said, "and the sun was set" (Bereishis 15:17). And the Divine Presence is always in the west, as it is said, "extol Him who rides upon the heavens" (Tehillim 68:5). There is one window in the center of the firmament, between the southeast of the *tekufah* of Teves and the northeast of the *tekufah* of Tammuz, and its name is *Mazrim*, as is said in Iyov, "and cold out of the scattering winds [*mezarim*]"; and the sun does not go out and enter through it except once in the Great Cycle [מחזור הגדול] in which it was created — through it it went out on the day it was created.

Pirkei d'Rabbi Eliezer (left column):

"as a tent to dwell in" (Yeshayahu 40:22). Just as the dwellings of man are below and prepared above, so too the ends of the heavens are fixed below and prepared above; and the whole earth, with the Ocean [אוקיינוס] beneath it, [is] like a tent, as it is said, "and He spread them like a tent to dwell in" (Yeshayahu 40:22).

Chapter 6: In the *tekufah* of Nisan it begins from the Window of *Te'alumah*, through which the light goes out, and goes on toward the northern corner, window after window, until it reaches the Window of Na'amon. **In the *tekufah* of Tammuz** it begins from the Window of Na'amon and goes on and circles backward, window after window, until it reaches the chamber-window [חלון [אל] חדר], in which is the storm-wind that goes out, as it is said, "out of the chamber comes the whirlwind, and cold out of the scattering winds" (Iyov 37:9). Just as in the east it goes out, opposite it in the west it enters; and the Divine Presence is forever in the west. It enters and bows down before the Holy One, blessed be He, and says before Him: "Master of all the worlds, I have done all that You commanded me." And there is one window in the center of the firmament, and its name is *Mazrim*; it does not go out and enter through it, except once in a Great Cycle, the day on which the world was created — through it [the sun] went out by

night. And in the west the sun, at the *tekufah* of Tishrei and Teves, goes and circles toward the southern corner and to the waters of the Ocean that lie between the ends of the heavens and the ends of the earth, for the night is long and the road is great, until it reaches the window in the east through which it wishes to go out by night.

[Lower portion, left column:]

The *tekufah* of Tishrei [recte: the *tekufah* of Nisan] in the west...[?]. In the *tekufah* of Nisan, [the sun] goes and circles toward the northern corner, to the waters of the Ocean that lie between the ends of the heavens and the ends of the earth, for the night is short and the road is short, until it reaches the windows in the east through which it wishes to go out, as it is said, "it goes toward the south and circles toward the north" (Kohelet 1:6). "It goes toward the south" — in the *tekufah* of Tishrei and in the *tekufah* of Teves; and "circles toward the north" — in the *tekufah* of Nisan and the *tekufah* of Tammuz. It circles six months in the southern corner and six months in the northern corner.

The *tekufah* of Teves: it begins from the Window of Bilgah and goes backward, ascending from south to north, window after window, until it reaches the Window of *Te'alumah*. **The *tekufah* of Nisan:** it begins to rise from the Window of *Te'alumah*, and goes on and circles, ascending upon the northeastern corner, window after window, until it reaches the Window of Na'amon. **The windows** on the northeastern side, their number is 91 [צ"א], and they are reckoned from the northeastern corner from the Window of Na'amon up to the chamber-window, which last one is named the chamber and is reckoned within the count of 91 [צ"א]. And this window named *Te'alumah*: between the Window of *Te'alumah* and the chamber-window there is the window named Nogah. So their number is 183 [קפ"ג] windows. These are the gates of the sun — and the sun is the *chamah*. Every day it rises from one window and sets and comes by one gate in the west opposite the window in the east; and further — Shadal reads "and until" [עד"ל] — until the thickness of the window passes and rises to show the dawn in the settled world, as it is said, "and as the dawn rose" (Bereishis 19:15), and until it comes and goes on and is drawn out in the seat of the gate, there is dusk, as it is said, "and the sun was set" (Bereishis 15:17). And the Divine Presence is forever in the west, as it is said, "extol Him who rides upon the heavens" (Tehillim 68:5). There is one window in the center of the firmament, between the southeast of the *tekufah* of Teves and the northeast of the *tekufah* of Tammuz, and its name is *Mazrim*, as is said in Iyov, "and cold out of the scattering winds"; and the sun

does not go out and enter through it except once in the Great Cycle in which it was created — it went out through it on the day it was created.

Explanation of the Matters Mentioned [באור הדברים הנזכרים]

[Editor's commentary, single column.]

Now let every just judge see and decide whether the words of the *Nasi* [Bar Hiyya] in Section 1 and Section 2 are truly the words of R. Eliezer, and whether it was by the hand of some later [interpolator], who sought to align the measure of the lunar month written in this *baraita* with the measure found in Tractate Rosh HaShanah, chapter 1 [פ"א] — where R. Gamliel said: "Thus I have received from the house of my father's father: the renewal of the moon takes no less than 29 days, 12 hours, and two-thirds of an hour, and 73 parts" — that the two words *and 876 parts* [ותתע"ו חלקים] (which is 12×73) were inserted into the book. And the sign of this for our judgment is this:

Proof One [הוכחה א]. Now, in Section 2 we found it explicitly stated in the name of R. Eliezer that the head of the molad [מולד] of the moon — that is, [the molad recurring] every 12×12 months, after 3 years of the small cycle [מחזור קטן] — runs with [a remainder of] one day, going backward through the days of the week. For this was, by their tradition of old, an established belief: that the seven planets [שבעה כוכבי לכת] govern in their order, one after another, in all the hours of the days of the week, each planet ruling one hour — that is, in the first hour of the first night [of the week], on Shabbos, [the planet] שמש [the sun] serves [first]; and their mnemonic is כצנ"ש חל"ם [Ketzanash Chalam]. That is: in the first hour of the first night, on Shabbos night, the sun [שמש] serves; and in that same hour, on the second night [of the week], Tzedek [Jupiter] serves; and on the third night, Nogah [Venus]; and on the fourth night [רביעי], Shabtai [Saturn]; and on the fifth night, Chamah [the sun]; and on the sixth night, Levanah [the Moon]; and Mars [מאדים] governs in the first hour of the seventh night, Shabbos night. And this too is by tradition: that the luminaries began at the start of the fourth night [of creation], at the hour during which, by the foregoing reckoning, the planet Shabtai [Saturn] was governing.

And behold, this statement of R. Eliezer holds true only if we accept the reading of the lunar month's measure to be **29 days, 12 hours, and two-thirds of an hour** exactly. For since the excess of one month's molad over its predecessor, by

this measure, after casting out the whole weeks contained within it, is **1 day, 12 hours, and two-thirds of an hour**, the excess for 36 months [ל"ו חדשים] (which constitute the *kapdan* cycle of 3 years) will be, since this 1 day, 12 hours, and two-thirds of an hour [recurs] 36 times [ל"ו], altogether **55 days** [נ"ה ימים]; and after casting out the whole weeks from this number, **6 days** [ששה ימים] remain. By this reckoning, then, the time of the second molad falls with one day [reckoned] in retrograde from where the first molad had been before it — in accord with the words of R. Eliezer, who stated explicitly: "at the start of the fourth night" (that is, the night of the fourth [day]). According to creation, by the tradition that we have mentioned, the head of the molad of the moon was in the hour of Shabtai [Saturn]; and after 3 years of the small cycle, the head of the molad of the moon at the start of the third night thereafter [falls] in the hour of Nogah (which is the planet [serving] on the third night, as mentioned). And this too is the very matter that the *Nasi* mentioned (in Section 2) when he said: "Whoever wishes to know, for any given Shabbos, the new moon [i.e., the molad] — let him reckon from when the world was created and assign for each day one and a half hours and a third of a great hour" (which is two-thirds of an hour, by the [reckoning of] 1/24 per day). For six months he assigns **2 days and 2 hours** (that is, doubled hours, which are 4 of our hours; for six times a day and a half are 9 days, and a further six times two-thirds of an hour are 4 hours); and after casting out the whole week, **2 days and 2 doubled hours** remain by its rule. For 12 months he assigns **4 days and 4 hours** (twice the excess of the six months); for 36 months [ל"ו חדשים] you go back again [by] one day (for three times 4 days and 4 doubled hours come to 13 days [י"ג ימים], and so, after casting out the whole week, the excess will be one week less one day) — [the molad] is found standing at the start of the night.

And from all this reckoning it has come out for us that it cannot be right, in the words of R. Eliezer in Section 1, to justify [the inclusion of] the two words "**and 876 parts**" [ותתע"ו חלקים] — at all events. For how could the *baraita* contradict itself in a single statement? And behold, I have seen in [the work of] R. Avraham the *Nasi* that he too did not mention these two words, neither in Section 1 nor in Section 2; nor can the measure be altered and "corrected" in [all] three places on account of the one place — unless [it be] as we have determined at the outset: that the words "and 876 parts" were added by the hand of some later [interpolator] who put out his hand. And the *Baraita d'Shmuel* is in fact the one called by us in the name of *Pirkei d'Rabbi Eliezer*.

The sage **R. Avraham ibn Ezra** [הראב"ע], too, in his commentary on Parshas Bo and in his work *Iggeret HaShabbat*, when he mentioned the measure of the lunar month as being **29 days, 12 hours, and two-thirds of an hour**, likewise did not

mention the 73 parts. And even if the language of the *Nasi* and the language of Ibn Ezra were not identical in their wording with the language of the *baraita*, there is no doubt that both of them transcribed the matter from it in different words — as many authors have done in transcribing the matter of another author from memory. And it is quite possible to determine that Ibn Ezra transcribed his words from the book of the *Nasi* and not from *Pirkei d'Rabbi Eliezer*, since they accord more closely with the words of the *Nasi*.

Proof Two [הוכחה ב]. From Section 3 and Section 4, every reader with open eyes will understand that the words of R. Shabtai Donnolo, who in his commentary attributes this matter to the *Baraita d'Shmuel*, are indeed the words of *Pirkei d'Rabbi Eliezer*; and as to R. Shabtai's change in calling the window of the *tekufah* of Teves by the name *Bilgah* —

[p. 4] this name of Shabtai [שבתאי, Saturn] found in *Pirkei d'Rabbi Eliezer* is itself a hidden allusion, since the name Shabtai [Saturn] is an ill omen, and he borrowed the name *Bilgah* relying on what was said at the end of the tractate [Sukkah]: that "they stopped up the window [niche] of Bilgah" — for the window of Shabtai is likewise stopped, since through it the nights are long. And if someone should object, saying: since the versions [of the text] are different, one may believe that there was a distinct *baraita* apart from *Pirkei d'Rabbi Eliezer* — behold, we have heard from the mouth of the *Nasi*, who states in plain words that *Pirkei d'Rabbi Eliezer* is called by the name of Shmuel. And now, after these true matters, will any further doubt remain in our heart against believing that the *Baraita d'Shmuel* is itself *Pirkei d'Rabbi Eliezer*? This too one ought to know: that only the earliest of our early ones called *Pirkei d'Rabbi Eliezer* also by the name of Shmuel; and for those who came after them this second name was forgotten, and therefore Rashi, the Tosafos, and the Rambam all called it by the first name, *Pirkei d'Rabbi Eliezer*, alone. And there is no doubt that the version of *Pirkei d'Rabbi Eliezer* that the earliest of our early ones possessed differed from the version we have before us — and this is nothing new, as is known to every examiner among printed books and manuscripts.

And when I had finished arranging the introduction to this book, I showed it to the great Gaon, our teacher R. Natan Adler, may his light shine, the head of the rabbinical court of the holy community of Britain [Britania], and after he had set his eye upon all that I had explained and proved, his heart greatly rejoiced; and he pointed out to me that, by the conjecture that *Pirkei d'Rabbi Eliezer* is the *Baraita d'Shmuel*, a wondrous matter in the *Sefer HaKuzari* — which its

commentators did not know to turn to the right or to the left [i.e., could not interpret] — is clarified. Open your eyes and see, for thus says the *Kuzari*:

Maamar 4, Siman 29 [מאמר ד סי' כט]

[A three-text presentation: the central column is the verse from the *Sefer HaKuzari*; flanking it are the two commentaries — *Kol Yehuda* (right) and *Otzar Nechmad* (left).]

[Kuzari, central text]:

"...And there yet remains, from the special wisdom [of astronomy] concerning this matter, the book called *Pirkei Rabbi Eliezer ben Hyrcanus* [רבי אליעזר בן הורקנוס], in which [are treated] the measure of the earth and each of the celestial spheres and the natures of the stars, the constellations and the figures, their good and their ill, their ascendance and descent, their rising and their setting, their elevation and their lowliness, and the course of their motion — and he [its author] is among the famous sages of Israel; and Shmuel, of the sages of the Gemara, who said, 'The paths of the firmament are as clear to me as the paths of Nehardea.'"

[Kol Yehuda commentary, right column]:

"And Shmuel," etc.: He means [to say] that just as we have found Rabbi Eliezer of the Mishnah, whose wisdom in matters of astronomy was great, as stated — so likewise we have found Shmuel, of the sages of the Gemara, who said, "The paths [of the firmament] are as clear to me," etc.; [Talmud] Berachos, chapter *HaRo'eh*.

[Otzar Nechmad commentary, left column]:

"And Shmuel": He means to say that he too was among the famous of the sages of Israel in the later generations.

[Continuation of the central Kuzari text, lower portion:]

"...[Rabbi Eliezer ben] Hyrcanus, in which [are treated] the measure of the earth, and each of the spheres, and the natures of the stars and the constellations and the figures, and their good and their ill, and their ascendance and descent, their elevation and lowliness, and the course of their motion — and he is among the famous sages of Israel; and Shmuel, of the sages of the Gemara, who said, 'The paths of the firmament are as clear to me as the paths of Nehardea.'"

[Editor's resumed commentary:]

These two commentators [Kol Yehuda and Otzar Nechmad] both made one error, and set Shmuel's statement as a separate statement [from the foregoing], because it did not occur to them to attribute *Pirkei d'Rabbi Eliezer* to Shmuel as well. But in truth the *Kuzari* intended to say: among the famous sages of Israel who composed the book *Pirkei Rabbi Eliezer* was **also Shmuel of the sages of the Gemara** — and accordingly the [proper] interpretation is, "and Shmuel is he, and among them is Shmuel as well."

After I had written all these words concerning the *Baraita d'Shmuel* up to this point, there came before me Orient, numbers 44 and 46 [מ"ד ומ"ו], for this year, and in it I found the letter of the sage Shadal [שד"ל] discussing that *baraita* at length. And in his opinion too, it was certainly known to the ancients, and is now lost and gone; and on the basis of his conjecture he proved that R. David Gans [ר' דוד גאנס], in his pleasant and agreeable work [*Nechmad veNa'im*], rightly judged that the words **"and 73 parts" [וע"ג חלקים]** entered the Gemara's [text of] Rosh HaShanah by the hand of some later [interpolator]. He did not, however, see that this *baraita* is *Pirkei d'Rabbi Eliezer*, nor that the **876 parts [התתע"ו חלקים]** [recte: 876] entered it in truth by some later hand, in order to align this measure with the measure of the Gemara. And this is a reliable proof that the 73 parts [הע"ג חלקים] were already within the [text of the] Gemara before the later interpolator mentioned.

[Continuation of Filipowski's introduction, p. 17.]

how very right were the words of the sage Shadal [שד"ל — Samuel David Luzzatto] in correcting the sage Carmoly [כרמולי]. For when he [Carmoly], in his letter to the Englishman [Anglese] (printed in the year [1840 = 5600 = ת"ר]), recalled the praises of R. [the author], the *baraita* in question did not in fact refer to Shmuel Yarchina'ah [שמואל ירחינאה], but only to some later Shmuel — since it [the source] calls him there "the sage" and not "Yarchina'ah." Shadal took two reliable witnesses against R. Avraham bar Hiyya [רבי אברהם ב"ח] — and afterward R. Avraham ibn Ezra [ר' אברהם אבן עזרא] — [namely], why they did not [mention him]? But they too — both of them, and the sage Carmoly along with them — overlooked the dictum of the Gemara (Bava Metzia, folio 64b), for it says there: "Rabbi Shmuel said in a *midrash*: I myself saw the book of Adam the first man, and it was written in it: 'a sage [named] Yarchina'ah shall be called *chacham* [sage], he shall not be called *rabbi*.'"

- 7) *Sefer Mahalchot HaKochavim* [ספר מהלכות הכוכבים] — *The Book of the Courses of the Stars* ([German:] *Das Planeten System*). And a reckoning of the Greeks, the Romans, and the Ishmaelites [Arabs]. A manuscript is found

in the Vatican Library in the city of Rome (Wolf [וואלף], part 1, p. 53). I do not, however, know whether this book may be the *Sefer Cheshbon HaMahalachot* [Book of the Reckoning of the Courses] that I mentioned above.

- 8) *Sefer HaMidot* [ספר המדות — *The Book of Measures*] ([German:] *Geometrie*). On the science of mensuration and the science of triangles, [and] spherical figures and converse angles. (Thus it is recorded in the aforementioned book of Wolf; but I have not learned which scholar intended by the words "converse angles," nor have I located the place of this manuscript.)

From all of R. Avraham's works we have seen that he was a wondrous astronomer and a great scholar in the mathematical sciences, in mensuration, and in astrology. His mind was straight and sharp to the point of marvel, and in every subject he studied he probed very deeply, leaving almost nothing for those who came after him to add. Above all this, he was God-fearing and very humble, a keeper of the Torah of God and ever drawing strength from the words of the Sages of the Talmud, leaning upon them as upon pillars of iron. In all his books he never began nor concluded a single chapter without calling upon the name of the Lord his God for his aid, and he always strove to demonstrate that all the sciences issued from the womb of Israel, and that they [Israel] were the first to teach and instruct the other nations — for to every teaching he added clear proofs and sometimes hints that their foundations rest upon the holy mountains, whether in the Written Torah or in the Oral Torah. He was also proficient in the Arabic tongue, as is evident from his translation of the dictum of R. Hai Gaon [ר' האי"גאון] in the seventh gate of the third *maamar*, and from the words of his introduction that we cited above, where he stated explicitly that, had he found in the Spanish books written in the Arabic tongue the subject matter of the science of intercalation, he would have translated them into the Holy Tongue. His learning in the science of astronomy was renowned among all the scholars of his generation, and in the generations that came after him they mentioned his name among the great astronomers; thus too the renowned French astronomer Laplace [לאפלאס — Pierre-Simon Laplace] mentioned him in his great work on the history of astronomy [*Exposition du système du monde / Précis de l'histoire de l'astronomie*].

Now, before I finish speaking of the author and his works, it is my duty to mention this: that for *Sefer Hegyon HaNefesh* [ספר הגיון הנפש — *Meditation of the Soul*] and *Sefer Megilat HaMegaleh* [ספר מגילת המגלה — *The Scroll of the Revealer*], I drew most of the matter for my translation from leaf 27 [עלה כ"ז] of the sage

Fürst's [פירסט] *Orient* [the *Literaturblatt des Orients*], published this year; and that on the matter of the parallel *baraitot* [מאמרים המקבילים] of the *Baraita d'Shmuel* with the other places, the sage Dov Goldberg [דוב גאלדבערג] alerted me. To both of them I return my thanks.

Explanation of a Difficult Dictum in the Ninth Gate, from the Second Maamar — by the Editor [p. 18]

[באור מאמר קשה בשער התשיעי מהמאמר שני מאת המסדר]

At p. 68 I promised, in a note, to clarify by means of the equivalence of the excesses [העודפים] within the bounds of the full years [גבולי שנים השלמות] over the bounds of the deficient years [גבולי שנים החסרות] — that is, the excesses that occur in the [nineteen-year] cycle of nineteen years. Let me now set it in order; so listen and hear.

Know, then, that the measure of the lunar month [חדש הלבנה] is well known to be 29 days, 12 hours, and 793 parts [chalakim — $1/1080$ of an hour], since an hour contains 1080 parts. Because its surplus over complete weeks is 1 day, 12 hours, and 793 parts; and since the number 1080 does not come out evenly when 793 is divided into it, and there is moreover no common number that would divide both 1080 and 793 without a remainder — it necessarily follows from this that the [number of] returns by which the moladot [molad calculations] come back to their starting point as at first cannot amount to less than the span of seven times [שבעה פעמים] twenty-four times 1080 months — which is the product of the days of the week by the hours of the day and by the parts of the hour. And these [amount to] 772 cycles [תשע"ב] and 20 months. This is the measure for the return of the molad of the month.

The measure for the return of the molad to the head of the cycle, however, grows together with the forty-seven, since the number forty-seven is one fifth of the number 235 months that are within one cycle — for the surplus of the cycle is a whole [day-count] of 2 days, 16 hours, and 595 parts, and the first molad [of creation] was at BaHaRaD [2 — ב"ה"ר"ד days, 5 hours, 204 parts]; the parts of the moladot at the heads of the cycles will therefore be none other than 4 or 9, and accordingly a fifth governs all the modes of the moladot. This is the measure for the return of the molad for the first year within the cycle.

As for the remaining years within it, those years depend upon the moladot of the first years from the creation: thus every second year depends upon the molad of the seventh year of the first cycle from creation, the third year [in turn] depends

upon the third [year], and so forth. And since the residues [yitrot] of the years within the one cycle stand upon 18 modes — apart from the surplus of the whole cycle, which is 2 days, 16 hours, and 595 parts — it therefore necessarily follows that the moladot at the heads of the years come, in their totality, together with all the kinds of parts within the great cycle [tekufah] that we mentioned.

After we have laid down this premise, the words of the Master, the author, are well clarified. For behold, the fixing [keviut] of the year always depends upon the molad of its [month of] Tishrei, [taking account of] whatever occurs in each and every part [chelek], whether it is earlier or later. The bounds of the full years comprise the count of parts which, when the molad of Tishrei falls within any part of them, the year will be full; and likewise, within the bounds of the deficient years, each and every part within the bound makes the year deficient. Now we have seen that the bounds of the full years exceed the bounds of the deficient years — by the Master's explanation there, with the [phrase] "25 days, 19 hours, and 925 parts," which is likewise 7 times (the count of the days of the week) — [this being] the measure of the surplus from the cycle over its nineteen years in their order. Hence, in order to complete this measure by making the number of full years exceed the number of deficient years, [we proceed as follows]. And because this measure is not composed of whole days alone, but contains in addition a surplus of 925 parts, we are of necessity driven to the aforementioned great cycle [tekufah] in order to fill out all the deficiencies. And according to our premise stated above — that the moladot at the heads of the years occur within each and every part within the great cycle — the number of full years will exceed the number of deficient years by just as great a number as the parts caught up within the aforementioned measure of surplus [25 days, 19 hours, 925 parts]. By this, the Master's words there are vindicated: "And the surplus and the deficiency [p. 19]...

by which you operate over the years takes you out neither from the customary order nor from the precise measure that our Rabbis of blessed memory transmitted to us regarding the lunar month."

Now, as for what I asked concerning this matter — let it not be hidden from you, O understanding reader. Behold: according to the residues of the moladot in the years of the cycle, it necessarily follows that in the years whose preceding [year] is intercalated [embolismic] and whose following [year is likewise embolismic], the molad will never fall on parts 3 or 8; and in the years that lie between two intercalated years, the molad will not come on parts 2, 3, 5, 7, 8, or on equal tens.

These eight modes will therefore be deficient in the surplus of the bounds mentioned above. Understand this.

To R. Avraham, the Author — I, the Editor, Speak [p. 19]

[אל רבי אברהם המחבר אנכי המדבר] — a poem in praise of the author by the editor]

In vain does every man boast, if only to grow rich he wearies his soul: when calamity comes upon him, ruin and breaking, does his wealth go after him to the grave? His silver and his gold he leaves behind, no memorial for his name — only for his heirs.

Not so a man, if a blessing he has left — Torah and wisdom he has set up there as a ransom for his soul. His name, like the scent of waters, sends forth fragrance; it shall not be wanting, his myrrh shall not be lacking. On the day when dust covers him and he is gathered in, from generation to generation his memory endures in books.

A hundred and seventy-four [years] have passed from the day you were gathered to your people; many are the slain who have fallen since then, [whose] names went down and have not risen! And you — though like them you were carried off, still through the windows of your books [your soul] gazes down. Like you, all your companions are yet alive [in memory]; all of you, be praised to the height of heaven!

[End of the editor's front matter. The author's own treatise begins on the facing page.]

Sefer HaIbbur [The Book of Intercalation] [p. 20]

[ספר העיבור] — the author's title and opening dedicatory poem, set in display type]

Take to yourself the work | in the reckoning of intercalation [העיבור], whose secret was sealed [נסתם], Dig over its treasures | and search out its hidden stores, | and it will light up for you when pleasant [נעתם], And you will understand the matter | in the measure of every count, | and a number sealed [נחתם] within it, And you will declare hidden things | by the paths of the sciences, | and the mystery of their wonders [פלאותם], Drawing forth every cluster | which the All [the Creator] created, | until the consummation is finished [ירתם], [He] grants [it] with merit | Avraham bar Hiyya [אברהם בר חייא], who composed them [חבר אותם], And builds up his world | and shows favor to his people, | and gathers in their exile [גלותם].

I begin, with the help of God, the composition. It is written: "The Lord by wisdom founded the earth; by understanding He established the heavens" (Mishlei [Proverbs] 3:19). May the Name of HaKadosh Baruch Hu be praised and glorified, who created the high and the low [the celestial and the terrestrial], corresponding to one another — above and below — and bound the one to the other, so that each of the two would explain the other: one who understands the matter of the one understands the matter of the other. For one who knows the matter of "above" at once knows and understands the matter of "below"; and through understanding the matter of "below," the matter of "above" is explained to him. So it is with the way of any two things that depend on one another and are joined to each other — this to that and that to this: each of them comes to be united with its fellow in its explanation and to share with it in the definition of its meaning.

And we have found Scripture treating the creation of heaven and earth in just this way — sometimes putting the one first and sometimes the other. One verse says, "The Lord by wisdom founded the earth; by understanding He established the heavens" (ibid.): [here] "He founded the earth by wisdom" first and "established the heavens by understanding" after. And another verse says, "who stretched out the heavens alone, who spread out the earth by Myself" (Yeshayahu [Isaiah] 44:24) — "He stretched out the heavens" and afterward "spread out the earth" — to teach you that each of the two is found on account of the other, and that a person cannot understand the one except through the creation of the other. This being so on the path of their creation, how much more so concerning a thing that is a product issuing from between them both! For example: one who wishes to explain the matter of the days, the months, and the years will of necessity be required to know the matter of the creation of the heavens and the earth and the manner of the course of the sphere [galgal] — and only afterward will he be able to explain the matter of the day and the month. For the bound of the months is fixed by nothing but the course of the sun and the moon, and the course of the sun and the moon follows along with the motion of the sphere and its revolution; and from the course of the sphere together with the sun, the days and the nights are known. The sum of the matter is: a thing has neither measure nor time except by the count of the course of the sphere.

So too: "Let there be lights in the firmament of the heaven, to divide between the day and between the night" (Bereishis [Genesis] 1:14). The lights do not divide between day and night except by the turning of the sphere — for at the time when the sun rises over the earth and is seen by the inhabitants of the world, and the stars are not seen, it is day; and when the sun...

[the sphere] travels beneath the earth, hidden from the inhabitants of the world, and the stars become visible — that is night. By this same revolution and motion they serve as signs for the appointed seasons, for days, and for years, which correspond to the Shabbosos, the months, the sabbatical and jubilee cycles, as it is written: "and let them be for signs, and for appointed seasons, and for days and years" (ibid. [Bereishis 1:14]).

The word "signs" [אוֹתוֹת] here can only mean the Shabbosos, as it is written: "for it is a sign between Me and you" (Shemos 31:13). "Appointed seasons" [מוֹעֲדִים] means the festivals, as it is written: "These are the appointed seasons of the Lord... which you shall proclaim in their appointed seasons" (Vayikra 23:4). You will find "the [new] month" mentioned at the head of that passage — "after the section dealing with the offering of Shabbos day" — and from this you learn that the new month is the foremost of the appointed seasons. Moreover, all the appointed seasons depend on fixed, known days, and the new month is the principal element of them all; once the new month is established, all of them become known. So too it is written: "He appointed the moon for seasons; the sun knows its going down" (Tehillim 104:19) — and "moon" here is the Moon [הַלְבֵנָה], as it is written, "for the sun or for the moon" (Devarim 17:3).

You will find that the Holy One, blessed be He, renews the festival in its proper month, just as it was at the very first, month by month. From all these matters, then, the new months are called "appointed seasons," and the days and years — that is, "and for years" [וּלְשָׁנִים] — are likewise so designated.

Scripture sometimes calls a span of days a "year," as it is written: "the days of its redemption shall be" (Vayikra 25:29), and immediately afterward it writes: "But if it is not redeemed within the space of a full year" (ibid.) — here it is called "year" rather than "days." It is also designated by Scripture as "years," as in "until a full year is completed" (ibid. 25:30); and again, "the end of years for days," as it is written "at the end of years" (Devarim 31:10).

We have already explained, regarding "days," that they are the sabbatical years [שְׁמִיטוֹת], since the sabbatical cycle is reckoned by years, as it is written: "Six years you shall sow your field, and six years you shall prune your vineyard" (Vayikra 25:3), and "in the seventh you shall let it rest" (Shemos 23:11). You see, then, that the sabbatical is reckoned by years; we count year by year up to six years, and when we count the seventh year we observe the sabbatical year. And the years of the jubilee cycle [יְבֻלֹּת] are so called because they were counted as sets of seven years each — "seven sevens of years, seven times seven years" (Vayikra 25:8) — every seven years being called one "week" [שָׁבוּעַ] or one "Shabbos."

It seems to me that the word "days" [ימים] here means one year, which is one part in seven of a sabbatical cycle; and "years" [שנים] — six of them — make one sabbatical [שמיטה], which is one part in seven of the [jubilee]. To this Scripture added "in the jubilee" (Vayikra 25:28). So Scripture said "and let them be for signs, and for appointed seasons, and for days and years" (Bereishis 1:14), placing the lamed before each one — "for signs... for appointed seasons... for days and years" — to teach you that each of them is a distinct matter in its meaning, separate from the one beside it.

Yet at the end it said "and for days and years," and did not set a lamed [ל] between them, to teach you that the one is closely bound to the meaning of the other, and that there is no real difference between them except of more and less. You may also interpret this verse in another way and say that the "signs" are the Shabbosos, as we said above; the "appointed seasons" are the festivals; the "days" correspond to the months, which match the year of the Moon [שנת לבנה]. Scripture did not call it a "year" because it is not a full year — for sometimes it is a deficient year of twelve months, and sometimes an intercalated year of thirteen months. And the "years" correspond to the cycles [מחזורות] in which the solar year [שנת חמה] and the lunar year [שנת לבנה] are equalized.

You will find, then, that all these spans of time — the sabbaticals, the jubilees, the lunar year, and the cycles — depend upon the matter of day and night, by which they are reckoned; and day and night depend upon the motion of the sphere [הגלגל], whose nature is here being explained.

Because I have set out to explain the method of reckoning the months and the years — which we are obliged to know, so as to grasp their proper order and arrangement, in order to sanctify the months in their season and to keep the festivals that depend on them according to their law — I found it necessary to explain the matter of day and night, by which the months and the years are reckoned. And since I found it necessary to explain the matter of day and night, I have come to explain a little of the creation of the heavens and the earth, the manner of the sphere's revolution and return, so that the nature and measure of day and night might be made clear thereby. I have taken pains to set down the whole matter at the outset, so that no one might suppose I am bringing in a discussion of this subject that I do not need — but let him know that the whole is required by the subject and its reasoning.

Now, had I found this work composed in the Holy Tongue [לשון הקדש] in the land of France [ארץ צרפת], expounding this whole subject to its end and bringing the proofs upon it in their proper manner, I would not have put myself to all this

exertion. So too, had I found among the works that came into my hands the books of the scholars of Spain [ספרי ספרד], written in the Arabic tongue [לשון ערבי] —

— who had completed all this need, I would have translated them into the Holy Tongue as best I could. But it would not have been fitting in my eyes to stand before great men and put my hand to the matter, for who am I to set my own mind to expounding or composing anything? Yet, since I found none of all this, I was compelled — against my own will, and with no benefit to myself — to come to this point, on account of the charge laid upon me by great men and scholars who commanded me to explain this subject as best I could. I could not transgress their words, nor depart from their command, as our Rabbis, of blessed memory, said: "I am no priest [to refuse]". And had my colleagues said to me, "Go up [to the platform]," I would have gone up. This is their rule: that a person should accept the words of his fellow — how much more so the words of his teachers and his sages, which is a positive commandment of the Torah, to heed them; and one who transgresses their words is liable to death.

I was therefore required to explain and make known all these matters; they pressed and constrained me to depart from my measure and to place myself where it was not fitting for me — perhaps the one who hears my pleas will judge me favorably. And I take courage to ascend to the rank to which they have raised me, beginning now with the matter of this book.

I say that this work — for all the reasons I set out in its preface — must be divided into three Discourses [מאמרות].

The **First Discourse** [המאמר הראשון]: an exposition of all the preliminaries we must set down before the work, to open up its subjects and to add insight for the one who studies it.

The **Second Discourse** [המאמר השני]: treating the months and their measure, the year of the Moon, the reckoning of the molad [מולד / המולדות] (the conjunctions), the fixing of the festivals, and all that depends on this.

The **Third Discourse** [המאמר השלישי]: treating the solar year [שנת החמה], the tekufot [התקופות] (the seasonal turning-points), the reckoning of the sabbaticals and jubilees, and what depends on this subject from the reckoning of the years of the nations, the dates of their festivals, and all that is similar to it.

I begin, with the help of Heaven, with the First Discourse. May God Almighty help me in His abundant mercy and guide me in the right path — for it is He who gives wisdom; from His mouth come knowledge and understanding.

המאמר הראשון — The First Discourse

It treats all the preliminaries proper to set down first, and it is divided into ten Gates [שערים].

The First Gate [השער הראשון]: on the form of the earth and the measure of the inhabited region within it.

The Second Gate [השער השני]: on the form of the heavens, the course of the sphere and its revolution around the earth, and how the constellations [המזלות] in the firmament face north and south.

The Third Gate [השער השלישי]: explaining the difference found among the places of habitation from north to south.

The Fourth Gate [השער הרביעי]: explaining the difference found among the places of habitation from east to west.

The Fifth Gate [השער החמישי]: explaining the breadth of the earth and its length, and why this is called "length" and that "breadth."

The Sixth Gate [השער הששי]: explaining the course of the sun, by which the days and nights vary in their measure according to its path of travel.

The Seventh Gate [השער השביעי]: on the course of the Moon, which determines the practice of the [new] month.

The Eighth Gate [השער השמיני]: explaining the word "day" [יום] in the Holy Tongue, and in how many senses it is used, and which of these senses we are discussing.

The Ninth Gate [השער התשיעי]: on the disputes among the nations of the world as to the beginning of the day — from which hour it is reckoned, and from which hour we count its beginning.

The Tenth Gate [השער העשירי]: on the hours of the day and their parts, and in what manner and from what point we count the hours of the day for the molad and for the tekufah, and on the planetary regents [שמי הרקיע, "the servants of the firmament"] that rule over each and every day.

השער הראשון — The First Gate

On the form of the earth and the measure of the inhabited region within it.

Know, then, that all the learned investigators of this matter have agreed upon a single view: that the earth is round, like a ball or a sphere, and that the waters of the Great Sea encompass it over half of it. Thus the earth is found to be half dry land — and there is the inhabited region — while its other half is submerged within the waters of the Ocean [אוקיינוס], where there is no habitation. As for the other seas that lie within the dry-land half, they belong to the matter of the islands within the gathering of the waters; and you will find the dry land of the earth equal in measure to the sea.

The proof of this from the Torah: it is written, "Let the waters under the heavens be gathered together unto one place, and let the dry land appear; and it was so" (Bereishis 1:9). Just as the waters were gathered to one place, so the dry land appeared in one place; and the measure of the one is like the measure of the other — they were divided upon a single fixed standard. So too it is written, "And God called the dry land Earth, and the gathering of the waters He called Seas" (ibid. 1:10). Now in the work of Creation, every thing whose place He divided into two, and called by two names, you will find the measure of the one equal to the measure of the other — as it is written, "And God called the light Day, and the darkness He called Night" (ibid. 1:5): just as the measure of day equals the measure of night, so the gathering of the waters equals the measure of the dry land. And just as there are places where the day exceeds the night and places where the night exceeds the day — and when you take the excess of the one against the other, the two come out equal in this matter — so there are places on the earth where the dry land is in excess and places where the sea is in excess; and when you set the one against the other, the two come out equal. It will thus become clear to you that half the earth is dry land and half is sea, and I need bring no further proof from the words of the external science [החכמה החיצונית, i.e. secular/Greek learning].

The dry land that is called "Earth" is divided into four parts by two lines, which a person imagines in his mind as though these lines divided it. The one runs from east to west, and this line lies along the length [אורך] of the earth and is called the equinoctial line [קו השווה, "the line of equality"]. The second runs from north to south, and this line lies —

— along the breadth [רוחב] of the earth and is called the middle line [קו האמצעי]. These four parts are two on the northern side — the one north-eastern, the second north-western — and likewise two on the southern side — the one south-eastern, the second south-western. These parts are not all inhabited; rather, the habitation runs over the whole earth from the line that issues from the east, until it reaches the far end of the west. It does not spread over the whole breadth, but begins at the line of length [קו האורך] and broadens toward the northern side, up to a distance of 66 parts [ס"ו חלקים] of the 90 parts [צ' חלקים] in the breadth of the northern side; from there onward there is no habitation, because of the cold. So too it begins at the line of length and broadens toward the southern side, up to a distance of only 16 parts [י"ו חלקים] of the 90 parts in the breadth of the southern side; from there onward there is no habitation, because of the heat.

You will thus find the inhabited region in the breadth of the earth to be 82 parts [פ"ב חלקים] out of the 160 parts [ק"ס] that lie from the northern side to the southern side; and all these 82 parts [פ"ב חלקים] are inhabited along the length, from the eastern side to the western side. From this the masters of the external science said that the inhabited part of the earth is only one part in four, since one half of the earth is submerged in the sea, and of the second half one half is waste and desolate and one half is inhabited.

Of this inhabited region, the 16 parts [י"ו חלקים] that lie from the equinoctial line toward the south are the dwelling-places of the children of Aram, the sons of Cham [בני חם], of whom Scripture speaks; and their condition differs in all their affairs from the affairs of the inhabitants of the northern side, because the days that are summer for us are cold for them, and the days that are cold for us are hot for them. When the day is long for us, it is short for them; and likewise their long night is short, and their short night is long. For this reason the masters of this science left them aside and did not trouble to explain the conditions of their land.

The inhabited region that lies on the northern side is 66 parts [ס"ו חלקים]. The scholars divided it into seven parts, and gave each of them a name in the Arabic tongue, "climate" [אקלים, iqlīm], and these are the dwelling-places of the rest of the seventy nations that are reckoned in the world. Those who dwell upon the equinoctial line [קו השווה] in the earth — which is the line of length — have day and night always equal, the one never exceeding the other throughout all the days of the year. This is the situation of those who dwell upon the equinoctial line, from the start of the east to the end of the west.

Those who dwell beneath the line distant from the equinoctial line by 16 parts [י"ו חלקים] — which is the middle of the **first climate** — have a long day in the

tekufah of Tammuz [the summer solstice] of 13 hours [י"ג שעות], and a short day in the tekufah of Teves [the winter solstice] of 11 hours [יא שעות].

Those who dwell upon the line distant from the equinoctial line by 24 parts [כ"ד חלקים] — which is the middle of the **second climate** — have a long day of 13½ hours [י"ג שעות וחצי] and a short one of 10½ hours [י' שעות וחצי].

Those who dwell upon the line distant from the equinoctial line by 30 parts [ל' חלקים] are the dwellers of the **third climate**; their long day is 14 hours [יד שעות] and their short day 10 hours [י' שעות].

The **fourth climate** is distant from the equinoctial line by 36 parts [ל"ו חלקים]; its long day is 14½ hours [יד שעות וחצי] and its short day 9½ hours [ט' שעות וחצי].

Those who dwell upon the line distant from the equinoctial line by 42 parts [מ"ב חלקים] are the dwellers of the **fifth climate**; their long day is 15 hours [ט"ו שעות] and the short one 9 hours [ט' שעות].

The **sixth climate** is distant from the equinoctial line by 48 parts [מ"ח חלקים]; its long day is 15½ hours [ט"ו שעות וחצי] and the short one 8½ hours [ח' שעות וחצי].

The **seventh climate** is distant from the equinoctial line by 54 parts [נ"ד חלקים]; its long day is 16 hours [ט"ז שעות] and the short one 8 hours [ח' שעות].

Those who dwell upon the line distant from the equinoctial line by 66 parts [ס"ו חלקים] — which is the end of the habitation in the north — have a long day of 24 hours [כ"ד שעות], the measure of a full day, with no night in it; and a short day that is all night, with no day in it. And so it is in all the measures in which the day is long: the measure of its night is exactly such that the two together come to 24 hours [כ"ד שעות], the measure of one full day. For example, if the long day is 16 hours [ט"ז שעות], its night will be 8 hours [ח' שעות], and the two together always 24 hours [כ"ד שעות].

This applies to the tekufah of Tammuz. But in the tekufah of Teves the matter is reversed in its divisions: the night is long and the day short. In the tekufah of Nisan and the tekufah of Tishrei the night and day are equal throughout all the habitation. And I have herewith transmitted to you a single round figure, in which I have drawn all the lines that divide the earth, so that it may appear to you in a visual representation [the figure is announced here; it falls at the head of the next page] —

so that the eye may study them more closely. I have inscribed in this figure the head of the east as <א> [aleph], the north as <ג> [gimel], the west as <ב> [bet], and

the south as <ד> [dalet]. The arc running from <א> to <ג> is the northeastern corner; from <ג> to <ב>, the northwestern corner; from <ב> to <ד>, the southwestern corner; and from <ד> to <א>, the southeastern corner. I divided each of these corners into fifteen parts, writing <ו> [6] in the first part, <יב> [12] in the second, and so on in order until the figure inscribed in the last part reached <צ> [90], which is the measure of the parts into which each and every corner is divided.

I began inscribing in each corner the head of the east at the eastern sides, and the head of the west at the western sides, since it is from these that the lands recede toward the northern side and the southern side. I drew seven lines on the northern side corresponding to the seven climes of the inhabited region in the north, each clime being drawn according to its distance from the equator. Likewise I drew a line at the limit of the inhabited region in the north, and another line at the limit of the inhabited region in the south. In this figure you will find that the equator is the line whose two ends are <אב> [aleph-bet] — the one in the east, the other in the west — while the middle line has at its ends <גד> [gimel-dalet], the one in the north and the other in the south. Here, then, is the figure drawn for you. This suffices for our explanation of the form of the earth, and we now begin to explain something of the form of the firmament and the form of its motion.

Diagram. A single large circle — "the form of the earth" (צורת הארץ) — representing the inhabited quarter, bisected by a horizontal diameter captioned at its center as the central/breadth-of-the-earth line. Crossing the diameter are vertical lines marking the seven climes (אקלימים); the upper semicircle carries the repeated clime-column headers, the diameter itself carries a graduated numeric scale in gematria, and the lower semicircle repeats a short stack of clime ordinals near the center. The four quadrant corners are tagged with the ordinal point-letters א/ב/ג/ד and a cardinal direction (matching the body text), and the four rim corners carry "קץ ..." ("the end, ...") corner captions.

- א (center-right end of diameter, start of scale): "א מזרח" — east
- ד (left end of the horizontal diameter): "ד דרום" — south
- ג (just below ד, lower-left): "ג צפון" — north [printed defective: צפן for צפון]
- ב (lower-left arc, boxed): "ב | מערב" — west
- Diameter center caption (running along the horizontal diameter): "זה הוא קו האמצעי והוא רוחב הארץ" — "this is the central line, and it is the width of the earth"
- Upper-right rim caption: "קץ דרומית מזרחית" — "the end, south-eastern (corner)"

- Upper-left rim caption: "קֶץ מִזְרָחִית צְפוֹנִית" — "the end, east-northern (corner)" [printed מִזְרָחִית with worn ת]
- Lower-left rim caption: "קֶץ מַעֲרָבִית צְפוֹנִית" — "the end, west-northern (corner)"
- Lower-right rim caption: "קֶץ מַעֲרָבִית דְּרוֹמִית" — "the end, west-southern (corner)"
- Clime-column headers (upper semicircle, the same two-word stack repeated ~7×): "אֶקְלִים ... וְחִלְקֵי" — "clime N, and its parts/divisions"; the rightmost (widest, nearest center) band reads the longer "קוֹ רֹחַב הָאָרֶץ וְחִלְקֵי"
- Lower-semicircle inner stack (clime ordinals, vertical, near center below the diameter): "הָרִאשׁוֹן" (the first) · "הַשֵּׁנִי" (the second) · the third (הַשְּׁלִישִׁי /)
הַג'...)
- Graduated scale along the horizontal diameter (gematria ticks, transcribed in source RTL order, center [א, East] → rim):
ו [6] · י"ב [12] · ח [8] · כ"ד [24] · [?] [45/54] · ס [60] · [?] [66/70] rather than interpolated from the run.]
צ [90] · פ"ד [84] · ע"ה [75] · ע"ב [72] · [?] [66/70] rather than interpolated from the run.]

The Second Gate

On the form of the firmament, the motion of the sphere over the earth, and how the constellations are arrayed in the firmament, facing north and south.

The Sages of Israel, may their memory be a blessing, as well as the sages of the nations, are agreed concerning the form of the firmament and its structure: that it is round, and that it encompasses the whole earth — from above and from below, from east and from west, and from north and south. It revolves over the earth from east to west and encircles it: it begins in the east and revolves around the whole earth, above and below, until it returns to the east from which it began, completing one revolution in the span of a full day.

In its revolution the firmament rests upon two points at its extremity, one of them being at the northern extremity — called in Arabic *qutb ṣafōn* [קוֹטֵב צְפוֹן, "the northern pole"] — and the second at the southern extremity, called the southern pole. You might also call them the bars of the firmament or the nails of the firmament; except that "bar" carries the sense of something that runs from

one end to the other. The poles, then, are two points at the two ends of the bar. These two points stand forever fixed in their place and never shift, and the firmament revolves while the earth sits within it like a point at the center of a circle.

One of the sages illustrated this matter thus: it is as if a man were to place a grain of mustard inside an ostrich egg, or inside a glass globe resembling an egg, and set it between two nails, and spin the egg between the two nails with great force. He would see the grain of mustard standing still at the center of the glass, not turning to either side as he spins the glass with great force — because the force of the glass's motion does not let the grain incline right or left. And in this experiment you will find that the nails which draw the glass do not move from their place. By this same principle the firmament revolves upon these two points, called the poles; they stand fixed and do not move, and the firmament rests upon them as it travels, revolving over the earth from east to west in unceasing motion, while the earth stands within the firmament. The force of this motion thrusts the earth away on every side, until it sets it at the very center of the firmament, inclining to no side: its distance from the east equals its distance from the west, and it is as far from the north as it is from the south. Likewise the distance of the heavens above it equals the distance of the heavens beneath it below. The earth lies within the firmament like the grain of mustard within the great egg or the glass — which is yet smaller than that — in the eye of the wise man, on account of the smallness of its body against the vast bulk of the upper body of the firmament that revolves about it.

Its two poles lie opposite each other, the one at the end of the northern side and the second at the end of the southern side. The wheel that lies above these two points, [running] from north to south over them, is what supports the revolution; it is what makes known its character and explains it. The arc of this wheel that lies over the earth is called the *meridian arc* [קשת חצי היום, lit. "arc of midday"], and it corresponds to the breadth-of-the-earth line in the figure I gave earlier. Upon this wheel there is another wheel that turns about its midpoint, equidistant from each of the two poles, the northern and the southern, by one equal distance of $\frac{1}{2}[90]$ parts. Along this wheel the motion of the firmament is measured; it is called the *plane of the equator* [גלגל המישור, the equinoctial circle], and it corresponds to the equator in the earth — the line I called the "length-line" in the figure I gave earlier. This wheel divides into two equal parts in every place in the world: half of it is seen above the earth, and half is hidden beneath the earth. Because of this we find day and night equal in every place at the time when the

sun stands upon this wheel in any place in the world — which is the moment when it [the sun] is at the head of [Aries...]

of Aries, and at the head of Libra. Upon these two points the wheel of the constellations passes, on which we observe the course of the sun. Upon this wheel there are twelve constellations, and each constellation divides into thirty parts; thus the whole wheel is found to divide into 360 parts. The sun revolves in the firmament along the wheel of the constellations, which is inclined to the north side and the south side relative to the plane of the equator by $\langle 24 \rangle$ כ"ד parts. It cuts the plane of the equator into two equal halves at the two aforementioned points, which are called the *equinoctial points* [נקודות היושר] — because day and night are equal there in every place: one is the head of Aries, where, when the sun is at the head of Aries, day and night are equal in every place; and from there onward, on the north side, day exceeds night. The second is the head of Libra, where day and night are likewise equal there; and from there onward night exceeds day.

You will find that the wheel of the constellations divides the wheel of the constellations [the ecliptic] into two equal parts likewise [recte: the plane of the equator divides the ecliptic into two equal parts]: half of it lies to the north of the plane of the equator, and the midpoint of this half inclines northward from the plane of the equator by some $\langle 24 \rangle$ כ"ד parts. In this half are the six constellations called the northern constellations, namely Aries, Taurus, Gemini, Cancer, Leo, and Virgo. The other half lies to the south of the plane of the equator, and in this half are the constellations called the southern constellations, namely Libra, Scorpio, Sagittarius, Capricorn, Aquarius, and Pisces.

The two points of greatest distance, where the wheel of the constellations is farthest from the plane of the equator, are called the *solstitial points* [נקודות התמורה, "points of turning"]. One is the head of Cancer, where the day reaches the limit of its length; from there onward the day shortens and the night lengthens. The second is the head of Capricorn, where the night reaches the limit of its length; from there onward it [the night] shortens and the day lengthens.

The firmament everywhere divides forever into two equal parts: one half is seen above the earth, and the second half is hidden beneath the earth. The circle that separates the visible half from the half not seen of the firmament is called, in every place, the *horizon-plane* [אופן המפריש, "the dividing plane"] of that place. Every circle in the revolving, turning firmament we call a *wheel* [גלגל], and every circle we mention in the path of its revolution and rotation we call a *plane* [אופן].

The Third Gate

On the variation found in the places of habitation from north to south.

For all who dwell on the earth along the equator, from east to west, the plane of the equator revolves directly over their heads, and the two poles appear to them on the horizon — the one in the north and the other in the south. Likewise the southern constellations [appear] to them to the south, opposite their zenith, and the northern ones to the north, opposite their zenith. The plane that separates for them the visible portion of the firmament from the hidden passes over the two points of the poles and divides all the planes of the firmament and its wheels into two equal parts: one half is visible and the second hidden. For this reason their day and night are forever equal on every day of the year. In this place the revolution of the firmament is in its proper and orderly arrangement; neither of the two poles is hidden from them, nor raised above them, nor sunk below them.

Those who dwell on the line of the first clime are at a distance of $\langle [16] \langle 1'' \rangle$ parts from the length-line [meridian] of the earth, turned toward the north side. For this reason the plane of the equator does not stand directly over their heads as it does over the heads of those dwelling on the equator; rather it inclines southward from over their heads by $\langle [16] \langle 1'' \rangle$ parts. Nor does the horizon-plane pass over the point of the poles; rather it inclines away from each of the poles by $\langle [16] \langle 1'' \rangle$ parts.

The southern pole will be hidden from them forever, and likewise all the stars within its bounds that lie up to $\langle [16] \langle 1'' \rangle$ parts from it will be hidden from them. The northern pole will rise above them and not be hidden from them ever; rather it is always visible to them. And all the stars that lie up to $\langle [16] \langle 1'' \rangle$ parts from it neither set nor pass beneath the earth for them, ever.

The horizon-plane does not divide the firmament — its wheel and its planes — into two equal parts; only the plane of the equator [is so divided]. As for the planes inclining northward from the plane of the equator, it divides them into unequal portions: the portion of them visible above the earth exceeds the hidden portion. And the planes that lie south of the plane of the equator are, by contrast, the reverse: the portion of them hidden beneath the earth exceeds the portion visible above it. For this reason the days will exceed the nights all the while that the sun travels through the northern constellations, from the head of Aries to the end of Virgo; and the night will exceed the day all the while that the sun is in the

southern constellations, which run from the head of Libra to the end of Pisces. When the sun is exactly at the head of Aries or at the head of Libra, day and night are equal, because the sun then travels along the plane of the equator, which divides into two equal parts everywhere, as we explained earlier.

The measure of the excess in this place — where the longest day exceeds the equal [day] — adds no more than one hour. In places where the day exceeds the night, or [the night exceeds the day], by two hours, their dwellings are $\langle 31 \rangle \langle \kappa \rangle^7$ parts distant from the equator, and the plane of the equator inclines southward from over their heads by $\langle 31 \rangle \langle \kappa \rangle^7$ parts. The northern pole and all the stars within its bounds, up to $\langle 31 \rangle \langle \kappa \rangle^7$ parts, forever rise above the horizon-plane and are visible and never set for those who dwell on this line throughout the year. The southern pole, and all the stars within its bounds up to $\langle 31 \rangle \langle \kappa \rangle^7$ parts, are forever hidden from them. The northern planes are divided by the horizon-plane into unequal parts, but their visible portion exceeds the hidden. The measure of the excess at the head of Cancer is two hours; for this reason their longest day is $\langle 14 \rangle \langle \tau \rangle^1$ hours and its night ten hours. The planes of the southern constellations are divided in the reverse: the hidden exceeds the visible, until at the head of Capricorn [it amounts to] two hours; thus their shortest day is ten hours and its night $\langle 14 \rangle \langle \tau \rangle^1$ hours.

Those who dwell on the line distant $\langle 41 \rangle \langle \kappa \rangle^n$ parts from the equator: the plane of the equator inclines southward from over their heads by $\langle 41 \rangle \langle \kappa \rangle^n$ parts. The northern pole and its star rise and are always visible to them, up to $\langle 41 \rangle \langle \kappa \rangle^n$ parts. The planes of the northern constellations cause their visible portion to exceed the hidden by up to three hours; thus the longest day is $\langle 15 \rangle \langle \iota \rangle^0$ hours and its night nine hours. The hidden portion of the southern planes exceeds the visible by this same amount, so the shortest day is nine hours and its night $\langle \rangle \langle \iota \rangle^0$ [15 hours].

Those who dwell on the line distant $\langle 49 \rangle \langle \upsilon \rangle^n$ parts from the equator: the plane of the equator inclines southward by $\langle 49 \rangle \langle \upsilon \rangle^n$ parts, and correspondingly the northern pole rises and is never hidden, while the southern pole correspondingly is hidden and never visible. The northern planes — their visible portion exceeds the hidden by up to four hours, and the reverse holds for the planes of the southern constellations. For this reason the longest day is $\langle 16 \rangle \langle \iota \rangle^1$ hours and the shortest day eight hours.

On this principle: the more you delve toward the north side and recede from the equator, the more you will find the plane of the equator increasing its incline toward the south side, away from the zenith; the northern pole rising higher to

ascend and become visible; the southern pole descending and being hidden; and likewise the length of the day increasing while its shortness [the short day] keeps decreasing — until you reach the place distant $\langle 66 \rangle \langle 1^\circ 0'$ parts from the equator. There you will find the plane of the equator inclining southward by $\langle 66 \rangle \langle 1^\circ 0'$ parts, and the southern pole hidden beneath the earth up to $\langle 66 \rangle \langle 1^\circ 0'$ parts. For this reason the head of the constellation Capricorn will be hidden from them forever, because the distance of the head of Capricorn from the southern pole is none other than $\langle 66 \rangle \langle 1^\circ 0'$ parts.

You can grasp this with a little reflection, since you know that the distance of the plane of the equator from each of the poles is $\langle 90 \rangle \langle 1^\circ 0'$ parts, and that the distance of the head of Capricorn from the plane of the equator, southward, is $\langle 24 \rangle \langle 1^\circ 0'$ parts. Subtract those from the $\langle 90 \rangle \langle 1^\circ 0'$ parts, which is the distance of the plane of the equator [from the pole], and there remains $\langle 66 \rangle \langle 1^\circ 0'$ parts...

the head of Capricorn will be hidden, and all these parts [of the sphere] lie hidden beneath the earth at this location. The northern pole, with all the wheels, spheres, and stars that lie near it, will be visible there permanently — and so the head of Capricorn will be hidden together with them. The head of Cancer, by contrast, will be visible together with them and will never be hidden, since it stands as far from its pole as Capricorn stands from its own, southward.

So when the head of Capricorn is hidden in this way, the head of Cancer is revealed. When the sun stands at the head of Cancer, it revolves around the earth all that day, visible to the inhabitants of this place, and it does not dip beneath the earth. But when it is at the head of Capricorn, it is hidden from them the whole day and is not seen. Thus the long day there is twenty-four hours, with no night in it, and the short [day] is wholly night — twenty-four hours, with no day in it. This is the limit of habitation toward the north; from here onward there is no habitation. Yet reason demands, and investigation and inference attest, that at a place lying sixty-nine $[0^\circ 0']$ parts $[69^\circ]$ distant from the equator, the northern pole rises sixty-nine $[0^\circ 0']$ parts above [the horizon], and the two constellations Gemini and Cancer rise above it permanently and are never hidden.

For this reason, when the sun is in Gemini and Cancer, it rises over this place and stands above the earth, never setting throughout those two months. And when it is in the two constellations opposite them — namely Sagittarius and Capricorn — it is hidden beneath the earth and is not seen. So at this place two months are day and the two opposite them are night, while the remaining months of the year have days and nights of twenty-four hours, the day adding to the night or the

night adding to the day. When the sun is at the head of Aries or the head of Libra, day and night are equal there, as is the custom everywhere in the world.

At a place seventy-eight [נ"ח] parts [78°] distant from the equator, there are four constellations — Taurus, Gemini, Cancer, and Leo — that are visible permanently. These yield four months of day, since the sun does not pass beneath the earth [during them]. Likewise there will be four constellations opposite them — Scorpio, Sagittarius, Capricorn, and Aquarius — that are hidden permanently. These four months are night, since the sun is not seen above the earth [during them], while the remaining months of the year each have a day-and-night of twenty-four hours.

At a place ninety [צ] parts [90°] distant from the equator, the northern pole stands directly opposite the head [overhead]. The plane of the equator forms a circle there that separates the visible part of the firmament from the hidden part. The six northern constellations — from the head of Aries to the end of Virgo — stand above it permanently, and the six southern constellations — from the head of Libra to the end of Pisces — are hidden permanently. The course of the firmament is altered at this place: it neither rises over [the horizon] nor descends, but its revolution resembles the turning of a millstone. There are six months [of day] there: the sun is visible above the earth all the days it is in the northern constellations, and likewise the sun is hidden beneath the earth all the days it is in the southern constellations, for six months. The whole year is divided into two equal parts, the one day and the other night. This is the revolution of the firmament and the alternation of the sun's standing over the earth, and the measures of days and nights throughout the northern region.

I need not explain the conditions of the southern region, since you can understand them from the variations of the northern region: for every place we named in the north, whose distance from the equator is such-and-such, and whose measure of days and nights we have specified — the corresponding distance in the south will have its days and nights with the same measures, the difference in their measure being [only] the reversal of the northern region. If here in the north the day is long, there [in the south] it is short; and if here it is short, there it is long. And so it continues up to the place where the year is divided into two equal parts, where you will find six months in which what is day in the north is night in the south, and what is night in the north is day in the south.

I have observed that the sages who are precise in expounding the Holy Scriptures derived a hint to the standing of light for many days in a single place from this

verse: "Which is the way to where light dwells? And darkness — where is its place?" (Iyov 38:19). [The meaning:] "Which is the way to where light dwells" — in which place does light dwell for six months? "And darkness — where is its place" — in which of these places, where light dwells for six months, [does darkness dwell for six months]? And what is the place where darkness stands?

A proof that the verse speaks of this matter comes from the verse above it: "Have you comprehended the breadth of the earth? Tell, if you know it all" (Iyov 38:18). The Holy One, blessed be He, said to Iyov: "If you have walked through the dwelling-places of the earth from north to south, and have comprehended its breadth — if you know its breadth, tell, then, in which place light dwells" for four and six months without setting. And [the verse meaning] when light is in one place, where then is the darkness — [this is] "Tell, if you know it all," and it says "the breadth of the earth," not "the length of the earth." This is because the earth's length runs from east to west, and in this length the matter of this alternation does not arise at all; the earth's breadth, by contrast, runs from north to south, and there light or darkness dwells and remains in one place for many days, as we explained above. We have already explained the matter of places that differ in the breadth of the earth and the variation between them, from the northern end to the southern end. Now we come to explain the matter of the variation between places far apart in the length of the earth, from east to west, with the help of God.

השער הרביעי — Gate Four

On the variation found among inhabited places from east to west

Know that the distance from east to west is one hundred eighty [פ"ק] parts [180°] — the measure of half the parts of the firmament. For the whole firmament is divided into three hundred sixty [ס"ש] parts [360°], and it is always divided into two equal halves: one half, of one hundred eighty [פ"ק] parts, above the earth, and the second half, of one hundred eighty [פ"ק] parts, below the earth. You will find that the distance from east to west, beneath the earth, is one hundred eighty [פ"ק] parts. If you divide each of these two parts into twelve — the number of the hours of day and the hours of night — each portion will be fifteen [ט"ו] parts [15°], which is the measure of one hour in the matter we are now discussing.

When the sun rises and shines at the eastern edge, it is seen by all who dwell at the very beginning of the eastern region, and that moment is the beginning of their day; but it is not yet seen by anyone dwelling further inward along the length of the earth — for them it is still night. When the sun has risen from the eastern region until it stands fifteen [ט"ו] parts high above the earth at the

eastern edge, it is then seen by all the places at a distance of fifteen [י"ט] parts from the head of the eastern region; when it shines upon them, that moment is the beginning of their day. So between the beginning of day at the [first] place and its beginning at the eastern edge there is one hour.

When the sun rises higher above the earth in the eastern region, until it reaches thirty [ל'] parts [30°], it is seen, shining, by the places at a distance of thirty [ל'] parts from the eastern region, and the beginning of day at that place falls at the end of the second hour from the [start of] day at the eastern edge. Likewise, when it rises to forty-five [מ"ה] parts [45°], it shines upon the places at a distance of forty-five [מ"ה] parts from the eastern edge, and between the beginning of their day and its beginning at the eastern edge there are three hours. So too those at a distance of sixty [ס'] parts [60°] from the eastern edge: between the beginning of their day and its beginning at the eastern edge there are four hours. Those at seventy-five [ע"ה] parts [75°] — between them, five hours. And those at ninety [צ'] parts [90°], who dwell at the middle of the earth — between them and the eastern edge, six hours.

The head of day for those dwelling at the middle of the earth is the midpoint of day for those dwelling at the eastern edge. On this principle [the sun] continues on its way until it reaches those dwelling at the western edge, and there will be...

[the sun] receding from the eastern region by the full one hundred eighty [ק"ע] parts, which is half the firmament — namely twelve [י"ב] hours. And the sun, at the moment it sets above [the heads of] those at the western edge, is the beginning of night for them, and it rises and shines upon them as the beginning of their day. Thus the sun is found, for the people of the east, to be day, while for the people of the west it is night; and the night of the people of the west is day for these [in the east]. This place is the end of habitation on the earth; beyond it there is nothing but the waters of the ocean, which no person crosses. From this you find that day and night are nowhere in the world equal — neither in their measure nor in their timing — but the day that has a known measure at this place will at another place be greater than it or less than it. On this principle, the night will be long at one place and short at another.

For this reason, throughout the year, in only two days are day and night equal in all the inhabited places in their measure — when the sun is at the head of Aries and the head of Libra. You see, then, that they are not equal in their measure everywhere, nor are they equal in their timing. Rather, in a single hour the sun is seen at one place and not seen at a second place, so that here it is day and there [literally: further on] it is night. You will not find the sun seen throughout all the

inhabited world in a single instant, nor likewise hidden from above all the inhabited world in a single instant, except [it being seen] in two quarters [of the world] on the same day — when it is at the midheaven over the heads of those dwelling at the middle of the earth, which is their midday. At that instant it is rising over the people of the west and setting over the people of the east, and it is [directly] opposite the heads of those dwelling at the middle of the earth. To those dwelling east of the middle of the earth, it appears turning from above their heads toward setting; to those dwelling toward the west of the middle of the earth, it appears rising eastward, ascending to the midheaven. At that instant it is seen throughout the inhabited world. And the second instant [of universal visibility/invisibility] is when it is hidden from above all the inhabited world — the instant it stands over the half of the heavens that is beneath the earth, opposite the feet of those dwelling at the middle of the earth.

השער החמישי — Gate Five

On explaining the breadth of the earth and its length, and why this is called "length" and that "breadth"

It has now been made clear to you, in the [preceding] gates, how the days and nights pass throughout the inhabited world, and the variation in their measure among [places] throughout the year, in the breadth of the earth which runs from north to south. Likewise it has been made clear to you the variation that runs from east to west. The distance between north and south they called the "breadth" [רוחב] of the earth, because the habitation in it does not extend from edge to edge; rather there remains in it desert and waste — both in the northern region and in the southern. The distance from east to west they called the "length" [אורך] of the earth, because the habitation in it runs from edge to edge. In all languages, the sense of "length" exceeds, in its measure, that of "breadth." For this reason they called the longer and the fuller distance — that of habitation — "length," and the shorter and the more deficient distance "breadth."

So too we find the verse: "Arise, walk through the land in its length and in its breadth, for to you will I give it" (Bereishis 13:17) — here the verse put the length of the earth before its breadth. He promised him [Avraham] that He would give all of it to him, and when He explained to him the manner of its giving, He said: "And you shall spread out to the west and to the east, and to the north and to the south" (Bereishis 28:14). You find in this verse that east and west are placed first, corresponding to "length" in the first verse [which was placed first], and north and south placed later, corresponding to "breadth," placed later. So you find from

the Torah that the length of the earth runs from east to west and its breadth from north to south. So too it is written: "As far as east is from west, so far has He removed our transgressions from us" (Tehillim 103:12) — and it did not say...

"as far as north is from south," because the distance of north from south, in the inhabited world, does not run from its [one] head to its [other] end. Had it said "as far as north is from south," it would have entered the minds of people that the Holy One, blessed be He, removes our transgressions from us [only] by that whole distance — but in fact there is a distance greater than it, namely the distance of east from west, which exceeds it. We suppose, then, that a person cannot measure it from the beginning of habitation to its end. If you begin to walk from the eastern region toward the west, the line between you and the east keeps increasing and growing until you reach the western edge and fix the length of the line between you and the east, and you can add no further [to it]. But if you set out to walk past the western edge, you would be going beneath the earth and approaching the eastern region [from the other side], and you would find no extent of habitation that adds to the line between east and west.

The breadth of the earth, by contrast, is not so in this matter, but rather: when a person begins to walk in one direction — whether toward the north or toward the south — he does not reach its end, on account of the great cold or the great heat. So too the verse says: "Have you comprehended the breadth of the earth? Tell, if you know it all" (Iyov 38:18), and it did not say "as far as the length of the earth" — to teach you that the breadth of the earth a person cannot reach to its end, as he reaches the eastern and western region, which is the length of the earth.

If you see in the external books [non-Jewish works] one saying that a certain city is so-and-so many parts [degrees] in breadth and so-and-so many parts — or so-and-so many hours — in length, and you ask and say, "By what method did these sages know the breadth of cities and their length, that they could say the breadth of this city is such-and-such and its length such-and-such?" — the breadth, we say to you, they knew from the measure of the arc that the sun reaches up to it [the city] when the sun is at the midheaven over the city whose breadth they were investigating, on each and every day, in the manner set forth in the reckoning of the stars [astronomical computation]. This is a matter close at hand for us in that craft, and a person can compute it for any city in which he is staying, at any time he wishes, for the reckoning of the breadth.

The length, however — its reckoning is not available at every time, because it is reckoned and revealed only at the time of an eclipse of the moon, by a method

that is not so difficult, or at the time of an eclipse of the sun, whose reckoning is difficult and corrupted [error-prone] and must be guarded against on many sides — which you do not need [to attend to] in the eclipse of the moon. The early kings who set their minds to establish this matter precisely used to appoint, in every city and province, men who were sages and reckoners, to investigate this matter. Each and every one of them, at the time of a lunar eclipse, would carefully observe and precisely mark the hour of the eclipse's onset and the hour of its ending, and would record these hours. They would then come before the king and would examine the discrepancies between each man and his fellow in his reckoning.

If they found, for example, that the eclipse began in one city at three [ג'] hours, in the second city at four [ד'] hours, and in the third city at two [ב'] hours, they knew that one city is distant from the second by [the equivalent of, eastward] one hour to the east, and that it is distant from the second city by one hour to the west. On this principle, they would compare the discrepancies at the [moment of the] completion of the eclipse, and would know that their reckoning was sound; and if they found discrepancies between the onset of the eclipse and its completion, they knew there was an error in their reckonings. They would go back over the matter many times until it became clear to them that there was no error. By this practice they proceeded in all the cities, and they began to investigate from the eastern edge until they reached the western edge, and they found the distance between them to be twelve [י"ב] full hours, and no more. [And this is] how you find the breadth of cities and their length set forth in the *Sefer Tzurat HaAretz* [Book of the Form of the Earth].

השער השישי — The Sixth Gate

Explaining the motion of the sun, by which the days and nights are exchanged in the measure of their course:

Know that the first heaven [רקיע] covers, encloses, or overlies all the heavens that lie beneath it — by whichever of these terms you wish to designate the relation, depending on what overlies and what is overlain. This eighth heaven is divided into 360 parts [חלקים], and each and every one of the firmaments beneath it is likewise divided into 360 parts; and each one of these parts, in each of the firmaments, is divided into 60 parts — and these are called *regaim* [רגעים]. And every *rega* may again be divided into 60, if you wish to say so; and likewise the seconds [שניים] into thirds [שלישיים] and the thirds into fourths [רביעיים]. Not that there is in the heaven any actual division into these parts — for in the heaven

there is no division at all — but rather we divide it in this way in order to refine our reckoning of its motion and of the motion of the stars upon it.

The heaven revolves from east to west in a day and a night, once. The sun and the moon, by contrast, travel within their heavens from west to east, indicating a motion opposite to that of the heaven; they do not run along with the rush of the heaven in which they are set. The sun travels within the heaven fifty-eight *regaim*, plus eight second-*regaim*, plus third-*regaim* and fourth-*regaim* that we need not specify, and by this it completes the whole circuit of the heavens in 365 days and a quarter, less a trifle. Thus the heaven goes round and revolves every single day, while the amount the sun travels [west to east] in a single year is one [circuit]. The heaven revolves about the center of the earth and adds nothing to its course on the second day over the first; but the course of the sun is not so. Rather, the sun travels within its own heaven — the heaven about which it revolves — at a motion equal to the course we have recorded for you, namely 59 *regaim* and the second-*regaim* that it adds to this; and in its own body it adds nothing on the second day over the first, nor does it subtract from it. It is to us alone, as it were, that the sun varies its course: at times it travels more slowly than its mean motion, at times it travels at a middling motion equal to its mean motion, and at times it travels more swiftly than its mean motion. This variation appears in its course because the center of the heaven about which it revolves and the center of the earth are not upon a single point. Rather, the center of its heaven lies outside the center of the earth by a distance of two parts out of one hundred and twenty parts measured along the line of the heaven's length. For this reason you do not find that all the parts of its heaven are at one distance from the center of the earth; rather you find within it one part that is farthest of all from it [the earth's center], and — when the sun is in this part — it is at its longest distance and its great apogee [גובה], with a part opposite to it that is nearest of all from it; and when the sun is in this part it is at its shortest distance and the small apogee [recte: perigee]. And there are two parts at the midpoint of the two sides, on this side and on that, in which the sun is at a middling distance; these are called the points of the mean apogee [נקודות הגובה הבינוני], because this apogee is less than the great apogee, while it exceeds the small one. And when the sun is at the great apogee, or [moving] toward it until it reaches the mean apogee, it appears to travel more swiftly than its mean motion — neither adding to that motion nor subtracting from it.

I will add for you an explanation here, and say: when the sun is at the point of its great apogee, it is at the limit of its distance from the earth and its elevation, and [there] it travels at the end of its slowness. When it rolls down from the point of

the great apogee, inclining to descend toward the mean apogee, it shortens its slowness and adds to the measure of its course until it reaches the mean apogee, where its course at that point becomes equal to its mean motion. From there onward it adds to its mean motion, hastening its course, until it reaches the small apogee [recte: perigee], and there it travels at the limit [end] of its swiftness, just as it had been at the great apogee traveling at the end of its slowness. When it rolls up from the small apogee [perigee], it proceeds to ascend toward the mean apogee, and it lessens its swiftness and shortens the measure of its course until it comes to the point of the mean apogee on the second side; there it travels at the mean motion. From there onward it shortens its course from the mean motion and tarries in its course until it reaches the great apogee.

The great apogee is in the sign of Gemini [תאומים], and the small apogee [perigee] is in the sign of Sagittarius [קשת]; the one mean apogee is in the sign of Virgo [בתולה] — and from there the sun descends to the small apogee [perigee] — and the second [mean apogee] is in the sign of Pisces [דגים], and from there the sun ascends to the great apogee.

We furnish you with a figure, so that by viewing it the eye may see the matters of the variation of the [sun's] motion, and that you may understand by it the further reason why the cold prevents settlement on the northern side and the heat prevents it on the southern side. In this figure we draw one sphere [אופן] whose center is the center of the earth — and this is the sphere resembling the sphere of the zodiac [גלגל המזלות] — upon the point of its center, א, and upon its four sides א ה ו ד. We divide this sphere into four equal parts by two lines passing through its center at right angles, upon the two ends of the one line א ה and upon the [two] ends of the second line א ו, and each one of these parts is 90 parts — for the whole sphere is divided into 360 parts. Point א is the middle of Gemini; point ה is the middle of Sagittarius; point ו is the middle of Pisces; and point ד is the middle of Virgo.

Within this sphere we draw a small sphere derived from it, and its center lies outside the center of the earth, away from point א toward point א, by a distance of two parts; this center is point ב, on the line א ה. This sphere is the heaven [sphere] of the sun, upon its center ב and upon its four sides א ב ג ד. Point ב is on the line א ה, below point א. We draw another line passing through point ב at right angles — this is the line א ב ג — and this sphere is divided into four parts, each part 90 parts of the heaven [sphere] of the sun. At the head of the first part, א, is the far apogee, which touches [i.e., is in contact — *miṭṭasheš*, explained: "joins"] the curvature of the sphere of the zodiac on the inner side. The second part, ב, is the

one mean apogee; the third, ס, is the small apogee [perigee]; and the fourth, ל, is the second mean apogee.

You will find, in this small sphere, that the line which is the diameter of the earth, ח ז, divides it into 360 unequal parts. The one [arc] is the arc ש ג ל [?], which is more than half of the sun's sphere; and this arc encompasses for it more than half by itself of the sphere of the zodiac — namely the arc ח ג ז, drawing through six of the signs, from the middle of Pisces to the middle of Virgo. The second part is the arc ש ס [?], which is less than half of the sun's sphere, while what encompasses it of the sphere of the zodiac is a full half — namely the arc ח ד ז, in which lie six signs, from the middle of Virgo to the middle of Pisces.

When the sun travels upon point ש of the curvature of its heaven, all who dwell upon point א, which is the center of the earth, see it upon point ח of the sphere of the zodiac, which is the middle of Virgo — that being the mean distance [המרחק הבינוני]. And when it is at point ג, it appears to them in the middle of Gemini, which is the height of its apogee; and though it travels through the whole arc ח ג of its heaven-sphere — which is more than a quarter of its heaven — it appears as though it travels through only three signs. When it is at point ה [recte: ש? — see note] of its heaven-sphere it appears at point ו, which is the middle of Virgo [?]; and you will find that it travels from point ח of its heaven-sphere to point ז, [a distance] from it of, for example, 184 parts of the parts of its heaven — which it travels in about 183 days less a quarter — yet it travels of the signs only 180 parts; and in this it appears to travel slowly.

In the reverse of this matter: when the sun travels from point [ש] ה to point ס of its heaven-sphere — that is, up to point ש — these being, for example, 176 parts of the parts of its heaven, which it travels in about 178 and a half days — it appears to travel the whole arc ח ד ז of the sphere of the zodiac, which is six full signs: the middle of Virgo and then Libra, Scorpio, Sagittarius, Capricorn, Aquarius [recte: read from context — וּמַאֲזִינִים וְעַקְרָב וְקֶשֶׁת וְגָדִי וְדָלִי וְחֹצֵי דָגִים], and the middle of Pisces; and in this it appears to travel swiftly, just as in the figure that follows.

You will see in this figure that when the sun is at a long distance above the earth, at point ג of its heaven-sphere, and on both sides of this point, it appears to travel in the sign of Gemini and Cancer [וְסִרְטָן]; and likewise, when it is at the short distance above the earth, at point ס of its heaven-sphere, and on both sides of this point, it appears to travel in the sign of Sagittarius and Capricorn [וְגָדִי]. You will find the sun, when it is in the sign of Gemini and Cancer and in the two signs before them and the two after them — namely Taurus and Leo [שׁוֹר וְאַרְיֵה] — traveling on the northern side of the sphere of the zodiac, inclining in its

revolution toward the dwellers of the north, circling opposite the heads of the northern dwellers and warming the air in all these places.

Diagram. A schematic of two concentric (eccentric) circles representing the sphere of the zodiac (outer) and the eccentric heaven-sphere of the sun (inner), demonstrating the solar anomaly. The outer circle is labeled around its circumference with the zodiac signs; the inner eccentric circle carries the apogee/perigee point-letters. Two perpendicular diameters cross at the earth's center (א), with a second center (ב) for the sun's sphere offset toward the top. The right rim runs clockwise from Gemini through Cancer, Leo, Virgo, Libra, and Scorpio; the left rim carries Capricorn and Taurus clearly, with Aquarius and one Aries/Pisces-region sign faint.

- חצי תאומים (top of outer circle): "the middle of Gemini"
- ג / גובה הגדול (top, inner-circle point under the Gemini mark): point א — "the great apogee"
- וסרטן (upper right, outer rim): "and Cancer"
- אריה (right, outer rim): "Leo"
- ובתולה (right, outer rim, between Leo and Libra): "and Virgo"
- ז (right, on inner circle at horizontal diameter): point ט
- ה (right, on diameter at earth-center level): point ה (*he* — roof bar + full right leg + a detached short left leg, the top-left gap diagnostic of *he*; distinct from ש below)
- מאזנים (lower right, outer rim): "Libra"
- עקרב (lower, outer rim): "Scorpio"
- גלגל המזלות (lower, on outer circle band): "the sphere of the zodiac"
- ד / וחצי קשת (bottom, inner-circle point): point ט — "and the middle of Sagittarius"
- גדי (lower left, outer rim): "Capricorn"
- דלי [?] (left, outer rim): "Aquarius" [faint/abraded]
- ח (left, on inner circle at horizontal diameter): point ח
- שור (upper left, outer rim): "Taurus"
- [?] (upper left, outer rim, between שור and the lower left rim): "and Aries" / "Pisces" [one faint curved sign, fixed by zodiacal order]
- ב / מרכז גלגל החמה (interior, upper): point ב — "the center of the sphere of the sun"
- קיץ (interior, upper, above ב line): "summer"
- ל / אביב (interior, upper horizontal radius): point ל — "spring"

- גובה רביעי (interior label on the upper radius near ל): "fourth apogee" — genuinely engraved; the prose names no fourth apogee (great, small, and two mean apogees only), so this is an engraving feature, likely the engraver's quadrant-count label for the ל/spring head, not a reading uncertainty
- גובה בינוני / מ (interior, left of center): point מ — "the mean apogee"
- מרכז הארץ / א (interior, center): point א — "the center of the earth"
- ש (interior, on horizontal diameter, right of א): point ש (*shin* — three upward prongs on a common baseline, the trident form; distinct from ה above)
- ס (interior, lower): point ס
- חורף / הגובה הקטן (interior, lower radius): "winter" / "the small apogee [perigee]"

You will find the warmth, in all the places of settlement in the north, on those days when the sun travels through these signs that lie to the north of the equinoctial sphere [אופן המישור] in the heaven — except that the sun is then at its longest distance from the earth; and for this reason the warmth in the north does not exceed its [proper] measure.

When the sun is in the sign of Sagittarius and Capricorn and in the two signs adjoining them, it travels on the southern side, drawing away and distancing itself from the heads of the northern [dwellers]; and you will find coolness in their land on those days. Yet the cold does not exceed its fixed measure, because the sun, at its near distance, is close to the earth, and this diminishes the cold; and you will find among the dwellers of the north that, if the warmth comes to them from one side, you find it opposed from a second side, which diminishes it. And if the cold comes from one side, a second side presents itself which weakens it. For this reason, settlement on the northern side extends [northward] until the sun distances itself a great distance from there — until it withholds its light from them by more than 24 hours [literally: 24 *sha'ot*; *kaf-dalet* with *gershayim* = 24, confirmed — the hours/degrees sense is interpretive], so that the cold overcomes them; and the more the settlement is in them, [the colder], for there is no warmth found except through light. For this reason settlement on the northern side stopped at a distance of 66 parts [degrees]; but on the southern side it is not so.

On the southern side it is otherwise: only when the sun is in the sign of Sagittarius and Capricorn and the two signs adjoining them, the sun is then traveling on the southern side, drawing near in its revolution toward the heads of the southern dwellers and warming their air. In these signs it travels in its

heaven along the arc nearest to the earth — namely arc $\sigma \eta$ [the small-apogee region] — and this matter adds to the warmth, and the heat is found on the southern side. Because the two sides gather there, each of them adds to the heat and intensifies it. And because settlement in the south reaches only up to 16 parts [degrees] — which are the distance of the midpoint of the sign of Scorpio and the sign of Aquarius [דלי] from the line of the equinox [קו המישור] — and these signs are not far from the mean apogee at all, for this reason settlement in the south reached only thus far. From there onward the sun draws near from the earth and grows deep in the south, and these two matters intensify the heat until living creatures can no longer endure it, and settlement in the south is cut off from that place onward.

You see from this that the heat prevents settlement in the south, and the cold prevents it in the north, as we recorded for you above. Thus the path of the sun's motion has been clarified, along with a few of the matters that depend upon it.

השער השביעי — The Seventh Gate

Explaining the motion of the moon:

The moon travels within its heaven at a uniform motion every day, on the model of the motion of the sun from west to east, except that its motion adds to the measure of the sun's motion — and we will explain this presently — toward the east. It is not like [the sun] in [all] the matters of its motion, but only in respect of the direction of motion, which is from west to east. The motion of the moon is compounded from two motions, according to the composite [model] that brings it closer to the learner's understanding; but its [true] motion is compounded from four motions, which we need not explain here. This motion takes place upon two heavens [spheres]. The one heaven encompasses the whole earth, like the other heavens, and its center is the center of the earth. The second heaven is a small heaven, set upon the larger first heaven, and its center lies upon the curvature of the first heaven. Thus half of this [small] heaven is found outside the curvature of the first, and its second half inside it, away from the curvature. The first sphere is called the sphere resembling [the sphere of the zodiac] [גלגל הדומה], whose center is the center of the earth; and the second, small sphere is called the sphere of the epicycle [גלגל ההקפה], because the body of the moon is set upon this sphere. The center of the epicyclic sphere revolves upon the curvature of the sphere that carries it round — the one resembling the sphere of the zodiac — and it [the carrying sphere] revolves from west to east, carrying the epicyclic sphere round

with it, 13 parts of 360 parts in the carrying heaven, plus about 11 parts of sixty parts per part [i.e. 11/60 of a part] per day.

The body of the moon revolves upon the curvature of the epicyclic sphere from east to west: if its body is upon the outer curvature of the sphere, [it moves west to east], and if its body is upon the inner curvature of the sphere, it travels from west to east [recte/[?]: the text reads "from west to east" — directionality of the two cases should be checked]. This motion is 13 parts of 360 parts in the epicyclic sphere, plus 3 *regaim* of sixty parts per part, plus *regaim* of *regaim* per day.

You will find that when the moon travels upon the curvature of the epicyclic sphere that lies within the curvature of the resembling sphere, its motion and the motion of the center of its sphere are both on one side, and the two motions combine together; and the moon appears as though it travels swiftly. But when the moon travels upon the outer curvature of the sphere, its body's motion is in one direction and the motion of the center [is in another]: its body travels toward the west while the center travels toward the east, and its [apparent] motion is diminished from the motion of the center, and the moon appears as though it travels slowly.

Here, then, is a figure that will let you see this matter for yourself; and I am drawing one large epicyclic circle [מעגיל אופן] corresponding to the moon's resembling-sphere relative to the sphere of the zodiac [גלגל הדומה / גלגל המזלות], and upon the two ends of the line that divides it I mark two points, א [aleph] and ב [bet]; and upon the midpoint of this line is point ג [gimel], which is the center of this sphere — the point that is the center of the earth.

And further, I am drawing one small epicyclic circle upon point א [aleph]; half of this epicycle will lie outside the sphere, and the other half within the sphere. I draw the line אב [aleph-bet] that divides the deferent sphere [הגלגל הסובל], and I extend it until it reaches

Diagram. A geometric construction illustrating the moon's deferent-and-epicycle model. A large deferent circle is centered at point ג [gimel], the center of the earth, with the horizontal diameter line running through it to point ב [bet] at the right end; the diameter is labeled at two stations as גובה גדול ("great apogee") on the left and גובה קטן ("small apogee") in the middle. A small epicycle is set on the left of the diameter, carrying points ד [dalet], א [aleph], and ה [he] across its own diameter (with ד at the upper left, א at center, ה just to its right at the small-apogee mark) and point ו [vav] below it. A second epicycle is drawn at the upper right, with radial lines from center ג fanning up to it; along and around it are

points ץ [ayin] (top-left), ח [chet] (just outside on the left), ס [samekh] (center), צ [tsadi] (lower-left), and מ [mem] (lower-right), with small radius-line tick marks at the top-right and intermediate points ט and ל marking where the radial lines cross the deferent's curvature.

- א (center of deferent, on diameter): center of the sphere — the center of the earth
- ב (right end of diameter): endpoint of the dividing line
- פ (left, center of lower epicycle): the point on which the small epicycle is set
- ד (upper-left of lower epicycle): a point of the epicycle's curvature
- ה (on diameter, at "small apogee" mark): a point of the epicycle's curvature
- גובה גדול (left of diameter): "great apogee" of the moon
- גובה קטן (mid-diameter): "small apogee" of the moon
- ע (top-left of upper epicycle): a point of the epicyclic curvature
- ח (left of upper epicycle): a point of the epicyclic curvature
- מ, צ, ס (around upper epicycle): points marking the moon's positions on the epicycle
- ל, ט (where radial lines cross the deferent): intermediate points

the curvature of the outer deferent sphere [העקמימות הגלגל ההקפה החיצונית] at point ט [dalet], and it will fall on the point from this same line, inward, where point ה [he] lies. And upon the two points that lie on the body of the deferent's curvature — which divide the epicycle, one of them at ז [zayin] and the other at ח [chet] (the second division) — in this figure you should consider that point ד, which belongs to the curvature of the deferent alone, is the moon's great apogee [גובה גדול], while point ה, which lies inward of that curvature, is its small apogee [גובה קטן].

The center of the epicycle revolves upon the curvature of the deferent, from the point opposite ז toward point ב [bet], from west to east. The body of the moon is sometimes at point ד, which is the great apogee, and sometimes at point ה, which is the small apogee. The moon is seen at these two points as though it stood at point פ, on the firmament of the deferent that resembles the sphere of the zodiac — the point upon which the center of the epicycle rests. And you should observe in this figure: if the moon, when it is on the curvature alone, travels contrary to the motion of the center (which is at point ו [vav]), then the body of the moon travels opposite point ח [chet]; for such is the manner of this revolution, and this is its figure.

If we now revolve center ν [ayin] upon the curvature of the deferent toward point τ , until the center reaches point ϕ [pe], and we draw upon point υ [tet] the epicycle in the same form it had at point κ , then the body of the moon, which had been

at point τ of the great apogee, revolves opposite point η and reaches point ν [ayin] of the epicycle. It will appear, on the firmament of the deferent, that the moon is at point χ [tsadi], and the station of the center will be at point ϕ [pe]. The arc through which the center has revolved runs from κ to υ , and over it is inscribed in this figure $\upsilon\text{ }^{\circ}\eta\kappa$. The moon, which has reached point ν on its epicycle, is seen on the deferent at point χ , because the line that goes out from the center of the earth and from the eyes of mankind, until it reaches the moon, is the line $\nu\text{ }^{\circ}\chi$ — it reaches the moon at point ν and sees it at point χ on the deferent. The arc visible in the moon's motion is the arc inscribed over it on the deferent, $\chi\text{ }^{\circ}\eta\kappa$. You will find that the moon's place falls short of the place of the center by the arc $\eta\text{ }^{\circ}\chi$; here the moon is seen as falling short of its mean motion [מהלכה הבינוני] and traveling at a slow pace.

But if the body of the moon, while it is at point η , travels opposite point τ and reaches point λ [lamed] on the curvature of the epicycle, then the moon will be seen along the line $\eta\text{ }^{\circ}\lambda$ at point μ [mem], which lies upon the curvature of the deferent. The arc visible in the moon's motion will then be the arc $\mu\text{ }^{\circ}\lambda\eta$, while the arc of the center's motion is the arc $\eta\text{ }^{\circ}\chi$; and here the moon will be found exceeding its mean motion and traveling at a swift pace.

You thus find the moon's motion varying in three respects, while the center of the deferent travels everywhere by one measure — namely, the arc $\upsilon\text{ }^{\circ}\kappa$. Sometimes it travels its swift motion, as in the arc $\mu\text{ }^{\circ}\kappa$; sometimes it travels its slow motion, as in the arc $\chi\text{ }^{\circ}\kappa$; and sometimes it travels its mean motion, which resembles the arc $\upsilon\text{ }^{\circ}\kappa$. You find the swift motion exceeding the slow motion by the arc $\chi\text{ }^{\circ}\mu$. This is what our Sages of blessed memory [לרבינו] meant when they said that Rabban Gamliel told them: "Thus have I received from the house of my father's father — that sometimes it comes by a long road, and sometimes it comes by a short road" (cf. Mishnah Rosh Hashanah 2:8). This is the meaning of "the long" and "the short."

You find, too, that the moon's motion far exceeds the sun's motion, doubling the sun's motion more than thirteen times over. You will find that when the sun completes its circuit of the firmament one time, the moon completes its own circuit thirteen times; and in that interval it overtakes the sun. It reaches the sun and meets it twelve times — the number of times it completes its own circuit

exceeding by one the single circuit the sun has made [i.e., 13 lunar circuits yield 12 conjunctions].

I have not needed to expound these matters to their end, since I do not intend here to investigate the motion of the firmament and the motion of the stars, nor to explain their corrected courses; rather, I have come to speak a little of this for the purposes of this work, and these matters belong to the science of the stars. And here I seal this Gate.

השער השמיני — The Eighth Gate

On the explanation of the term "day" [יום] — the several senses in which it is used in the Holy Tongue, and which of these senses we require in this work.

Know that the word "day" [יום] is used in the Holy Tongue for many senses, of which I shall explain those relevant to our subject. Sometimes it refers to any moment that may befall a person, whether by day or by night, as it is written: "And it came about on a certain day [כהיום הזה], that he went into the house to do his work" (Bereishis 39:11) — meaning, when the occasion arose for him to come, whether by day or by night. Sometimes its sense is precisely "now," as it is written: "Swear to me as of this day [כיום]" (Bereishis 25:33), whose meaning is "swear to me now." Sometimes it refers to a span of time not fixed to any known moment, as it is written: "And it shall be on the day [ביום] that Gog comes" (Yechezkel 38:18 / 39:11) — which is not said of a known day or a known moment at all, but only of the time [העת] that the Holy One, blessed be He, will, in His mercy, reveal. And there is a place where they called it "day"

[Bereishis 1:5]: it is said of the light, as it is written: "And God called the light Day" (Bereishis 1:5) — even before it shone upon the earth, for the earth was not yet visible and its place was not known, and it was not called "land" until the third day. In all of Scripture's accounts He called the time of light "morning" and the time of darkness "evening," yet did not call them "day" and "night" — to teach you that the very essence of light [עצם האור] is what is called "day," the first day of Creation. And sometimes "day" is used of the measure of time [מדת הזמן] in which the light, like the air, fills the world together as one [כמעור / as a unit]. If the sun's body itself is not visible — that is, from the rise of dawn until the emergence of the stars [צאת הכוכבים] — and there is no other thing present, but only the sun's light caught in the air near the earth and in the clouds rising from the earth: for likewise the stars do not come forth and become visible except at the time when the light separates from this cloud-filled air. Scripture called this entire span

"day," as it is written: "So that the night was for us a guard, and the day for work" (Nechemiah 4:16).

On this matter our Sages of blessed memory [לר"ז] relied in all the commandments a person is obligated to perform at night, that they be done in actual night, where there is no ambiguity and no doubt. And in other places they ruled that those who are stringent in commandments, while it is still day, should "add from the profane onto the sacred" [מוסיפין מחול על הקדש], and they count the night before the twilight of the sun [דמדומי חמה] — yet this addition pertains only to the twilight of the sun. But once it darkens — which is its setting [שקיעתה], according to their words — the whole is already either daytime or Shabbos without doubt, and there is no "addition" there. The "addition" is whatever you, while it is still day, take upon yourself as a stringency. Just as there is an addition here at the beginning, so there will be one at the end — for they count the night from the emergence of the stars, an addition (or a diminution, if you wish to put it so). And from this you learn that the precise measure of the day in which there is neither addition nor diminution is from the moment the sun rises in the east until it sets in the west; and the night is from the moment of its setting in the west until the moment of its rising in the east. As it is written: "the greater luminary to rule the day, and the lesser luminary to rule the night" (Bereishis 1:16).

And throughout the time the sun shines upon the earth, the light of the moon has no power to spread over the earth — even if the moon is full — because it has no rule [ממשלה] by day. And if the sun sets, you see at once the light of the moon illumining the earth and spreading over it; and if the moon is full, its light extends until the sun rises, because its rule belongs only to the night. From this you have proof that the beginning of the night is from the moment of the sun's setting, and the beginning of the day from the moment of its rising.

And sometimes "day" is used of both these times together — day and night — which, when joined together, are called "day," as it is written: "And there was evening and there was morning, one day" (Bereishis 1:5). You see from this verse that the two together are called "day." And if you find us saying "day" in this work, know that we are speaking of one of these two latter senses: either the measure of the sun's being above the earth, from the moment of its rising until the moment of its setting — which is "day," as against the "night" opposite it — or the day-and-night together, which together are called "day." We do not use it in any of the former senses, for most of them are said by way of analogy and the broad usage of the language, and here we have no need of them — only of these two latter senses.

We offer a rationale for these two senses, and say: Scripture called the light "day," and we find no light in this world except from the sun. At every time the sun appears to us, the light is present with us, and that time we call "day," because we see the light spreading over the earth. And we call "night" the time at which this light is hidden from us; but this time called "night," even though the light does not appear to us, it is known that the sun is shining upon another place, or going beneath the earth and illumining the waters that are under the earth — and there it is "day." So you will find the light of the sun at night; and if it is absent

from one place, it is found in another. By this same reasoning these two times were called "day" when they join together. You find, then, that "day" is said in a general sense and also in a particular sense. It is said of the general span [הזמן הכללי]: from when the light begins to appear over the earth and completes its entire course over the earth and beneath it, until it returns to the place at which it began to appear; and in this span its light completes its spreading over the earth, both from above and from below. This is the general "day" [היום הכללי] spoken of in the general sense. And it is said in the particular sense [בפרט] of every place where the sun's light spreads — for as long as its light spreads over that place it is called "day," and if it does not spread over a place but over another, then that place is called "night" while the other is "day."

השער התשיעי — The Ninth Gate

This Gate speaks of the disagreements among the nations concerning the beginning of the day, and according to which view we reckon its beginning.

The "day" spoken of in the general sense behaves, in its measure, after the manner of a circle [עגולה] that revolves: it begins from one place and travels around, circling and turning, until it returns to the place from which it began; and at once it turns back and continues to circle as is its way, never standing still. You will find in it no known place fit to be called the "head" [ראש, the beginning] in the judgment of all people. By the agreement of his own reasoning, each person assigns it a head and a beginning from whatever place he wishes — for just as the circle has no fixed head, so too should it be with the conduct of the "day."

Yet when we examine the matter of the day with careful inspection, we find in it four moments [רגעים] fit to be set as the head and beginning of the day, because at them the sun turns from one side to another in its circuit, toward one place, and at that place it changes the character of its motion; and if it does not change the character of its motion in its circuit of the whole earth, it changes the

character of its motion relative to a particular place. The first of these moments is the time of its rising [זריחתה], because then it begins to ascend over the place upon which it rises. The second moment is the time of its being at the meridian [חצי השמים], because then it reaches at that place the limit of its height and ascent over the place upon which it has risen, and from then onward it inclines toward setting. The third moment is the time of its setting [שקיעתה], because then it begins to go beneath the earth and to hide from the place upon which it had risen. The fourth moment is the time of its being at the lower meridian — in the half of the heavens that is beneath the earth — because from there it begins to ascend over the earth and to travel to shine upon the place above which it had set.

We have found that the nations, and the craftsmen who must reckon days and nights to compute the courses of the stars, began to count the beginning of the day from one or another of these four moments, each according to his own view and his own need. Those who examine the reckoning of the motion of the stars, and who investigate the measure of their courses — who must inquire into the course of each and every star, how much it travels in a single day — these set the beginning of the day, or the time of the sun's being at the meridian above the earth (which is midday), or its being at the lower meridian beneath the earth (which is midnight).

They said: We cannot set the beginning of the day from any single place, because the days and the nights are not equal throughout the world. But if you join a single night to the day that preceded it, the two together will indeed make a single day, except that their measure will not be equal — because the day before the night either exceeds or falls short of the day that

(Gate 9 conclusion; Gate 10 opening.) ...came after it. We could not, by way of this kind of inquiry, arrive at any single determination — that is, the inquiry by way of the sun's rising. And likewise: had we begun the inquiry from its setting — namely, the moment from the sun's setting until the [next] setting of the sun — one man would have begun his inquiry from one [point] in the day, and another from another point. We could not arrive at a single determination on account of the disparity between the days and the nights. So this whole line of inquiry leaves us confounded.

And now, when we reckon by either midday or midnight, we likewise can never arrive at a single determination — because the equality found in them [only obtains] along the equator [קו השווה]. For if you join half a day to half a night, the two being adjacent and contiguous, the two together do not yield a day in which

you would find the first half-day to equal the second, neither exceeding nor falling short of it. This is the regular rule on every single day: if the first half of the day exceeds the [following] half of the night on a given day, you will find the matter reversed on the next day — the half-night will exceed the half-day. Yet the two of them together will always amount to a full twelve hours, because the sun's course from the meridian above the earth down to its [lower] meridian beneath the earth is equal to its course from the meridian of the heavens above the earth down to its [other] half beneath the earth, in all the inhabited places. But the measure of its course above the earth is not [equal] to its course beneath the earth: sometimes it exceeds, and sometimes it falls short.

In view of this matter, you will find that all who reckon the motion of the stars set the beginning of the day in their reckoning at either midday or midnight — and for them the reckoning is set up only in this manner. They did so out of the requirement of their craft, and we are not permitted to rely upon them or to follow after them, because midday and midnight are not a matter open and available for every person to know. No one can know it precisely by day except by measuring the shadow, or by weight, or by measuring the instruments that pour out water or sand — all instruments built to track the hours — or by gauging the body of the sun above the earth. And [by night] it is known only by measuring the instruments that pour out water or sand, or the like, by means of instruments built to track the hours, or by gauging the body of one of the stars shining at night. Every one of these matters is feasible only through a skill found with one man and not found with the next man. We require that the beginning of the day and its end be open and well known to every person, so that everyone may arrange all his needs in the world; and you find no moment in the day that would be open and well known to every person except at these two moments — the rising of the sun in the east or its setting in the west.

It is fitting that one of these [moments] be set as the beginning of the day. And we find the Christian nation, and all who follow its custom, begin their reckoning of their days from the setting of the sun together with its setting. They say that the day must begin first and the night follow it, because the day is more excellent than the darkness, and that which is more excellent deserves precedence. Furthermore — because HaKadosh Baruch Hu created the light first, and through it He opened all His creatures; and when the light came into being, the day came into being. From then onward the days and the nights began to be counted. So Scripture says: "Yours is the day, Yours also the night" [Tehillim 74:16] — [placing] the day before the night. And further it is written, "Day to day pours forth speech, and night to night declares knowledge" [Tehillim 19:3] — here too

the day precedes [the night], just as the one who says here is prior in [the order of] knowledge. And no man can know a thing unless [the prior teacher] informs him of it. And so Scripture says, "by day and by night," "and the cloud was [over it by day]" [Bamidbar 9:21 — "and they journeyed"]; here it counts a full day and begins from the day, and attaches the night to it. So you have, in any case, that the day is prior to the night and is fit to be counted first.

On the basis of these arguments, and others like them, all those who begin to count from the rising of the sun have established their words. But we examine their arguments and probe their words, beginning from the proofs they have brought from the Holy Scriptures. We say to them: the verse from which you bring your proof at the end of your arguments — that the day comes before the night — Scripture did not come, in this place, to inform us of where the day begins, from which point [it begins]; rather, [it came] to inform us how HaKadosh Baruch Hu had compassion upon His people Israel when they journeyed

and encamped — that they would journey and encamp only by day. For this reason it said, "day and night," [meaning] the cloud rested [over them] a day and a night following it; the cloud would be taken up on the morrow by day, and Israel would journey and proceed by light. We might have inferred from this that the night precedes [the day] — except that this is no place to bring a proof for this matter. For so it is written before it: "and there were [times] when the cloud was [there] from evening until morning, and the cloud was taken up [in the morning], and they journeyed" [Bamidbar 9:21]. And it is written, "or [whether it was] a day and a night, and the cloud was taken up, and they journeyed" [Bamidbar 9:21] — because they would not journey by night. And the cloud was never found resting over them a night with the following day, and then taken up at the end of the day together with the beginning of the [next] night — because, had Israel needed to journey at night and go [by night], HaKadosh Baruch Hu had compassion upon them and did not require of them this [nighttime] journeying. For this reason it said "day and night" and not "night and day."

And likewise the second verse [Tehillim 19:3] — it did not come to arrange the night and the day, [showing] how they are counted, and which [comes first]. Rather, it came to inform [us] how they testify to the glory of their Creator. It began with the day, in which the sun is seen by every person, and it likened it to an utterance of the mouth that the ear hears and that reaches it, as it is written, "Day to day pours forth speech." And the night follows it — in which the light is hidden and stored away, and none among men perceives the place of the light at night except those possessed of understanding. For this reason it likened it to

knowledge, which is within the heart, as it is written, "and night to night declares knowledge" [Tehillim 19:3]. So too the day is mentioned first in the first verse [Tehillim 74:16], and it said "Yours is the day, Yours also the night," to teach you that HaKadosh Baruch Hu rules over the upper world, which is wholly light — and He likened it to the day; He, may His name be exalted — and He rules over the lower world, which is darkness, likened to the night, as Chazal said: "He knows what is in the darkness, and the light dwells with Him" [Aramaic, Daniel 2:22: "yada mah bachashokha, u-nehora immeh shari"].

He said: even though the ways of men are such that if they stand in the light they cannot see what is in the darkness, and if a man is in the darkness he can see what is in the light — and it may arise in your heart that nothing visible is seen until the light covers it — the way of HaKadosh Baruch Hu is not so. Rather, the light is before Him, and He knows what is in the darkness; and a thing that is in the darkness does not give light. [This is] to teach you the great difference there is between His power, may His name be exalted, and the power of human beings.

All these verses give no proof for arranging the day and the night [in order of counting]. And as for their saying that the light is more excellent than the darkness, and that for this reason it was fitting to give it precedence in time — that is no proof. For there are many things in the world that are more excellent and are given precedence in rank, yet come later in time. You find that the human being has a rank above all other living creatures, and even in this world — because he possesses knowledge and understanding, and the Torah and the commandments were given to him, for which he is found meritorious and obligated, whereas other living creatures are not. On this account he is prior to them in rank, yet they are prior to him in time — because they were created on the fifth [day] and at the beginning of the sixth, while the human being was created after them. So too all living creatures are prior to the grasses and the trees [in time], yet stand above them in rank, because they have a spirit of life, whereas the growth of the earth has neither life nor soul. And they [the animals] are later in time, because the growth of the earth was created on the third day and the living creatures on the fifth and the sixth.

In the same way you can say of the day that it is prior in rank yet later in time. And if you should say: the light was created first, and at its creation the day came into being — [then] we say: we do not count the day except from the rising of the sun, which was created on the fourth day. And before the creation of the sun it is certain that darkness was present upon the earth during the three days that preceded it, for so it is written, "and let them be for lights in the firmament of the

heavens to give light upon the earth" [Bereishis 1:15]. From this you may learn that the light was not seen upon the earth until the fourth day; and you will find that the night precedes the day.

So we have shown [our] investigation into the beginning of the day. For of the three moments [rising, midday, midnight], each one has arguments that withhold it from being set as the beginning of the day, and there remains in our hands of the four moments only one — namely, the beginning of the night. We are fit to set the beginning of the day from it, because [each of] all four things had a fifth [criterion] that will become clear to you, and their nature will be that their account requires [appeal] to one of them. And we shall see

in this place, since it has been transmitted to us that you have no place in the day to set as its beginning and its head — but [rather] that if one [of the four moments has its arguments]... Each one of the four moments [had its] regain [that withhold it], and it rose [as established] in our hands concerning each one of the three that there is in it no [fitness for] all our need [of it]. And we have no need to seek again for another reason to confirm it [לחזקו]; rather, it is only for good measure [Aramaic: לרוּחָא דמַלְתָּא, *l'rawḥa d'milta*, "for the easing of the matter"] that we say [it].

[We say:] Even though this inquiry, which required us to set the night before the day, finds proofs from reason [סברא] and from the Torah that testify for us and assist our words from reason — [now] know that what we set forth earlier, [drawn] from the creation of the sun on the fourth day, and because we found that most things are prior in rank yet later in time, and that the day is prior in rank on account of the light found in it, yet later in count [i.e.] in time — and because darkness is nothing but the absence of the light and its loss, so that the darkness is [first] in potential and afterward found in actuality — accordingly we say of this day that it was first in potential during the existence of the night, and for this reason the night is prior. These are the proofs from reason, and no opponent contesting us can refute us regarding the arguments by which we [argued].

And the proofs from the Torah: we find Scripture, in the section [סימן] that arranges the course of the day, putting the night before the day in the count, as it is written, "and there was evening and there was morning, one day" [Bereishis 1:5]. There is in this verse no matter other than the ordering of the reckoning of the day alone, and the manner of its creation. For this reason Scripture said, in the section of the Day of Atonement, "and you shall do no manner of work on this very day" [Vayikra 23:28] — it warned us against doing work [for] one full day;

and at its end it explained for us how the "very day" itself is to be counted, [namely] how it is reckoned, saying "from evening until evening shall you keep your Shabbos" [Vayikra 23:32]. So it has been firmly established in our hands, in any case, that the beginning of the day is from the setting of the sun, and that the night precedes the day. With this is in agreement the view of Chazal, whom we are commanded in every matter to heed and to give ear to their words; and this is the arrangement upon which we rely in the reckoning of the moladot and the tekufot, which we are about to discuss. For their honor [i.e., to honor Chazal] we set forth the matters we have transcribed up to here.

The Tenth Gate [השער העשירי]

[This gate] speaks of the hours of the day and their parts; and in what manner and at what place we count the hours of the day in [reckoning] the moladot and the tekufot; and of the [ministering] servants of the firmament that govern each day and its hours.

The day is divided, according to the words of Chazal and the words of the other sages among all the nations, into 24 equal parts called "hours." Of these, twelve hours are by night — corresponding to the number of the constellations of the firmament, or corresponding to the number of the months of the year — and likewise twelve hours by day. Each and every one of these hours [arises] from the motion of the sphere through 15 parts [chalakim] of the sun, which are one part out of the 24 parts of the parts of the firmament, which are 360 parts. By this measure all the nations reckon their equal hours [as] 15 parts in each hour.

But according to the words of Chazal, the hour is divided into 1,080 parts [chalakim], which are three times the parts of the firmament. When we reach, with the help of Heaven, the explanation of the measure of the [lunar] month, the reason that Chazal divided the hour into these parts will become clear to you. And further, they divided one part of the parts of the hour [into smaller units]: they divided 1 chelek into 76 parts, called regaim — because we needed, in the reckoning of the tekufot, to divide the chelek into all these regaim, as will become clear to you in its place, with God's help. And these hours [as 360-part hours?] do not follow an equal custom among themselves throughout all the days of the year except in the places that dwell along the equator [קו השווה] which is in the earth. But in the other places of the inhabited [world] the hours of the day are never equal except on two days only out of the days of the year, as was explained in the rest [of the chapters] of the first [section] of this treatise. And even though the night and the day are not equal in their measure, you will find each one of them in itself [evenly] divided into twelve

equal parts; and each one of [the parts] of the night and [the parts] of the day will be 1/12 of [it]. And so it is for the day in all the world — [each of] its twelve hours [being equal among themselves]. Except that the parts of one hour of these add to, or subtract from, the parts of [the corresponding hour of] the other — for example: if the parts of one hour at night are 17 parts [י"ז], the parts of the day-hour paired with it [התלוי בו] will be 13 parts [י"ג]; and so, conversely, until the two hours — one of the night and one of the day — together come to 30 parts [ל'] in their measure. The hours of the night together with the hours of the day, all of them together, [amount to] 360 parts of the parts of the firmament. Such is their custom throughout the inhabited [world].

And from the words of our Rabbis, of blessed memory, we have learned the disparity between the days and the nights in the dwelling-places of the earth, as they say: "From the tekufah of Tishrei until the tekufah of Nisan, the night exceeds the day; from the tekufah of Nisan until the tekufah of Tishrei, the day exceeds the night; at the tekufah of Nisan and [the tekufah of] Tishrei, the two of them are equal throughout the whole world." Since we have learned this matter from the words of our Rabbis, of blessed memory, and they were expert in it by a tradition [transmitted] to them — and since we saw that they reckon the moladot and the tekufot by hours and parts that are equal in their measure throughout all the days of the year, and they did not command us to vary the measures of the hours, neither between the day and the night, nor in the days of winter, nor in the days of summer — neither in the reckoning of the tekufot nor in the reckoning of the moladot — it has become clear to us with fine clarity, in which there is no doubt at all, that this whole reckoning they fixed [as based] upon the days [reckoned] along the equator which is in the earth.

After this matter became clear to us, we came to inquire and to say [what is] certain, according to the view of all the sages [taken] together: that since the day and the night are not seen as a single matter in every place — but in this place it is day at the time when it is night in another place; in one place [the difference is] three hours or four or five, [more] of day than of night; in a second place [it is] more than this; and in a third place less than this — this is the rule of the days and the nights throughout the whole world, [whether] along the equator which is in the earth, or upon each and every line [latitude] of the [seven] climes that are reckoned. And we have found our Rabbis, of blessed memory, saying: "The moon was born at such-and-such an hour of the night," and likewise "the tekufah falls at such-and-such an hour of the day or of the night" [?]. We needed to understand to what place these hours are referred. [Their reckoning] is from the length of [the day along] the equator, upon which they based their reckoning; and once

that place is known, we can say from it at what hour the molad or the tekufah will be in our own places where we dwell.

When we came, in this study, to investigate the matter from every side, according to the reach of our hands, it appeared to us that they fix the reckoning of the moladot and the tekufot upon their occurrence as it is along the equator [17 השווה], at the eastern edge [of the inhabited world]. This matter became firmly fixed for us when we saw one of the sages, of the contemplative ones, whose view was as our view; and he said that this reckoning is [conducted] in the manner of the eastern edges [of the world] and cannot be in the manner of another place. And the order of inquiry of which I have spoken proceeded along these lines: it is certain that the firmament revolves over the earth every single day from east to west, and carries the luminaries around with it; and the luminaries themselves revolve in the firmament gradually, from east to west [?]. From this there are two distinct matters: the one, the motion of the firmament; and the second, the motion of the luminaries. We need to know these two matters [as they were] at the creation of the luminaries.

First, we need to know in which constellation [למ] they were created, in order that we may know from which place their bodies began to revolve upon the firmament, and which time of the year it was. Afterward we shall come to investigate from which place the firmament began to revolve [carrying them] in it — because this matter is found in them only after they were created and suspended in the firmament. And we find that Scripture explained these two matters, each of them on its own. First it said, "Let there be luminaries in the firmament of the heavens to divide between the day and between the night" [Bereishis 1:14], to inform you of the need and the benefit that bring about their creation in the world. And because this need came by way of two paths, [Scripture] at once returned [to it] and informed you which benefit they bring to the world in their going with their bodies upon the firmament, saying, "and let them be for signs and for appointed times and for days and years" [Bereishis 1:14]. For the months and the years are renewed, and return, and are counted, only by way of the circuit of the bodies of the luminaries ...the body of the luminaries in the firmament. Now our Rabbis, of blessed memory, informed us in which constellation [למ] the luminaries were created. For R. Eliezer [ben Hyrcanus] says that the world was created in Tishrei, while R. Yehoshua says that the world was created in Nisan. We need not pursue this matter further here, in light of what Scripture itself has shown us. The first thing Scripture pointed to was an allusion to the place of the luminaries within the firmament.

The proof of this is that, in coming to explain the second matter, Scripture said, "Let there be luminaries in the firmament of the heavens" [Bereishis 1:14], and said further, "And God set them in the firmament of the heavens to give light upon the earth" [Bereishis 1:17] — "in the firmament of the heavens to give light upon the earth," meaning upon the earth, that is, upon that place in the world which He called "earth." It did not say "to rise," "to ascend," or "to shine," nor "to go out over the earth," nor "to turn," nor "to bend," nor "to incline," nor "to come up from over the earth" — all those expressions in which you find the luminaries described, by way of the firmament's circuit over the earth. Scripture mentioned none of these. Rather it said only "to give light upon the earth," to teach you that the luminaries were placed by Him in their location in the firmament, at the moment of their creation, in such a position that there would be light spread evenly over the whole earth. Such a state of affairs occurs only when the sun stands at the midpoint of the arc of the half of heaven that is over the earth — that is, at the portion which lies directly above the heads of the inhabitants of the center of the earth. At that moment you will find the sun giving light over the whole earth: the inhabitants of the eastern edge see it as it is setting, the inhabitants of the western edge see it as it is rising, and the inhabitants of all the other places see it off to one side or the other, as has been explained in the gates that have passed. The sun was then giving light directly above their heads, and its light was spread out over the whole inhabited world across the whole earth — from east to west and from north to south. From east to west, because it was at the midpoint of the distance between them; from north to south, because the sphere of the celestial equator [גלגל המישור] was in the firmament at the head of Aries, according to R. Yehoshua, or at the head of Libra, according to R. Eliezer.

After Scripture had shown us this matter, it came on to inform us what benefit the luminaries confer upon the inhabitants of this world when the firmament revolves over them across the earth. It said, "and to rule by day and by night, and to divide between the light and between the darkness" [Bereishis 1:18] — they divide between the light and between the darkness, and rule by day and by night, by way of the sphere's revolving them, not by way of their themselves revolving over it [the earth]. From this too you learn that the sun was placed in the firmament, at its creation, at the midpoint of the arc of heaven that lies opposite the heads of the inhabitants of the center of the earth. When the sun reaches this place [in its daily course], it is setting from over the heads of those at the eastern edge, and that is the beginning of night for them. And we find that Scripture counts the days, in the six days of Creation, from the onset of night, as it says, "and it was evening and it was morning" [Bereishis 1:5] — and we learn that this manner of reckoning applies only with respect to those at the eastern edge, and

that this is the proper place to begin from, since it is from there that the firmament begins to revolve and to rise over the earth.

From this we see that our Rabbis, of blessed memory, reckoned their computations of the molad [מולד] and of the tekufot [תקופה] according to the manner of this place, which is the edge of the eastern extremity. For whenever they say "the moon was born after midday," or "after midnight," or "the tekufah falls at such-and-such an hour of the day or of the night," they mean it only with respect to the eastern edge, and not with respect to any other place in the world. I shall bring a proof of this matter from the words of our Rabbis, of blessed memory, when we come — with God's help — to explain the manner of fixing the New Moons and the festivals. We have already clarified the measure of the day and the night, the explanation of their nature, the count of their parts, and from which place Scripture began to count them.

Know that the luminaries and the stars [planets] rule by day and by night, and serve in each and every hour of the night and of the day, in the following manner: one star [planet] serves during one hour, and when that hour is completed, the star [planet] beneath it in the firmament serves during the hour that follows it. So the matter proceeds, one serving after another, until the seven stars [planets] have completed their turn at the seventh hour; then they return again in their cycle. The star [planet] that served at the first hour returns and serves again at the eighth hour, and on this pattern they return to serve, one planet after another, in the order of their arrangement in the firmament. Then they return again a third time and a fourth, and upward from that, until the seven days [of the week] are completed. And the order of their arrangement in the firmament is as follows.

The highest of them all is the one that begins the service [of the week], namely Shabbetai [Saturn]. After it is Tzedek [Jupiter], and after it the one that serves [next] after it is Ma'adim [Mars] — the third; Chamah [the Sun] — the fourth; Nogah [Venus] — the fifth; Kochav [Mercury] — the sixth; Levanah [the Moon] — the seventh. Their mnemonic, in the order of their arrangement, is ShaTZ"m ChaNK"L שצ"מ חנכ"ל = Shabbetai, Tzedek, Ma'adim / Chamah, Nogah, Kochav, Levanah].

Now since the luminaries were created at the first hour of the eve of the fourth day [Wednesday night], Shabbetai [Saturn] — which is the first to serve — began at the first hour, and after it Tzedek [Jupiter], and so on hour by hour until the days of the week were completed; and they continue in this same manner. They were directed along this path to serve, and this is the practice they follow until

the end of the world's days. [In the table of governance:] Shabbetai [Saturn] is the planet of the first hour of the eve of the fourth night [Wednesday night], and it governs the eve of the fourth night. At the second hour Tzedek [Jupiter] serves; at the third hour Ma'adim [Mars]; at the fourth hour Chamah [the Sun]; at the fifth hour Nogah [Venus]; at the sixth hour Kochav [Mercury]; at the seventh hour Levanah [the Moon]; at the eighth hour the service returns to the beginning, as at the start, to Shabbetai [Saturn]; the ninth to Tzedek [Jupiter]; the tenth to Ma'adim [Mars]; the eleventh to Chamah [the Sun]; the twelfth to Nogah [Venus] — and the hours of the eve of the fourth night [Wednesday night] are completed with Nogah [Venus].

Then the fourth day [Wednesday daytime] begins, and the lot of the service passes from Nogah [Venus] to the planet Kochav [Mercury]. So Kochav [Mercury] serves at the first hour of the fourth day and governs the fourth day; the second hour the Moon; the third Shabbetai [Saturn]; the fourth Tzedek [Jupiter]. And so the lot of the service of the hours proceeds, from one planet to another, on the fourth day, until it reaches Ma'adim [Mars] at the twelfth hour — and the fourth day [Wednesday] ends with Ma'adim [Mars].

Then the eve of the fifth night [Thursday night] begins, and the lot passes to Chamah [the Sun]; and Chamah [the Sun] governs the eve of the fifth night and serves at the first hour, then Nogah [Venus] at the second and Kochav [Mercury] at the third. And so they proceed in their order in the firmament, one planet after another, until the lot reaches Tzedek [Jupiter] at the first hour of the fifth day [Thursday daytime]; and Tzedek [Jupiter] governs that day and serves the first hour. The lot passes round in this manner until the days of the week are completed, and the governance and the service return to the planet from which it began.

Thus you find the ordering of the days and the nights by the service of the hours, and their governance, proceeding in this manner. Go out to the mnemonics that you have in hand: your mnemonic for the days is ChaLMa"N [חלמ"ן], beginning on the first day [Sunday] with CheLeM-KaShNa"TZ [a mnemonic string]; and your mnemonic for the nights is ChaL"M KaSHN"TZ ChaL"M [as printed]. The planet that serves at the first hour, whether of the night or of the day, is the one they spoke of as governing that day or that night — because it serves throughout the world, and because the sun travels over the earth from the moment of its rising at the eastern edge until its setting, or from its setting until its rising, in this manner.

The planet [that governs] serves at the first hour of the day at the edge of the eastern quarter, where the sun rises over them. When one hour of the day passes

at the eastern edge, the second hour comes, and another planet begins to serve at the eastern quarter; [meanwhile] you will find the sun rising over [another] one place of the earth, and that planet serving at that place at their first hour. So too the sun rises over place after place, and that [same] planet serves at the first hour at place after place, until the end of the twelve [hours] at the eastern edge. [By then] the sun is setting and rising over the inhabitants of the west, and that planet serves at the first hour for the inhabitants of the west just as it served at the first hour in the east; and you will find that planet serving at place after place, from the end of the east to the end of the west, until the completion of thirteen (י"ג) hours. This is the practice of the day.

So too the planet that governs by night, by the service of the hours of the night, from the setting of the sun in the west until its rising over them. I have not come here to explain this matter, nor do I consider it part of the [proper subject of this] work; but because I saw that the ancients and the sages mentioned the service of the planets at the hours by day and by night, I felt bound to rely upon them and to follow after them, and was compelled to explain the matter as best I could. And here I seal the First Maamar, and begin to join to it the Second Maamar, with the help of the One who has no second.

The First Maamar is completed, with the help of God — may His name be glorified, lauded, forever and ever, to all eternity.

המאמר השני — The Second Maamar

On the explanation of the months, the year of the moon [שנת הלבנה], and the molads [המולדות], and the fixing of the festivals — and all that depends on this. And this Maamar is divided into ten gates [שערים]:

The First Gate — at the opening of the Maamar: the explanation of the term "month" [חדש], the term "molad," and their definitions.

The Second Gate — on the measure of the month, the count of its days, its hours, and its parts [chalakim], and the points of disagreement concerning it among the nations.

The Third Gate — on the year of the moon [lunar year], and the excess [המותר] between it and the solar year [שנת החמה], and the explanation of the common [year] and the leap [year].

The Fourth Gate — on the explanation of the term "cycle" [מחזור], on how many matters the cycle is reckoned, and the science of the cycle of the moon upon which we rely.

The Fifth Gate — on the arrangement of the intercalated years within the cycle, and the reckonings that were established in it according to this order.

The Sixth Gate — on the reckoning of the molads. It is divided into three parts: the first part — on the reckoning of the molads in the manner ordered for everyone; the second part — on the method of reckoning them from the tables [לוחות] made for them; the third part — on examining the reckoning of the molad, whether it is correct or whether there is an error in it.

The Seventh Gate — on the fixing of the New Moon [ראש חודש], and what the molad zaken [molad zaken] is, and the explanation of its reason.

The Eighth Gate — on the full and defective years that follow the [regular] order, and the disqualified days [for fixing], and the explanation of their nature and their reason.

The Ninth Gate — on the explanation of the four gates [the four "gateways"] upon which the fixing of the festivals depends in each and every year.

The Tenth Gate — on the fixing of the New Moons and the festivals in the common and the intercalated years, and all that depends on this matter.

השער הראשון — The First Gate

At the opening of the Maamar: the explanation of the term "month" [חודש], the term "molad," and their definitions.

All the reckonings of the molads and the tekufot that I come to explain in connection with all the matters compiled in this book — you will find their root and origin in the words of the early authorities [ראשונים] and the ancients [קדמונים]; the whole basis of it was already mentioned, set in its proper place and according to its law. The trouble is that the ancients handed down to us closed generalities and analogies that are not transparent. The secret of it all was clear to them, by the abundance of their wisdom, and revealed to their eyes. Now had I copied down their words without explaining anything and without the additions that I have seen fit to make for the sages of the generation — or [without] what appeared to me, according to my poor understanding, to be correct — I would have been laying waste to my own soul and mocking myself. For anyone who

explains a matter that has already been explained by earlier authorities, and merely compiles it as it stands, without addition or subtraction, deserves to have every bad trait in the world ascribed to him; and at the very least he is called a thief and a fool, because he is boasting of something that is not his own acquisition — it is borrowed in his hand — and is wrapping himself in a garment that confers no glory upon him.

But if, by these words of his, he has revealed a secret that was hidden in the words of others, or [supplied] the resolution of a difficulty raised against them, or has given a great general principle for matters that were scattered, or [shown that] under a great general principle there lie particular matters that need to be separated out, [or has known] when to add to a thing and when to reduce — according to the reach of his understanding — if he has done one of these, he deserves to have his fault forgiven; and even if he has erred in his explanation, since his intention was for the good and his desire was to explain correctly, the error in which he erred [is one in which] "from Heaven they compelled him" — Heaven forced it upon him against his will. And if Heaven assists him, so that his reasoning turns out well and the path is made straight before him, then it is fitting that he should have a small reward for it.

In most of the matters I take up, I am speaking so as to explain the words of the sages of the generations who came before me, and to report the words of the sages of the nations where we have need of them. Sometimes I show my own opinion on a given matter, according to the [measure of my] poverty [of understanding]. Let this not be hard in the eyes of the great and gaonic sages into whose hands this work may come, on the grounds that they see in it many things that are plain and revealed to them. I beg of them: do not blame me for this, but in their kindness judge me favorably; for I have not compiled all these things except for the young and for students, in order to open their hearts to wisdom and to guide them along the path of understanding. It is for this reason that I opened this Maamar with the explanation of "month," and began with a matter that is revealed to everyone:

And I said: The word "month" [חדש] is derived from "renewal"/"newness" [חצובה [מהדוש] — yet it is not properly applied except to the moon [לבנה], in respect of the renewal that occurs within it. And the definition of "month" is the measure of the moon's motion from the moment it has cleaved [to the sun] until it cleaves to it once again. Thus you will find that the definition of "month" is bounded by the moon's motion, and you will see that "month" pertains in its origin to the moon alone.

Now those who speak of "the months of the sun" or "the months of the solar year" do so by an extension of the language, and by way of comparison — either on the grounds that [the solar month] resembles [the lunar one] in some respect, or because the [calendrical] solar months are close in their measure to the lunar months. So they too renew themselves in each month [i.e. each solar twelfth], and "month" was applied to them, and they are called "the months of the sun." But [the term] was applied to a [solar] segment of one twelfth — to a part after [each] twelfth of a chelek in the solar year — because the moon renews itself in each segment [of that span].

In the language of the Ishmaelites [Arabic] we find that they call the lunar month *shahr* — which is *luna* in the vernacular [בלע"ז] — and the masters of [pure] Arabic say that this term "month" is so named in [their] language because it is a term of "revealing" [גלוי]: for the moon becomes visible in it, and it is "revealed" to the eyes after having been hidden from our sight. The Ishmaelites reckon by the moon alone and do not reckon by the sun at all, and they call [the lunar months] "the months of the sun" [?] — for one party calls the [month] by the name "month," following the name of the lunar month, and they distinguish between the two: the one calls the [solar reckoning] "the sun-month" as a separate term without any attendant, while "the sun-month" is attached either to the sun or to the nations [?]. So too I find that the Romans and the wicked kingdom [מלכות הרשעה — Christian Rome/Byzantium] who are in these lands call the month *luna*, after the name of the moon in their language; and they also call it *menshish* [?], and this term is borrowed from the language of the Greeks. The moon in the Greek tongue is *yon* [Greek: μήνη / Ionian form?], and the name of the month in their language is *menshish* [?] — [the month] being called after the moon.

Thus you find the [word for] "month" in the three languages of these nations either hewn from the moon's motion and its renewal — as it is in the language of Ishmael — or from the very name of the moon — as it is in the language of the Romans and the Greeks. So too in the language of Targum [Aramaic], which is the tongue of the Chaldeans, [the word for "month"] is hewn from the name of the moon: for *yarḥa* is the name of the moon in Targumic Aramaic, and it is also the name of the month. And we find it in the holy tongue [Hebrew] designated by two names taken from the name of the moon, which is *yareah*: as it is written, "a month [ירח] of days" (Devarim 21:13); "of the precious things of the moons [ירחים]" (Iyov 39:2 [?]). And the second name is taken from the renewal of the moon — namely, *ḥodesh* [חדש, "month/new-moon"].

This term [*hodesh*] is spoken of in the Holy Scriptures both generally and particularly. It is said generally of the whole month, as it is written, "and he stayed with him a month [חדש] of days" (Bereishis 29:14); "until a month [חדש] of days" (Bamidbar 11:20); "a month [חדש] they would be in Lebanon for two months at home" (I Melachim 5:28). And it is said particularly of the head of the month [ראש חודש] alone, as it is written, "and Yehonathan said to him, Tomorrow is the New Moon [חדש]" (I Shmuel 20:18); "neither new moon [חדש] nor Shabbos" (II Melachim 4:23); "a New Moon festival and a Shabbos" (Hoshea 2:13); "and on the Shabbosos and on the New Moons [ובחדשים]" (Yechezkel 46:3 [?]) — all this is said particularly of the head of the month alone, since the [whole] passage treats Shabbos custom on account of the offering.

Since "month" [*hodesh*] is applied to both these matters, it is evident that the foundation of the term [תחילת הדבר] was fixed upon one of them, and after it was fixed upon the one, it was applied to the other by way of analogy or by extension of the language. Now each of these two matters may be the prior one in this respect: one priority in one regard, another priority in another. A person might say that the head of the month [ראש חודש] was fixed upon first, and afterward "month" was applied by analogy to the whole month, because all the days of the month follow after its head and depend upon it — for so it is written, "on the fifteenth day of the month" [לחדש], "on the tenth of the month" — meaning, so-and-so-many days from the head of the month. So when it is said, "in the tenth year of Tzidkiyahu king of Yehudah" (Yirmiyahu 32:1), the meaning is the years numbered from the start of his reign; the beginning of his reign is the head, and all the years that come after it depend upon it. Likewise the essence of the name "month" was handed down upon its head [ראש], and the rest of the days are called by its name.

But another person may say: rather, [the whole month] was fixed first, and afterward "month" was said of the head of the month by way of analogy — for so you will find the Scripture, when it has need to specify the matter by its [own] proper name [, doing so]: "And in the heads of your months [ובראשי חדשיכם] you shall offer up" (Bamidbar 28:11); "and on the day of your gladness and on your appointed times and on the heads of your months" (Bamidbar 10:10) — so that...

[so that] no doubt may befall us on the day on which we are obligated in these commandments, on account of the name "month" stated jointly with respect to two matters [the head and the whole month]. But where there is no concern for doubt, that very [text] said, "month by month" [חדש בחדשו] (cf. the burnt-offering passage); and you may [also] say that here [the verse] did not abandon the matter

until it removed the doubt from it. By saying "in its [renewal/]month" [בחדשו] — that is, the burnt-offering of the [new] month — [Scripture means] you are obligated in it at the time of its renewal, and it is reckoned to you as though you had offered up the offering of that whole month.

It is further written, "in the first month, in the second year" (Shemos 40:17): for from the fact that it said "in the first month, in the second year," they understood the head [ראש] of the month upon which this name was fixed, [as if] to make the matter precise. And from the fact that it was necessary to say "on the first of the month" [באחד לחדש], we learn [ש"מ] that this name was fixed only upon the whole month; and they called it "month" because we begin to count it from the time of the moon's renewal itself, and the head of its renewal that is proper to be named upon it is the moon's molad [מולד], which is hewn from "birth" [מלדת].

It is fitting for the renewal of the moon to be called *molad* [מולד], because in it the moon begins to be born and to acquire light. But in its [first faint] light it has no power to show itself to the inhabitants of the world like the other stars — like the newborn child, who has no power to conduct himself as grown men do, to walk, and to move like other living creatures. And they distinguished, by this term, between the moon's first renewal — which they called *molad* — and its second renewal, which is when it is visible to the inhabitants of the world, this latter being the [visible] sighting [הראיה].

The definition of the molad [מולד], according to the words of our Rabbis of blessed memory [ז"ל], is the moment [רגע] at which the moon and the sun cleave together in a single segment [חלק] of the divisions of the firmament along their mean motion [המהלך השווה] — proceeding always in one [uniform] manner. It is the head of the coming month and the end of the month that has passed. By the motion of the luminaries it would have been fitting to make [this molad] the head of the month, were it not that the moment of the molad is not manifest to the inhabitants of the world, and no person reaches it except by way of computation and reasoning; and both of these are difficult for most of the world, and doubts arise concerning them, and the reasonings of human minds do not coincide in them upon a single view.

For this reason the Holy One, blessed be He, did not impose upon us the obligation to observe the heads of the months from the moment of their [astronomical] beginning in the firmament, which is the moment of the molad. Rather, He enlarged the matter for us, and gave us license to fix the [head of the] month upon the counsel of our Sages — because we have no testimony [אורה] whose beginning is in the firmament, whereas its beginning is for the sight of our

eyes, and that is what is revealed to us. This [visible] beginning is not equal to the eyes of every person, and on this account it requires aid and support [סיוע ולסיג]. So the Holy One, blessed be He, gave the authority over this and the power into the hand of our Sages and our Elders, to support [the matter] according to their understanding and their wisdom.

He did not do so with all the commandments whose sign testifying to their beginning is manifest and well known. Rather, with these commandments [whose beginning is manifest] He commanded us to keep them in their [appointed] time, and gave us no license to perform them either earlier than their time, nor — at our discretion — later. But for great need [He permitted it] — as in the commandment of circumcision [מילה] spoken of [in Scripture]: "and on the eighth day the flesh of his foreskin shall be circumcised" (Vayikra 12:3) — [namely] in a case where the day of [the child's] birth was clear to us, without doubt, so that we know which is the eighth day for him; but we may not err in this commandment such that we do not know which is the eighth day for him. And of this nature is the commandment of Shabbos, whose sign testifying to its beginning is manifest and well known to every person, and there is no doubt in it — it being the end of the sixth day. For this reason the Place [God] commanded us to keep it and to rest on it at its [proper] time, and we have no license to transgress its time, nor to exchange it, nor to set it later, nor to set it earlier.

So too He says, "the appointed times of the Lord, which you shall proclaim them as holy convocations" — "they are My appointed times" (Vayikra 23:2); "and you shall proclaim them as holy convocations." You have no license to advance them before their [appointed] times, nor to defer them after [them]. And straightway He wrote the commandment of Shabbos alone, as it is written, "Six days shall work be done, and on the seventh day [there shall be] a Shabbos" (Vayikra 23:3). And concerning it He said, "these are My appointed times" — meaning, those proclaimed in My name, not the appointed times proclaimed in your name. When He had completed the commandment of Shabbos, He opened with another passage to explain the commandment of the appointed times, and said, "These [are]...": "the appointed times of the Lord, which you shall proclaim them as holy convocations in their seasons, which you shall proclaim them" (Vayikra 23:4). [They are] holy convocations in their seasons, which you shall proclaim them. In the first verse He said, "which you shall proclaim them as holy convocations" — that is, you are commanded to proclaim them as holy; and there is no mention of [the act of] appointing [the time] by proclamation. But in the second verse He said, "the appointed times of the Lord, which you shall proclaim them in their seasons" (cf. Vayikra 23:4), and He made the appointing [of the time] depend

upon the proclamation — to show that the authority is in our hands to fix the appointed times.

After the second verse had set out the order of all the appointed times — one appointed time after another — and had sealed them, He said, "besides the Shabbosos of the Lord" (cf. Vayikra 23:38), and added the name of Shabbos to the Lord's holy name [ק'ה]. So too you find, in most places, the name of Shabbos attached to the Lord, to His great name: as it is written, "My Shabbosos you shall keep" (Vayikra 19:30 / Shemos 31:13 [?]); "a Shabbos it is to the Lord" (Vayikra 23:3). And you find the appointed times attached to His people Israel: as it is written, "a Shabbos of complete rest [shabbaton] is it for you" (Vayikra 23:32); "you shall observe it"; "in your appointed times" (Bamidbar 29:39); "and on the day of your gladness and in your appointed times" (Bamidbar 10:10).

So too [Scripture] says, "on the New Moons and on the heads of your months [ובראשי חדשיכם]... you shall offer up a burnt-offering" (cf. Bamidbar 28:11). He joined the heads of the months to those that are attached to us [Israel], to teach you that they are fixed by the agreement of our Sages. For had the verse said, "and on the heads of the months you shall offer up a burnt-offering," we would have needed to understand it as meaning that the offering of the month is to be brought at the moment of the molad, which is the essence of the head of the month, and we would be bringing the offering of the head of the month sometimes by day and sometimes by night — at whatever hour the molad chances to fall, whether by day or by night. And if we were fixing it [the festival of the head of the month] at the head of the month itself, we would not be bringing the offering at dawn at the head of the month itself; rather, sometimes before it — when the molad is more than three hours past dawn [or "from daytime"] — and sometimes after it, when the molad falls at night, [all] according to the plain sense of the verse. And we would thereby be transgressing, in our deed, the plain sense of the verse.

There would further befall us other reversals in the counting of the days of the month: in this [one] country the molad would fall on the fourth day — by way of example — and they would count the beginning of the month from the fourth day, which is the day of the molad for them; whereas in a country far to the east of it, the moment of this molad would be on the eve of the fifth day [ליל ה'], and they would need to count the month from the fifth day; and so the months and festivals would not be counted on a single day in every place. But since the verse said, "and on the heads of your months," it has become clear to us that the matter reverts to our [own] reckoning and to the opinion of our Sages. And if the months

are fixed according to our [own] judgment, then all the festivals will be sanctified according to our agreement; and the explanation of the measure of the month and the method of its reckoning is a great and pressing need among the requirements of our Torah.

We now come to make known the dispute that exists among the nations concerning the measure of the month, so that the science of the [true] measure of the month — handed down to us by tradition from our Rabbis — may be made clear to you, with the help of the Name [בעז"הש].

השער השני [The Second Gate]

On the explanation of the [measure of the] month and the dispute concerning it among the nations:

The nations who reckon their years by the months of the moon follow two practices in the calculation of the month. Some of them begin the reckoning of the days of the month from the moment the moon's roundness fills with light, when it is distant from the sun by the whole arc of half the heavens — which is 180 [ק"פ] of the 360 divisions of the firmament — until [the moon] has gone round the entire orb and returns to being distant from the sun by the same distance, the first [distance] from which it began to revolve. According to this view, the month is [the span] from that far point [of distance] between these two luminaries until the far point a second time. Those who rely on this reckoning are the minority of the nations, who are at the eastern edge and toward the southern quarter.

Others begin the reckoning of the days of the month from the moon's cleaving to the sun, when the two of them cleave together within a single one of the divisions of the firmament, until [the moon] has gone round the whole orb and returns to cleave with the sun a second time. These are the rest of the nations, and they count the days of the month from the [point of] cleaving — which is, in our terminology, [counting] from the molad to the molad. Except that they do not reckon the motion of the luminaries by the mean motion [המהלך השווה] as we reckon, but some of them reckoned by the variable motion [המהלך המתחלף] and relied upon it; according to [the practice of] the masters of this nation [?] their reckonings [are computed]. And some of them rely on the [visible] sighting [הראיה] and do not reckon by the molad. Some of them rely on the sighting and reckon toward the molad, relying upon it in the doubts that arise concerning the sighting. Those who count only by the sighting were a minority of the ancient

nations: they relied on the sighting for the head of the month, were not occupied with computation, and were not practiced in it.

[Among them] the moon would be found, sighted in one month at thirty days, and in the next month at twenty-nine [כ"ט] days. And if they found two months between which there were not thirty-and-thirty days, [where] in that year they found, one after the other, two further months of twenty-nine-and-twenty-nine [כ"ט מכ"ט] days, they would balance the one against the other, and reasoned that the moon was moving here for a short span and there for a long span. It arose in their opinion that the [length of] the month stands at twenty-nine and a half days [כ"ט יום וחצי], without [any] addition. They stood by this opinion for many years, until those skilled among them were roused to examine the matter, and found three months, one after another, that came [in] less than 30 days — and they did not find their like in that year, nor in the year following, [where there were] three months of twenty-nine-from-twenty-nine [מכ"ט כ"ט] days; rather, they found two months, one after the other, of twenty-nine-from-thirty [מל' כ"ט] days, with one full month with a surplus remaining in their hands. They saw that this matter came to their notice in every three years, [whereupon] their opinion concurred, and they decreed that the [length of] the month stands at twenty-nine and a half days, and a further one part of thirty-six [$1/36 = \text{מל"ו}$] of the chalakim in a day — which is two-thirds of an hour [שני שלישי שעה].

Now some of the sages of Persia and the Chaldeans were among the ancients. As I saw written in one book among the words of Ptolemy [בתלמיס — Ptolemy], who was in Alexandria [באסכנדריא], and as to this measure for the measure of the lunar month we have found the reckoning in the Baraita called [the Baraita] of Shmuel and of R. Eliezer ben Hyrcanus [ר' אליעזר בן הורקנוס] — for so it is written in the name of R. Eliezer ben Hyrcanus: "The reckoning of the lunar year [comes to] 354 [שנ"ד] days and a third [ושליש] of a day; and all the hours of the lunar month [are] 708 [תש"ח] hours and two-thirds [ידות] of an hour. And all the hours of the lunar year [are] eight thousand five hundred four [— שמונת אלפים תק"ד — 8504] hours [שעות]."

You see from this reckoning that the lunar month [is] twenty-nine days and twelve hours and two-thirds of an hour [כ"ט יום וי"ב שעות ושני שלישי שעה]. And in this Baraita in the name of Shmuel it is written: "He who wishes to know in how many [days fall] the head of the lunar month, reckoning from the creation of the world: he reckons the head of the month and gives a day and a half and a third of an hour greater [larger] than $1/12$ [מי"ב] for each day, for every month; and for thirty-six months [לששה ושלשים] he gives 54 [נ"ד] days and 24 [וכ"ד] hours, plus

1/36 chalakim [לל"ו]. " [If] you then turn back one day [שב אתה לאחריך יום אחד], you find it standing at the beginning of the night [תהלת הלילה]. Likewise you will find all the reckonings in this Baraita counted upon twenty-nine days and twelve hours and two-thirds of an hour alone.

We cannot say that this was [merely] the opinion of Shmuel and of R. Eliezer ben Hyrcanus, that they were disputing all the [other] sages in this dispute. Rather, they came to make known the opinion of the Persian sages who reckoned by this reckoning. And all the sages of Persia and the Chaldeans, these did not let their hand cease from probing and examining the measure of the month, until research brought them to say that the measure of the month is twenty-nine days and half a day and one part of forty-three [מל"ג — 1/43] of [the parts of] a day — and these are 786 [תשפ"ו] chalakim less something [פחות משהו]. And they would reckon, in every 33 years [ל"ג שנה], twelve [years] [י"ב] as complete years, [each] of which contains five deficient [29-day] months and seven complete [30-day] months. They stood by this reckoning a long time, until their sages probed further, and their opinion concurred with the opinion of the sages of Egypt as to the measure of the month — namely, that it is twenty-nine days and twelve hours and eleven chalakim and 15 regaim [כ"ט יום וי"ב שעות וי"א חלקים מט"ו רגעים], at the hour they are 792 [תשצ"ב] chalakim. These [Egyptian/later sages] would reckon, in every 30 years [ל',], eleven [years] [י"א] as complete, and they call [such a year] "kevushah" [כבושה — an intercalated/leap year] (Hebrew: והיו עושים בל' (שנה י"א שלמה וקורין לה כבושה); and the dispute that exists between these [Egyptian/later] and those [earlier] [is] that the earlier ones add one part out of five to the third [part] [מחמשה אחד חלק בשליש].

As to this latter measure [the 29d 12h 793-chalakim value], it is the one upon which the counsel of these sages stands, after they scrutinized the matter and investigated it with all their power. By this reckoning the sages of Egypt would compute their seasons when they counted [their months] by the moon, and those who dwell today in the land of Egypt — being Ishmaelites — count their months [by it as well].

[Continues in the next gate's body.]

concerning this measure. They [the nations] do not rely on calculation at all, but only on direct observation; and if it appears to them by their reckoning that the moon is deficient on a particular day, yet on that day the moon is not visible to them, they discard their calculation and rely instead on observation — for it is on observation that they rely in all their lands. By contrast, [the Egyptians] confessed, after Ptolemy, the true measure of the month — the measure upon

which the wise men who investigated it relied — and in this matter [the Egyptians] differ from the rest of the Ishmaelites.

[The author] then praised the sages who investigated this matter, [saying] that this was the opinion of all the ancient sages and the philosophers concerning this matter; and that man was Hipparchus [אברכ"ש = Abrahahsh = Hipparchus], who investigated the matter, traced it to its root, and drew it forth from its sources of meaning. He found, regarding the ancients — from as far back as four hundred years before his own time — that they had recorded the lunar eclipses that occurred in their days, with their hours and chalakim [chalakim, 1/1080 of an hour], written down in their books. He examined the eclipses of the moon that occurred in his own day and investigated their hours, comparing the first eclipses he had examined with the later observation he himself had made. [He computed] the count of complete months reckoned from the remotest [eclipse] up to the count of these later [eclipses], and afterward he knew how many days, hours, and chalakim lay between the [first] examination and the [later] one that he himself had examined; and he divided these days, hours, and chalakim by the count of the complete months that lay between these two times. The result rose in his hand — the [length of the] month suitable to rely upon — which is: twenty-nine days and twelve hours and seven hundred and ninety-three chalakim [= תשצ"ג 793].

In each chelek there are seventy-six regaim [regaim, 1/76 of a chelek]; in each regaim there are twenty-five fifths [רביעיים — "fourths/quarters"? read as חלקים [רביעיים]; and a sixth [part] of a chelek is nine chalakim, and another three [?] — [the text here gives a sub-division of the chelek, the exact reading uncertain]. And one chelek [is] one part out of four [?] chalakim in the fractions [שבתות = "remainders/sabbatical-fractions"], as Ptolemy spoke of the matter. When you remove [reduce] the chalakim, you will have in your hand a count in which all the fractions are eights [i.e., divisible by eight — eighty-something?]; for when you take its ninth [part — i.e. divide the chalakim], the result will be found to be [a whole], and you find that the ninth part of it [is] a fifth and a sixth and a quarter; and you cannot find a count by which you would be able to [express] these [chalakim] in fractions less than a thousand-and-eighty. As our sages of blessed memory said: "the hour [is divided] into these chalakim not because there is none [smaller], but only so that these fractions would be found whole in this count, by which we count." For we find in it a count [of] 793 chalakim, and three out of five chalakim [in] each [?], and one part out of four chalakim in the fractions [שבתות] — by our reckoning. And there will rise in your hand, from all these fractions, by the counsel of the sages, these [values]: twenty-nine days [כ"ט

29 = יום], twelve hours [12 = י"ב שעה], 793 chalakim [תשצ"ג]; and this will be the count of the new [month].

And [the value] of 12 hours and 793 chalakim — [this is] what we have by tradition from our master Rabban Gamliel; thus it is, that I [Rabban Gamliel] received it from the house of my father's father: that the new [moon] does not appear at less than twenty-nine days and a half [day] and two-thirds of an hour and 73 chalakim [ידות שעה וע"ג חלקים = "two-thirds of an hour and 73 chalakim"]. (This is the same molad expressed in a second form: two-thirds of an hour is 720 chalakim, and $720 + 73 = 793$ — so 73 here is not a competing variant of 793 but its complement above the $\frac{2}{3}$ -hour.)

[The author brought] all these matters to lend support to the words of our masters of blessed memory; for the words [of the nations] need not be reinforced by the words of Torah and the Holy Scriptures, God forbid. Rather, the whole purpose of this matter is to make known to you that all the wise men among the nations who possess understanding [agree with our masters of blessed memory]: for Hipparchus, who studied this matter, lived in the eightieth year [80 = שמונים] after the death of Alexander [אלכסנדרוס מוקדון = Alexander of Macedon]...

of Macedon, whose reign was forty years [40 = ארבעים] [the close of his reign: "the end of forty years and ..."], at the close of his reign — and so the time of Hipparchus falls in this [year]; and this is in the year 116 [קכ"ו = 116] reckoned from the building of the Second Temple. And this halacha was received and held in hand by the fathers of [the house] of Rabban Gamliel, who lived at the beginning of the Second Temple. It is known that his fathers [received it], for from their mouths the nations heard this true measure of the month. [The author] said: and if you raise an objection in the matter, saying that in [the nations'] own time [these traditions came] from their sources of meaning [?] — likewise [the response is that] every science and every body of knowledge in which the expert is versed [is one thing]; for the one matter, which we have not seen with our own eyes, would [need to] be testified to by something else. [The author said:] I bring as proof upon it the words of the wise men of the nations, the Ishmaelites of this kind [?].

השער השלישי [The Third Gate]

[On the year of the moon and the excess [המותר] which lies between [understanding/the calculated value] and the [solar year], and the simple [common] year [שנה פשוטה] and the intercalated [leap] year [שנה מעוברת]:]

The "year," according to the plain sense of its root, is the [period] fixed [for] the [sun]: it is the course of the sun through one of the divisions of the firmament until it revolves back [to the same point], such that all twelve [months?] revolve. [The sun] begins there to revolve from it, and it [the solar year] differs from the [lunar] cycle [?]. The course [of the sun] in this [year] is in all 365 days [= שס"ה 365] and a quarter [day], less a trifle [פחות משהו = "less something small"] — [or rather] not [less], but slightly more [שרוב = "the majority/most"?], such that we count by the sun and reckon it a complete quarter [רביע שלם]. And the [conduct/practice] of this [solar] year differs and does not revolve back to the place [from which it began]...

[a "year" is so] called [שנה] because the moon, at the end of each twelve months [12 = י"ב חדש], is renewed in its beginning [position]; but [the sun] is not [renewed] in that [same] portion [each year?]. From [the practice of] the ancient nations — such as the Chaldeans and the Greeks, the first ones — they [counted] the moon, giving a name to each and every month; and each renewal of the moon falls [in a new sign], and they would attach names to the moon according to the name of the sun [-month?] in which the new moon was renewed, and they would say [it is] the month of Aries [טלה], or the month of Taurus [שור]; and when it would happen to them that one of the renewals of the sun [a solar-month boundary], or the [renewal of the] moon, would fall in the [same] sign in which the [other] had renewed — that is, when the renewal of the moon and the renewal of the sun fall together in one [single] sign, renewing in one sign twice — once at the head [beginning] of the [sign] and once [later]...

[On p. 55 the discussion continues:]

to the moon there are twelve months in each and every year, [and a "year" of them]. But [for] the [solar] month — which is fit to be at the head of the year [as] a quarter[-day longer], and a half[-day] of which [extends] beyond the head of the solar month — [it] renews in this month before the renewal of the first [lunar] month; and on account of this they would add to the renewals [intercalate], so that in [a year of] thirteen months [13 = י"ג חדשים] the moon would be renewed [enough] for the renewal of the sun, which renews in the first year — the fourth [?]. And this practice resembles the practice of our [own intercalation]; and if [the nations'] intention was not of the same kind as our intention — for our intention is to keep the days of our festivals [tied] to [the moon], and we do not reckon the days of the solar month — and they [did] not keep [count of] the days of the renewal of the sun, nor were they reckoning the days of the renewal of the moon, but rather their festivals [fell] sometimes at the beginning of the month and

sometimes in the middle and sometimes at the end. So they would call [a name] to that month [in which] the festival [fell], and that festival would be [named for the moon-month] in which there is [a festival]...

[On p. 55, continued:] but at the end of the third year, [there is a problem] with the molad [molad, "birth" of the new moon]: by the end of the third year the [distance of the moon from the sun] is greater than 12 [?] [the moon's distance from the sun would be more than the value $\text{מל"ב} = \text{"more than 42"}?$ reading as a numeral crux — see report], such that the solar month would be more than two days [more]; and the moon would [then need to be reckoned anew]. [The author continues:] the new [month] of the moon which is renewed in [the third] year — they reckon according to the renewals of the moon, the third [year's] one, and they count [the lunar renewals], and the moon is renewed at the head of a new month — fourteen [14 = ט"ו] of it in the month — [reading uncertain] of the first [year]; and this [month] will be [the head of the year]. This [practice] resembles the practice [by which] most of the world [the nations] conducted themselves in their years; for our intention is to keep the days of our festivals [tied] to the renewal of the [moon's] month — [namely] the days of the renewal of the sun. But the intention of the [other] nations of old was [different]: they did not reckon the days of the renewal of the moon, but rather sometimes [their festivals fell] in the middle [of the month] and sometimes at the end, and they would call [the festival]; and they would call [a name] to that year of the moon in which there is [a festival]...

[A grammatical/etymological excursus follows, p. 55–56:] ...[if] you answer it [the question] in their language, saying that it is "the thing fixed [carved] in its garments" — that is to say, a year [שנה] in which there is no [change?] — [then] the practice fit for all the years [is one]; and likewise a man upon whom a fresh garment [is placed] — [the term] is in its [own] form. [The author addresses the Hebrew terms:] the year that is counted [reckoned], in the language of the nations its interpretation is [from a root meaning] "conquered" [כבושה], that is to say [it is from a root for] "to press [conquer] silver" [$\text{כושין כסף} = \text{pressing/refining silver}$]; and we [Hebrew speakers] call it [שנה] for two [reasons]. You may say it is from [the root meaning] "the thing fixed [carved]"; or you may say [it is] from [the root for] "repeating [it] another time" [שונה — to repeat/study], [meaning the year repeats]. And from the words of our masters of blessed memory, who say "[a] sufficient [cow / parah] is intercalated" [שאומרין פרה מעוברת] = "they say 'a pregnant cow'", [we learn] the second [meaning] is not so far [from the first]. For inasmuch as our masters of blessed memory found, that when they said "we intercalate [the year]" [מעברין] — we did not find [the verb] "to intercalate" [מעבר]

[used for] Elul; and the full [year] is called to them "full," not "intercalated," because there is no [pregnancy?]; it does not resemble [a year that is] "full." [The intercalation is] because there is added [נוסף] in it [a month], a day [or month] that is intercalated [מתעבר], just as a woman is made pregnant [מתעברת]. And our masters of blessed memory called the whole secret of intercalation [סוד העיבור], because the science of this reckoning...

and its [right] meaning and its full correction [תקונה] — it is entirely [contained] in the intercalation [עיבור] of the year.

[Etymological note, continuing:] ...the practice [reading]: you may say "spread out" [סתורה] or "covered" [מכוסה], from the Targum [Aramaic translation]; and "we call it intercalated" [מעוברת], and this name can be distinguished [interpreted] [as] "carved [fixed] from the past," that is to say "that which is gone-by [bygone] of the new" — and we [therefore] intercalate. [Citing:] "carved from his צא, and he shall not redeem" [חצוב מן שורו ולא יגאל] (Iyov [Job] 21:10 [איוב כא י]). [The author says:] this [interpretation, that the year is] intercalated, and this reasoning, is pleasing in my eyes. And if [you object that] our masters of blessed memory call the full [year] "the full [month] of thirty[-day months]" [משלשים יום = "of thirty days"]: [the reply is that] this is [the year] that is intercalated; and if [so,] you cannot say here [that] Elul is [the thing] intercalated, for we do not intercalate it [Elul]. Rather, the thing that is intercalated [מעובר] [is like] a woman who is made pregnant [מתעברת]. And our masters of blessed memory [called] the whole [matter] the secret of intercalation [סוד העיבור], because the science of this reckoning [is the secret of the year].

השער הרביעי [The Fourth Gate]

[On the explanation of the term "cycle" [מחזור] and of several matters of the moon [?] which our masters of blessed memory handed down to us:]

The [term] "cycle" [מחזור] is said of anything that revolves [recurs] [in a fixed course], unchanging [ואינו מתחלף]; and it is said of a number of years which conduct themselves according to one [fixed] matter — [one] arranged...

[a cycle is] arranged and fixed, such that it is completed [as] whole at the end of the years together with the [complete sun-and-moon reckoning], [and] the second cycle [conducts itself] like the practice of the first, without any change ever — such as the solar cycle that conducts itself in every group of four [years], in which they reckon to the sun [365¼ days per year]... ...their years [being] 365 days [שש"ה], three years [being so], one after the other, and [the fourth] being

intercalated [כבושה = "leap"] on account of the day added in it; and the [first day] will be the sixth [day], from the day on which the cycle began — and so [on], from the sixth [day] to the day on which the week is completed at the end of the year 28 [28 = כ"ח], because the days of the week complete themselves at the end of the year 28; on account of which the head of the [twenty-ninth] year [29 = כ"ט] is [made to] conduct itself [as before]. For every 4 years [is] a small cycle [מחזור קטן], and for every 28 years [28 = כ"ח] a [large] cycle. The tekufah [tekufah] of Shmuel [שמואל = Samuel the Amora] is found in every 28th year [כ"ח שנה]: the tekufah is created [falls] at the beginning of the night, as you see by this reckoning [סימן] [BeShaH"H — בע"שה"ש / the mnemonic, reading uncertain].

And further, according to the words of Shmuel and R. Eliezer [ben Hyrcanus] [ר' אליעזר בן הורקנוס = R. Eliezer ben Hyrcanus] — [or] according to the words of the Baraita [Baraita of Shmuel] — [which is] written: that from the year that the moon [completes] 354 [354 = שנ"ד] days — the 12-month lunar common year — [is reckoned] a great cycle of the moon, because the moon, according to their words, [returns] from the day on which it is renewed at its beginning and at the hour in which it [was renewed], returning to be renewed on the sixth day at that hour and at [that] portion of the day. [As to] these cycles, [we say]: we are not coming to dispute over them, nor to investigate closely; but rather we came to dispute concerning the cycle of the moon — that is, the solar years and the lunar years in their [reckoning]. And we say: the truth is...

[On p. 56, continued:] ...their years [being] 365 days [שס"ה], three years one after the other, and [the fourth] year [being] intercalated [כבושה] on account of the day added in it; and the [first] will be — from the day on which the cycle began — and likewise in every group of 4 years [it] revolves [recurs] upon [this] matter. Thus 28 years [כ"ח] is called, for this [great] cycle, the great [solar] cycle [מחזור גדול]; [the small cycle] is conducted like the practice of the first, and on account of this [the cycle of] 28 [years] is called the great cycle. And from this matter you [understand]: the tekufah of Nisan [תקופת ניסן] returns to the beginning of the night, as you see in the reckoning of our tekufot in their place from the treatise [מן החבור].

[and] from R. Eliezer ben Hyrcanus, or according to the words of the Baraita [Baraita of Shmuel], [the moon's great cycle is] 354 [354 = שנ"ד] days; and on the third day of every 21st [year] [21 = כ"א] ... the moon, according to their words, returns to be renewed on the sixth day, at that hour, and at [that] portion of the day. As for these cycles, [we say] we are not coming to dispute over them in

the morning [?] [reading uncertain — "neither morning"], whether it [the reckoning] is bitter or [sweet?]...

their years [being] 365 days [שש"ה], three years one after the other; and in the fourth year [366 = שס"ז, the leap year] — [a day] is added — and there will be from [the day] on which the cycle began [a sixth day]; and it will be that the head of the fifth year [is] on the fifth day [reading uncertain]. And likewise in every group of 4 years [it] revolves [recurs] upon the matter... [until] 28 years [כ"ח] is called the great cycle. [The small cycle] is conducted like the practice of the first, and on account of this [the 28-year cycle] is called the great cycle. And from this matter you [now understand] [that] the tekufah of Nisan returns to the beginning of the night, as you see by the reckoning of our tekufot in their place, from the treatise.

And [further], R. Eliezer ben Hyrcanus, or [according to] the words of the Baraita: that to the moon there is a great cycle, [namely] that the moon — according to their words — [returns] from the day on which it is renewed at its beginning, and at the hour in which [it was renewed]; [returning to be renewed] on the sixth day [for every?] 21 [21 = כ"א]; the moon, according to their words, [returns] to be renewed on the sixth day, in that very [hour] and at [that] portion of the day. And [as for] these cycles, [we are] not [coming] to dispute over them, neither morning nor evening, whether it [the reckoning] be bitter or [sweet] — that is, [the cycle] of the moon, which we are counting it to, and in which we [find] no [discrepancy]: for the truth is that [the nations] were intercalating the year...

[On the moon's renewals and the 19-year cycle, p. 56:] ...the new moons of the [lunar months] — a known [thing] of the renewals of the sun — and they would make the cycles, in the beginning, to intercalate the years; [a cycle of] eight years [8 = שמונה שנים], they would intercalate [it by] three months [3 = ג' חדשים]; for in every group of eight years [בכל שמונה שנים] — such as three months [שלושה חדשים] [intercalated] — [there] was found the excess of the solar year over the year of the moon, in every [group of eight] — [it being] not less by [more] than one day and a half [day] and a trifle [אחד וחצי יום ומשהו] = "one and a half days and something"; and they did not reckon this deficiency [חסרון]. So they would intercalate in every eight years three months [3 = ג' חדשים], and this deficiency was light in their eyes...

and they discarded the reckoning [neglected to be precise about it] for many years, until there came to them [the sage] Hipparchus [אבר"כש = Hipparchus], and he made known to them and showed them that in every 152 years [= קנ"ב 152] — that is, 19 eight-year cycles [8 × 19 = 152 ; 19 = י"ט מחזור] — the

intercalations they were fixing as intercalated came to 57 [57 = נ"ז] years, whereas only 56 [56 = נ"ו] were truly needed: a discrepancy of one month [57 - 56 = 1], one month more than is needful for you. [So] they returned to intercalate: cycles of 11 years [11 = י"א שנה], and they relied in their opinion on the reckoning. They intercalate over [a run of] 209 years [209 = ר"ט] — in which there are 19 cycles [19 = י"ט] of the eleven-year kind [209 = 19 × 11]. By these cycles of yours [you find that], over the sun against the moon, you intercalate 76 months [76 = ע"ו חדשים] across the 209 years; and over the [true excess of this] cycle you must add one month more.

and [Hipparchus] said to them: "Behold, you, by your cycles, intercalate this [much] — 76 months [76 = ע"ו]; but the count of the [true] excess requires 77 months [77 = ע"ז]; and so you, over this cycle, are deficient by one month [77 - 76 = 1]: you add one month. Now, come and join together..."

[and they came and joined the two cycles together] and made of them one cycle, and counted upon it; and they came [back] to the root of the matter, and the days of Hipparchus [אברכש = Hipparchus] returned [the reckoning] to intercalate by 7 [years] [7 = ז' שנים] in every [nineteen] ... and [the excess] between the sun and the moon [is] seven [7 = שבעה] new-moons of the moon — [seven lunar months over each cycle] — such that in every 19 years [19 = י"ט שנה], seven [7 = שבעה] [months] are intercalated, no less and no more. These were the [intercalated] years, one exceeding the other [the solar over the lunar], and not deficient. And you [now have the cycle] which our masters of blessed memory handed down to us. For all the sages [who reckon to the moon] — [we do not need to explain their cycles], such as the Ishmaelites and the Persians; and we are not obliged to explain the cycles [of those] who reckon to the moon — such as the Ishmaelites and the Persians; but [only] the cycle which we [ourselves] reckon to, which we call "doubled cycles" [מחזורים כפולים] or...

The Fifth Gate

On the ordering of the intercalated years within every cycle [מחזור], and the foundation by which our masters of blessed memory established this arrangement for us.

If you wish to grasp the order of the intercalations within the cycle that we count from the creation of the world, you will find them set out in good order upon this matter. The intercalation comes in the third year, the sixth, the eighth, the

eleventh, the fourteenth, the seventeenth, and the nineteenth — their mnemonic being **[19 ,14-17 ,8-11 ,3-6]** ג"ו ח"א ד"ז ט"ו.

Most of those who discuss the secret of intercalation [סוד העיבור] give a reason for this arrangement and say that HaKadosh Baruch Hu commanded us to keep the lunar months and to sanctify the festivals at their known seasons in accord with the solar year, so we became obligated to reckon the new moons [months] by the count of the moon and the years by the count of the sun. For this reason we had to reconcile the lunar count with the solar count: we examined the excess between them and found that the solar year exceeds the lunar year by 10 [י'] days, 21 [כ"א] hours, and a further [number of] chalakim [parts]. We carry this surplus over to the head of the cycle.

In the cycle, the sun and the moon stand level together [at the start]; and by the end of the 12 [י"ב] lunar months there would be between the sun and the moon 11 [י"א] days, less an eighth of a day — that is, what remained owing to the sun to complete its [solar] year — and this is a little less than half a [lunar] month. For this reason the first year is reckoned as a simple [common] year [שנה פשוטה] outright. By the end of the second year the surplus would be, for example, 22 [כ"ב] days less a quarter [day], which is most of a [lunar] month. From this point we intercalate the third year, so that there should not stand between the sun and the moon — after the completion of three full years — more than 3 [ג'] days, two [ב'] hours, and a further [number of] chalakim. In the fourth year the surplus would be, for example, 14 [יד'] days, with two [ב'] hours and further chalakim within them, and half a [lunar] month. In the fifth year the surplus between them would be, for example, 24 [כ"ד] days and 21 [כ"א] hours; for this reason we intercalate the sixth year, and at its close the surplus of the sun over the moon will be six [ו'] days, five [ה'] hours, and chalakim. By the close of the seventh year the surplus would be 17 [י"ז] days and two [ב'] hours and chalakim — which is more than half a [lunar] month; for this reason we intercalate the eighth year. At its close the sun and the moon are near to leveling together, there being between them only, for example, half a day and half [a further measure], such that the moon [now] exceeds the sun [?].

In this way you find, at the close of every year of the moon's revolving cycle, that the moon returns to its place where it was at the head of the cycle — exceeding it, or falling slightly short of it — until the close of the nineteenth [י"ט] year, which is the end of the cycle, when it returns to its very own place and neither exceeds it nor falls short of it by anything.

[Editor's note (המגיה): From all of this reckoning, set forth explicitly according to the words of the Rav HaMechaber [the author] in the name of most of those who discuss the secret of intercalation, it appears that the intercalation-month, by their reckoning, is not [a uniform addition] of thirty days; rather, as the law of intercalation requires, it is in each case 29 [כ"ט] days, 12 [י"ב] hours, and 793 [תשצ"ג] chalakim.]

In this manner they sought to account for the reason behind the ordering of the intercalations in the cycle. This reason, in its plain sense, is sound and correct, and fit for understanding all who count by the moon in order to keep the solar months — which is the opinion of the ancient nations. In our own view, however, the reason that they gave — that we who count for the moon do so in order to keep the solar months, so that the months should arrive at their proper place relative to the solar year — is not correct. Moreover, you will find that the reason they gave did not hold up in their hands; rather, they at once undermined it and its corollary. For they said: we became obligated to count the months for the moon and the years for the sun. Yet when they came to explain the matter in the first year, they strayed from the path. They said that after 12 [י"ב] lunar months, such-and-such days and hours remain owing to the sun, since it [the sun] has not completed its year; and we did not intercalate the second year, because this surplus was less than half a month — so behold, we are counting our years by the moon, in accordance with their own words. For the first year, in fact, is genuinely a lunar year, and they themselves said the reckoning of the years is for the sun. The whole point that bears upon this matter, then, does not fit well by their account; and we are right to free ourselves of this difficulty and to set the intercalations within the cycle by a reason that will be sound in our eyes, so that the new moons of the moon shall be ours, and our [annual] changes [in length] shall remain the years counted for the moon.

We say, rather, that we are not commanded concerning the new moons from the beginning of the creation of the world; but we are obligated, by virtue of all the commandments, from the standing at Mount Sinai, and the keeping of this commandment — which is [keeping] the new moon for the moon and intercalating the year — we are obligated in it from the day of the Exodus from Egypt, if you examine the matter precisely. For thus is it written: *"This month shall be for you the head of months; it shall be for you the first of the months of the year"* (Shemos 12:2). From this verse we see [the command] to keep the new moons; and that Nisan is the first [month] for all, since it is said *"This month shall be for you the head of months"* — every new moon that falls within the months of the year; and if it should come before the days of this [particular] month, [the

head] is not [that] first one, but the new moon that comes after it, which will fall within the days of this month. And from this is hinted the intercalation of the year. Furthermore it is written, "*Remember this day on which you went out from Egypt ... and no leaven shall be eaten*" (Shemos 13:3) — and we see from this verse [the command] for the intercalation of the year, since it is written after it "*Remember this day,*" and "*no leaven shall be eaten*": that is, from this day onward leaven shall not be eaten; before this day you have no obligation in it. And from the meaning of this verse: that we are obligated to perform the Pesach offering only on the day we went out from Egypt, or after this day. And [thus] if the 15th [ט"ו] of Nisan should fall before the date of the Exodus from Egypt, we are required to intercalate that year.

Scripture called Nisan the head of the months, as it is written, "*It shall be for you the first of the months of the year*" — and it did not say "It is the first of the year," to inform us that the head of the year is not given over to a month other than Nisan, and in the going-out of the year [the autumn] (cf. there 23:16). Yet we found that Scripture says "*and the Feast of Ingathering at the going-out of the year*" (Shemos 23:16), and "*the Feast of Ingathering, the turn [tekufah] of the year*" (Shemos 34:22). From this we know that the head of the [civil] year is counted from Tishrei, since it called the Feast of Ingathering "the going-out of the year." And it is known that at the going-out of this year, a second [year] at once arrives, with no break at all between them. It is therefore established for us that the head of the [civil] year is Tishrei and the head of the months is Nisan, by Scripture — as it is handed down to us from our masters of blessed memory.

It is known that our ancestors of blessed memory went out from Egypt in the year **2,448 [2448 = שני אלפים תמ"ח AM]** from the creation of the world, as is set forth explicitly in *Seder Olam*, and that year was the 16th [ט"ז] year of the cycle. The seventh month from when they went out from the land of Egypt was the head of the 17th [י"ז] year of the cycle. By the end of Adar of the 17th [י"ז] year, 12 [י"ב] lunar months had been completed since the Exodus from Egypt, yet the solar year had not yet been completed; and the head of the 13th [י"ג] month at the time of the Exodus came earlier than the head of the [solar] month upon which they went out from Egypt by, for example, 11 [י"א] days. Had they made the Pesach in that month, the Pesach would have come before the day on which Israel went out from Egypt. For this reason they intercalated that year, and called the 13th [י"ג] month "Second Adar," by the name of the month which is the end of the year of the Exodus from Egypt, and they made the Pesach in Nisan, on the 14th [יד] from their going out. Thus the 17th [י"ז] year of the cycle was found to be intercalated

for this reason; the Pesach came after a full solar year, but it exceeded it [the solar year] by, for example, 19 [ו"י] days.

You can demonstrate that Israel intercalated the second year of their Exodus from the land of Egypt, if you examine the matter from these verses: *"And the LORD spoke to Moshe in the wilderness of Sinai, in the second year of their going out from the land of Egypt, in the first month, saying: Let the Children of Israel make the Pesach at its appointed time"* (Bamidbar 9:1). Now did Israel need to be informed of the date of the Pesach? Is it not written, in the passage on the Exodus from Egypt, *"And you shall keep this ordinance at its season, from days to days"* (Shemos 13:10)? And it is further written, *"Seven days you shall eat matzos ... as I commanded you, at the appointed time of the month of spring"* (Shemos 23:15). [Scripture] dwelt upon this matter and commanded concerning it. So why did it make this stipulation here, and not make such a stipulation regarding the other festivals? Rather, it admonished them in this place that they should not perform it [the Pesach] before its appointed time, in the Second Adar, which one might suppose to be Nisan; and it commanded them to intercalate the year, since it was Nisan. For this reason it said, in the second year of their going out from the land of Egypt, *"in the first month."* And it set the mention of the year before the mention of the month, to teach you that the second year had [already] entered while the first month had not yet entered. For in every place where Scripture mentions years and months [together], if the [point of the] matter is in the year, it sets the year first; and if the [point of the] matter or the commandment is in the month, it sets the month first.

In a place where the [point of the] matter was in the year, it said *"And it came to pass in the fortieth year, in the eleventh month, on the first of the month"* (Devarim 1:3); and it is written *"in the fortieth year of the going out of the Children of Israel from the land of Egypt, in the fifth month, on the first of the month"* (Bamidbar 33:38) — there it set the mention of the fortieth year first, because that was when the time arrived of the decree decreed on account of the Waters of Strife [Meribah], and that was the [point of the] matter. And afterward it mentioned the month, to make known how many months there were between the two deaths that hinged upon that decree.

In a place where it was necessary to set the month first, Scripture says, *"And it came to pass in the first month of the second year, on the first of the month, the Mishkan was set up"* (Shemos 40:17). It set the mention of the month first because it [the setting-up] occurred then, and was [the matter] of the commandment, as it is written, *"On the first day of the first month you shall set up the Mishkan, the Tent*

of Meeting" (Shemos 40:2). And when it came to the actual deed [of setting it up], it set the mention of the month first — the month in which the commandment fell — and after it the mention of the year, which is subordinate to it. So too it is written, *"in the wilderness of Sinai, in the Tent of Meeting, on the first of the second month, in the second year of their going out from the land of Egypt"* (Bamidbar 1:1) — it set the mention of the month first, the month in which the deed occurred and in which Israel was numbered this time, before the mention of the year.

It is known that the commandment of the Pesach is in the first month, and this was the very root of this directive; and reason warrants that the new moon be given to the commandment of the Pesach. It mentioned [the Pesach] at the outset because it is the time of the commandment — which is the root of the matter. Scripture did not state the matter so [explicitly]; rather, it stated it by implication, *"in the wilderness of Sinai, in the second year of their going out from the land of Egypt, in the first month"* (Bamidbar 9:1): it set the year before the month upon which the chief point depends, since the 12 [י"ב] lunar months had been completed while the solar year had not yet been completed. And it would arise in their hearts, after the solar year was completed, that the days that remained over from the 13th [י"ג] month for the moon would be counted from Nisan of the second year, and that this Nisan would be the head of the months of the second year. Scripture says to them: if it should arise in your hearts that it [the present month] is a second year, because the solar year began within [that] month — and you suppose that this one [Nisan] should be the head [of months] — it is not so. The first [head of months] is none other than [the Nisan] within the [completed solar] month; this [present] new moon, which is coming, is not the [head]: it is the month that has [already] passed.

We find a hint here that HaKadosh Baruch Hu commanded Israel to intercalate the second year — which is the 17th [י"ז] year of the cycle. That Pesach came later than the Pesach of Egypt by 18 [י"ח] days, 15 [ט"ו] hours, and 671 [תרע"א] chalakim. In the third year — which is the 18th [י"ח] year of the cycle — the Pesach came later than the Pesach of Egypt by, for example, 7 [ז'] days, 18 [י"ח] hours, and, for example, 550 [תק"נ] chalakim, and they did not intercalate it. But the fourth year [of the Exodus], which is the 19th [י"ט] year of the cycle, they had to intercalate, because over the three full years that had passed since the Exodus from Egypt the surplus of the sun [over the moon] was, for example, 32 [ל"ב] days, 86 [פ"ו]; running total — supra-24 by design; ?] hours, and, for example, 365 [שס"ה] chalakim. Take out from these the intercalation-month that has passed, and there will remain over for the sun [over the moon], for example, 3 [ג'] days, 2 [ב'] hours, and 652 [תרנ"ב] chalakim in excess of the moon. When we intercalate

the year, this surplus enters into the intercalation; and the Pesach comes about 26 [כ"ו] days, 10 [י'] hours, 141 [א"חק] chalakim after the Pesach of Egypt. In the fifth year [of the Exodus] — which is the first [year] of the [next] cycle — the Pesach came after the Pesach of Egypt by 15 [י"ו] days, 13 [ג"י] hours, 19 [ט"י] chalakim. So too in the sixth year, which is the second [year] of the cycle, the Pesach fell 4 [ד'] days, 26 [כ"ו; possibly 16, ר"ט; ?] hours, 978 [ח"תקע"ח] chalakim after the Pesach of Egypt; and they did not intercalate these two years.

But in the third year [of the cycle] — which is the seventh [year] of the Exodus — they were obligated to intercalate it, because the surplus of the sun over the moon, after two intercalations that had passed, was 6 [ו'] days, 5 [ה'] hours, and further chalakim. When the year was intercalated, this surplus entered into the intercalation-month, and that Pesach came after the Pesach of Egypt by, for example, 23 [ג"כ] days, 7 [ז'] hours, 569 [ט"קס"ט] chalakim. For this reason the 4th [ד'] and 5th [ה'] years of the cycle were the years they were — namely the 8th [ח'] and 9th [ט'] [of the Exodus] — simple [common] years for the Exodus.

But in the sixth year [of the cycle], which is the tenth [י'] year of the Exodus, [the year] was intercalated, because the surplus of the sun over the moon — after the three [?] intercalations that had passed — was 9 [ט'] days, 7 [ז'] hours, and 876 [ת"תע"ו] chalakim; and on this account they intercalated it. The Pesach in the sixth year fell about 20 [כ'] days and 5 [ה'] hours after the Pesach of Egypt, and there was no addition to this in [the] surplus measure of 2 [ב'] solar years over [the] lunar [years]. For this reason they had to intercalate the eighth year — which is the 12th [י"ב] year of the cycle; the Pesach came in it after the Pesach of Egypt by about 28 [ח"כ] days, full [days]; and so the 9th [ט'] and 10th [י'] [years of the Exodus] were simple years, because the Pesach in them was after the Pesach of Egypt.

And in the 11th [א"י] year — which is the 15th [ט"ו] year of the Exodus — they intercalated it, because the sun was in excess over the moon, after five [ה'] intercalations that had passed, by 4 [ד'] days, 15 [ט"ו] hours, and 975 [ח"תקע"ה] chalakim. When they intercalated it, that surplus entered into the intercalation, and the Pesach came after the Pesach of Egypt by about 24 [ד"כ] days and 21 [א"כ] hours. And they did not have to intercalate the 12th [י"ב] year or the 13th [י"ג] year, because the Pesach in them fell after the Pesach of Egypt. But the 14th [יד"] year — which is the 18th [י"ח] year of the Exodus — they intercalated, because they found a surplus of the sun over the moon, after six [ו'] intercalations that had passed, of 7 [ז'] days, 18 [ח"י] hours, 550 [תק"נ] chalakim. When they intercalated it, the Pesach came after the Pesach of Egypt by about 21 [א"כ] days and 18 [ח"י]

hours. And the Pesach fell in the 15th [ט"ו] year [of the cycle] — which is the 19th [ט"ט] year of the Exodus — about 10 [י'] days, 21 [כ"א] hours, 121 [קכ"א] chalakim, 48 [מ"ח] regaim after the Pesach of Egypt. The Pesach then comes in the 16th [ט"ז] year of the cycle, which is the 20th [כ'] year of the Exodus from Egypt, [the year] that is the head of the cycle, on the day of the Exodus, on the day of the first Pesach performed in Egypt — neither later than it nor earlier than it, not even by a single chelek; and so it [the cycle] revolves forever.

By this reasoning you find that our years are always counted upon the solar year, and our festivals upon the lunar months. Had we reckoned the head of the cycle from the Exodus from Egypt, the intercalations would have been ordered in the cycle in the second year, the fourth, the seventh, the tenth, the twelfth, the fifteenth, and the eighteenth — their mnemonic being **בדז"י בה"ח ,2-4-7-10** **[12-15-18]**. These are the very ones that are ordered in the cycles counted from the creation of the world by the mnemonic **גו"ח א"ד ז"ט ,11-14 ,3-6-8** **[19]**:

- The 3rd [ג'] year of the [creation] cycle corresponds to the 7th [ז'] year of the Exodus;
- the 6th [ו'] year of the [creation] cycle corresponds to the 10th [י'] year of the Exodus;
- the 8th [ח'] year of the [creation] cycle corresponds to the 12th [י"ב] year of the Exodus;
- the 11th [יא'] year of the [creation] cycle corresponds to the 15th [ט"ו] year of the Exodus;
- the 14th [יד'] year of the [creation] cycle corresponds to the 18th [י"ח] year of the Exodus;
- the 17th [י"ז] year of the [creation] cycle corresponds to the 2nd [ב'] year of the Exodus;
- and the 19th [י"ט] year of the [creation] cycle corresponds to the 4th [ד'] year of the Exodus.

Because our whole reckoning, by which we count, is from the creation of the world, our masters of blessed memory established for us the markers of the intercalations upon the cycles of the creation of the world. Their essence [origin], however, is from the Exodus from Egypt; for they knew that this fact does us no harm in the reckoning. They were not concerned about it, just as they did the like in the reckoning of the jubilee [יובל] and the sabbatical years [שמיטות] which Israel counted from the 14th [יד'] year of their entry into the Land: they handed down to us their reckoning from the creation of the world, as they said: *"He who*

does not know how many years there are in the [current] sabbatical cycle should go and ask the master of Seder Olam" [Aramaic: מֵאֵן דְּלֵא יָדַע כְּמָה שְׁנֵי בִשְׁבִיעִית לְשִׁילִיָּה וְנִסְפֵי חֲדָא], "and add the partial years of this one year" [Aramaic: וְנִסְפֵי חֲדָא שְׁתָּא] — and let us reckon the general jubilees and the particulars within the sabbatical cycle. And [thus] we had to count from a [year of the] mishnah [tradition] by which they [the intercalations] in fact began — and not [from] the one [actually counted]. So too, let us say, they fixed the intercalations of the years from the Exodus from Egypt, and handed down to us the markers from the creation of the world.

And if any person should fault me for having multiplied words in this matter and gone on at greater length than was warranted, and for having brought proofs from verses upon which the Sages of blessed memory did not expound [their own] expositions, and did not bring a proof from them — I say...

[Continues.]

had I not brought a proof from Scripture to apportion blame to them — God forbid! — but only to reinforce their words and confirm them. Yet this reckoning has compelled us to expand on it at length, explaining it in full before the nations who level their false charge against us over this very calculation.

For you know that those who err alongside the gentiles imagine that their Passover [Pesach] resembles ours, and they reckon according to it: through all the years of the cycle [מַחְזֹר] they keep their Passover after the date of our Passover, and they do not delay it more than eight days beyond it — except in the fifth year and in the sixth year, when those who err in their reckoning keep their Passover after our festival by a full month. In most of their errors, they err willfully and deliberately. They charge against us, and they say, "You have erred in your reckoning of these two years!" And they suppose that they can bring a proof against us from the year in which Israel went out of Egypt, claiming that that year was the head of the cycle by the reckoning of the Creation of the world [bri'at olam].

Now, you would have had to intercalate this present year — which is year 16 [שְׁנַת 16] by your reckoning — when, by us, we intercalate it because it is year 19 [שְׁנַת 19] of the cycle. Had you reckoned the beginning of the cycle from the Nisan in which the Children of Israel went out of Egypt, then it would in fact be the head of the cycle for us! And it would resemble their bringing against us a proof from the four hundred and thirty years [430 = 700] that the Children of Israel dwelt in the land of Egypt — from which year shall we reckon, and on what basis do

they confound us in this matter of reckoning? — these being things I have no need to spell out.

When one of their scholars charged me with these false claims of his, I said to him: the Exodus from Egypt is for us the head of the cycle, and it is upon it that we base the intercalation of the year. So, when we reckon the head of the cycle, we are reckoning this year, since we calculate from the Exodus when we intercalate. I showed him the reasoning and the rationale upon which we rely, and the proofs that compel us to intercalate the years in the manner I have set out above. He fell silent and had nothing to answer me, except that he said to me: "This thing you have invented out of your own mind, for I have never heard it from any others of your own people. The mnemonic [סימן] that the ancient Christians established for this reckoning — which is in their hands — is the mnemonic GUḤ A"D Z"Ṭ [ג"ח א"ד ז"ט], which they received from your own ancients."

I said to him: this mnemonic is reckoned from the Creation of the world, but our reliance upon the intercalation rests only upon the year in which our forefathers went out of Egypt. We did not concern ourselves with that year — whether or not it is the head of the cycle for the Creation of the world. And because it entered your mind that this reckoning is built upon the Creation of the world, you fell into the error that stood before you — in the fifth year and in the sixteenth year [שנת 5 ו 16] of the cycle. Since I saw that this rationale is of service to us, and refutes these claimants, and emerges in accordance with our view — and the Holy Writings bear witness to it, and the words of our Rabbis, may their memory be a blessing [לז"ל], attest to it — I have set forth the matter and strengthened it with every consideration that arose in my mind as confirming it, vindicating it, and testifying to its soundness.

The Sixth Gate [השער הששי]

On the reckoning of the conjunctions [חשבון המולדות molad], and it is divided into three parts.

The first part of it: on the reckoning of the conjunctions [molad מולד, "birth" of the new moon] as it is ordered for everyone. I begin first with the months of the conjunctions, on which the reckoning rests, and afterward I shall explain the method of the reckoning.

I say: the measure of the lunar month, which we reckon for it, is 29 days, 12 hours, 793 chalakim [כ"ט יום י"ב שעות תשצ"ג חלקים]. If you cast out these days

seven by seven [i.e. by complete weeks], the remainder [המדה] left in your hand — the interval between the conjunction of one month and the measuring of the next month that follows it after the [completed] days of the week — is the remainder, namely 1 day, 12 hours, 793 chalakim, with the mnemonic A"YB TaSHTSa"G [1 = אי"ב תשצ"ג day, 12 hours, 793].

If you multiply the measure of the month by 12, according to the number of months of the common year [shanah peshutah], there will come into your hand the measure of a common year: 354 days, 8 hours, 876 chalakim [שנ"ד יום ח' שעות]. And if you cast out this measure seven by seven, there remains in your hand 4 days, 8 hours, 876 chalakim [ד' ימים ח' שעות תתע"ו חלקים]. This is the excess [המותר] between the conjunction of one common year and the conjunction of another common year, [counted] from the days of the week, with the mnemonic Da"Ḥ TaTa"V [4 = ד"ח תתע"ו days, 8 hours, 876].

Half of this measure is 2 days, 4 hours, 438 chalakim [ב' ימים ד' שעות תל"ח], with the mnemonic Ba"D Ta"L"Ḥ [ב"ד תל"ח], and it is the marker for six months.

When you multiply the measure of the month by 13, there will come into your hand the measure of a leap [intercalated] year [shanah me'uberet]: 383 days, 21 hours, 589 chalakim [שפ"ג יום כ"א שעות תקפ"ט חלקים]. And when you cast it out seven by seven, there remains in your hand 5 days, 21 hours, 589 chalakim [ה' ימים כ"א שעות תקפ"ט חלקים], and this is the marker for a leap year, [namely] Ha"Ka"A TaKPa"T [5 = ה"כא תקפ"ט days, 21 hours, 589].

Likewise, if you multiply the measure of the month by 235, according to the number of months of another [full] cycle, there will come into your hand 6939[?] days, 16 hours, 595 chalakim [ששת אלפים ו'תתקל"ט יום י"ו שעות תקצ"ה חלקים] — the printed day-figure reads "ה'תקל"ט"; the arithmetic of 235 months requires 6939, i.e. [תתקל"ט]. And these are the days of one cycle of the 19[-year cycles] — that is, of the lunar cycles. Cast them out seven by seven, by the number of the days of the week, and there remains in your hand 2 days, 16 hours, 595 chalakim [ב' ימים י"ו שעות תקצ"ה חלקים]. This is the measure [המדה] between the conjunction at the head of one cycle and the conjunction at the head of another cycle, [reckoned] from the days of the week.

Our purpose in the reckoning of the conjunctions is only this: to know in which fraction [chelek] of which hour of the day or of the night the conjunction of the month falls within the days of the week. You already know that the conjunction of the month is the conjoining of the moon with the sun in one of the divisions of

the firmament, and it is what is called the conjunction of the month or the conjunction of the year [molad ha-shanah].

It is clear that, if you knew how many years there are between you and the Creation of the world, and how many leap years and how many common years are among them, then you would multiply the marker of the common year by the number of common years in your hand, and likewise multiply the marker of the leap year by the number of leap years, and add these together, one to the other. From the chalakim you would make hours, and from the hours days, keeping back the chalakim that did not complete an hour and the hours that did not complete a day; and what is gathered for you out of the days, you would cast out seven by seven. There would remain in your hand the measure between the conjunction in which the world was created and the conjunction you seek.

And if you add the conjunction of the world to the measure that is in your hand — and if it should amount to more than seven, you cast out seven complete days from the total: if there be more than seven in it, [discard a week] — there remains in your hand the day of the conjunction of the month, and its hours and its chalakim, [counted] from the days of the week.

It is a tradition handed down to us from our forefathers that the moon and [its first crescent] were created at the beginning of the eve of the fourth day [Wednesday], at the end of the month of Adar — yet the moon was not yet conjoined with the sun until 9 hours and 642 chalakim into the eve of the fourth day, with the mnemonic Ta"t TaRMa"B [9 = ט"ט תרמ"ב hours, 642]. Because we reckon Rosh Hashanah from Tishrei, we were compelled to determine the conjunction of Tishrei according to what arises [in the calculation] — for it preceded the Creation of the world by six months. [We needed to know] in what hour and on what day it could have been.

For this reason, this [value] that issues from the conjunction of Nisan is Ta"t TaRMa"B [9 hours, 642 chalakim], which is the marker of six months, namely Ba"D Ta"L"Ḥ [2 = ב"ד תל"ח days, 4 hours, 438 chalakim]; and there remains in your hand the measure of BaHaRa"D [ב"ה ר"ד — Monday, 5 hours, 204 chalakim]. So it emerged for us that the conjunction of Tishrei in the year in which the world was created fell on the eve of the second day [Sunday night], at 5 hours [into the night], with so many chalakim. This was a tradition in our hands.

[Editorial gloss, in brackets in the source:] Whoever wishes to reckon the conjunctions by this method should first know how many complete years — apart from the surplus remaining months — there are from the Creation of the world

up to the year in which he is standing, or whose conjunction he is seeking. Out of these years he shall form cycles of 19 years each, and shall know how many cycles they are. He shall assign to each cycle 2 days, 16 hours, 595 chalakim [ימים ... שני... י"ו שעות תקצ"ה חלקים], and combine the chalakim, making of them hours at the rate of 1080 chalakim [תתר"ף חלקים] for each hour, keeping back in his hand the remainder of chalakim that did not complete an hour. He shall combine the hours he made from the chalakim with the hours he assigned to each cycle, and make of them days at 24 hours per day [כ"ד], keeping back in his hand the remainder of hours that did not complete [a day]. He shall combine the days he made from the hours with the days he assigned to each cycle, and cast out all the days seven by seven [ז' ז'], and the remainder that is less than seven he shall keep back. The interval thus left in his hand — the days and the hours and the chalakim — is the conjunction [molad] that he seeks.

And there remain in his hand the years that did not complete a cycle. He shall know how many leap years there are among them, and assign to each such year 5 days, 21 hours, 589 chalakim [ה' ימים כ"א שעות תקפ"ט חלקים], and to the common years among them he shall assign to each year 4 days, 8 hours, 876 chalakim [ד' ימים ח' שעות תתע"ו חלקים]. He shall combine the chalakim and make of them hours, keeping back the remainder; and likewise he shall combine these days with the [earlier] days and cast them out seven by seven [ז' ז'], as he did at first. The remainder from these days that did not complete seven, and from the chalakim that did not complete 1080 [תתר"ף], he shall add to the 24 [hours] that did not complete [a day] —. He shall add it to the conjunction at the head of the cycle [computed] by the method he has learned, and there will come into his hand the conjunction of Tishrei for the year whose conjunction he seeks.

And if he wishes to determine the conjunction of one [particular] month among the months of that year, he shall know how many months there are from the head of the month of Tishrei up to the head of the month he seeks, and assign to each month A"YB TaSHTSa"G [1 = אי"ב תשצ"ג day, 12 hours, 793 chalakim]. He shall combine the whole by the method he applied to the years, and what comes up in his hand — of days and hours and chalakim — he shall add to the conjunction of Tishrei in his hand, and he will find the conjunction of the month he seeks.

From this method you understand the reckoning of the conjunctions of the heads of cycles, and the conjunctions of the years that did not complete a cycle, and the conjunctions of the months — and I need not give you a worked example of this reckoning.

And if you wish to reckon the conjunctions by another method: know how many years there are, from the Creation of the world up to the year whose conjunction you are seeking, and make of them cycles of 19 years each. For each cycle take seven months, according to the number of the intercalations [embolismic months] of the cycle [shiv'ah chodashim — the 7 leap-months per 19-year cycle]. And if there remain years that did not complete a cycle, take for each leap year among them the one month that is in it, and add them to the months taken from the [full] cycles. Combine the whole, and make of them common years of 12 months for each year. Add these years to the years you are counting from the Creation of the world, and there will come up in your hand, from the number of common years that elapsed from the Creation of the world up to the year you are seeking, [the total]. Out of these years make cycles, each cycle of 90 years [צ' שנה], and assign to each cycle of 90 years 1 day and 1 hour only [יום אחד ושעה אחת] [בלבד]. And for the years that did not complete 90 years: if you wish, assign 1 day for every two years, and 1 day for every thirty years; and for every single year take 12 chalakim [י"ב חלקים]; and for every year that has no pair [no partner], take 4 days [recte: see note]; and for those that did not complete three years, take for each one of them 8 hours [ח' שעות]; and for those that did not complete thirty, take for each one 864 chalakim [תתס"ד חלקים], as is set forth by the ancients [the earlier authorities]. Combine the whole, add to it the conjunction of the Creation of the world — which is BaHaRa"D [בהר"ד] — and there will come up in your hand the conjunction you seek.

We assigned 1 day and 1 hour to each 90-year [cycle] because, in every 1080 months [אלף ושמנים חודשים] — which are 90 years — the fractional chalakim of the month complete whole hours, and no chalakim remains for the conjunction at all; but there come up in your hand 793 hours [תשצ"ג שעה — see note], which are 33 days and 1 hour, and from these there come into your hand, from the day, [the surplus].

[The text continues in this vein on page 3, refining the 90-year method:]

and from the cycle [of 90 years] there comes out 1 day for every 7 [years]. And what remains is kept back together with the hours and the [days] that came up in his hand. The interval thus left in his hand — the years' surplus and the [residual fractions] — is what he seeks. He adds to it 2 days, and it becomes the conjunction in which the world was created, namely the measure he had in hand; and by this calculation he proceeds.

He shall combine the chalakim, and from them remove 1080 [תת"ר] if there is more than 1080 in them, keeping back the remainder; and likewise add the hours

to the hours, and to them the hour he made from the chalakim, and remove from the hours one day if there is more than 24 in them; and add this day onto the days; and combine the days with the days up to the day he took. Cast out the remainder of the days seven by seven, removing seven if there be more than seven among them; and likewise the remainder of the hours, if it amounts to a part of [a day]. What remains in his hand — of the days, the hours, and the chalakim — is the conjunction at the head of the cycle that he seeks.

And if there remain in his hand years that did not complete a cycle, he shall know how many leap years there are among them, and assign to each such year 5 days, 21 hours, 589 chalakim [ה' ימים כ"א שעות תקפ"ט חלקים], and to the common years among them assign to each year 4 days, 8 hours, 876 chalakim [ד' ימים ח' ימים ח' שעות תתע"ו חלקים]. He shall combine the chalakim and make of them hours, keeping back the remainder; and likewise combine these [hours and] days, and cast them out seven by seven [ז' ז'], as he did at first. The remainder from these days that did not complete seven, and from the chalakim that did not complete 1080 [תתר"פ], he shall add onto the 24 [hours] that did not complete [a day], onto the conjunction at the head of the cycle [computed] by the method he has learned. There will come up in his hand the conjunction of Tishrei for the year whose conjunction he seeks.

And if he wishes to determine the conjunction of one month among the months of that year, he shall know how many months there are from the head of the month of Tishrei up to the head of the month he seeks, and assign to each month A"YB TaSHTSa"G [אי"ב תשצ"ג]. He shall combine the whole by the reckoning he applied to the years, and what comes up in his hand — of days and hours and chalakim — he shall add onto the conjunction of Tishrei in his hand, and find the conjunction of the month he seeks.

From this method you understand the reckoning of the conjunctions of the heads of cycles, the conjunctions of the years that did not complete a cycle, and the conjunctions of the months — and I need not bring you a worked example of this reckoning.

And if you wish to reckon the conjunctions by yet another method: know how many years there are from the Creation of the world up to the year whose conjunction you are seeking, and make of them cycles of 19 years each. For each cycle take seven months, according to the number of intercalations of the cycle. If there remain years that did not complete a cycle, take for each leap year among them the one month within it, and add them onto the months taken from the cycles. Combine the whole, and make of them common years of 12 months for

each year. Add these years onto the years you are counting from the Creation of the world. There will come up in your hand, from the number of common years that elapsed from the Creation of the world up to the year you are seeking, [the total]. From these years make cycles, each cycle of 90 years [צ' שנה], and assign to each cycle 1 day and 1 hour only.

For the years that did not complete 90 years: if you wish, assign 1 day for every two years, and 1 day for every thirty years; for every single year, 12 chalakim [י"ב חלקים]; for every year that has no pair, take for it 4 days [ד' ימים — see note]; for those that did not complete three years, [take for each of them] 8 hours [ח' שעות]; and for those that did not complete thirty, take for each one 864 chalakim [תתס"ד חלקים], as is set forth by the ancients. Combine the whole, add to it BaHaRa"D [בהר"ד], and there will come up in your hand the conjunction you seek.

We assigned to each cycle of 90 years 1 day and 1 hour only, because in every 1080 months — which are 90 years — the fractional chalakim of the month complete whole hours, and no chalek at all remains for the conjunction; but there come up in your hand 793 hours [תשצ"ג שעה], which are 33 days and 1 hour [ל"ג יום ושעה אחת]. From the day there comes into your hand, for every 90 years, 1 day and 1 hour.

This being so, you assigned for every two years 1 day, on account of the surplus of the conjunction for each month [being more than a half-day], and it is completed across 24 months [בכ"ד חדש] — that is, in two years it amounts to 10 days [א' ל"י — see anomaly note]. And if you cast them out seven by seven, there remains in your hand 1 day. You assigned 1 day for every three years on account of the third [year's] hour: the hour that is in the conjunction of the month, exceeding one day and a half, accumulates over three years to 1 day. You assigned 1 day for every thirty years on account of the 73 chalakim [ע"ג חלקים] that are in excess over the [day-and-a-half plus] one-third of the hour in each month; and if you take 72 chalakim [ע"ב חלקים] of them and double them, they will amount in a single year to 864 chalakim [תתס"ד], and over thirty years they will reach 1 day. And you assigned 12 chalakim [י"ב חלקים] for each year on account of the one chalek that remains, namely 73 chalakim [מע"ג — i.e. the 73rd] in each month: it amounts in a year to 12 chalakim. From these chalakim, the hour you place at the head of the reckoning for every ninety years is filled out; and the day you place along with it is from the days [accruing] to the two-year and three-year and thirty-year [reckonings]. So in every ninety years there is 1 day and 1 hour, and you can grasp the rest of the reckoning on your own. This is a reckoning set forth by the earlier authorities.

And if you wish to reckon by yet another method, you would assign to each ninety years 1 day and 1 hour, as you did at first, and the remainder in your hand that did not complete ninety years [you treat thus]: for every five years assign 20 hours and 60 chalakim [עשרים שעה וששים חלקים]; for the years that did not complete five, assign for each five months 16 hours and 725 chalakim [חמ"ו שעה — see note]; and for the months that did not complete five, assign for each month A"YB TaSHTSa"G [אי"ב תשצ"ג]. Combine the whole, and from the chalakim make hours, and from the hours days, and cast out the days seven by seven, as I showed you above. What remains in your hand, reckon together with BaHaRa"D [בהר"ד — read בהר"ד] as you did in the first reckoning, and there will come up in your hand the conjunction of the month you seek.

I instructed you to assign to every five years 20 hours and 60 chalakim because, in 60 months, there is completed for you, out of the 793 chalakim that are in each month, 1 day, 21 hours, and 60 chalakim. This day you add onto the ninety days that came up in your hand [as] half-days for sixty months, and they become 91 [days];, and all of them are divisible into whole weeks, and there remains for sixty months only 20 hours and 60 chalakim. You can work out the rest of the reckoning from your own mind. And so too you are able to reckon the conjunctions by many methods, some of which are a long way [a roundabout method] and some a short way [a direct method] — and these methods that I have brought are sufficient for this treatise.

And if you take the marker of the conjunction for ninety common years and multiply it 24 times, according to the number of the hours of the day, it will be 25 days [כ"ה יום], without hours and without chalakim. And if you divide them into weeks, there remain in your hand 4 days; and these are a marker for 2160 [years] — that is, two thousand one hundred and sixty common years [אלפים ומאה וששים שנה]. These are leap years and common years adjusted within the [great] cycle of two thousand, [namely] 2095 years and 9 months [אלפים וחמש ותשעים שנה ותשעה]. And if you multiply this marker seven times, it will be 28 days, and this number divides evenly into weeks, and there remains in your hand for the marker of the conjunction neither days nor hours nor chalakim. This matter applies to 15,120 common years [חמשה עשר אלף שנה ומאה ועשרים שנה], and these are leap years and common years duly [adjusted], [namely] 14,669 [years] and 8 months [ארבעה עשר אלף ושש מאות ותשע וששים שנה ושמונה חדשים]. And in the count of cycles, 792 cycles [תשע"ב מחזורות] plus one year and eight months [ושמונה חדשים].

And so it is found that the conjunction of the moon cannot return to the [same] fraction and hour of the day on which it first fell, until [the lapse of] the count of these years and months [in full].

I have already informed you of the reckoning of the conjunctions from the Creation [of the world]...

[Continuation of Maamar Sheni, Gate 6, First Part — on computing any molad from a known one]

forever, until the end of the world — whether to determine the molad of one month that you wish, when one molad is taken in relation to another. If the molad you seek falls after the one you know, or before it, you need not revert back all the way to the Creation of the world. Realize how far the molad you seek lies from the molad you already hold in hand. The molad and the months are the basis: you will know how many days, hours, and chalakim [chalakim, $1/1080$ of an hour] of the years and months separate the two molads — all of this by the method you learned in the reckoning of the moladot [molad, "birth" of the new moon].

If the molad you seek falls *before* the molad you already hold, take out of that known molad the days, hours, and chalakim you have in hand, and you will arrive at the molad you are seeking. But if the molad you seek falls *after* the molad you hold, add onto it the days, hours, and chalakim — and the molad you seek will come up in your hand.

A worked example. Suppose, by way of illustration, the molad of Tishrei for the year 4865 [$865 + 4000 =$ ד' אלפים תתס"ה] from the Creation of the world — which is the head of a [intercalation] cycle — and its molad was: day 4 [Wednesday], 18 hours, 244 chalakim [ד"רמ]. You now wish to know the molad of Tishrei two hundred years *later*. Know that two hundred years are ten cycles and ten years; and their sign [סימן — the mnemonic for the accumulated molad value], by the method of the reckoning of the moladot, is: five days, three hours, and 889 chalakim [תתפ"ט].

So if you seek the molad two hundred years after the one you hold in hand: add the 889 chalakim [תתפ"ט] of your sign to the chalakim of the molad you hold, which are 244 [ד"רמ]. They make 1133 chalakim; these exceed one full hour, which is 1080 chalakim, by 53 chalakim [נ"ג]. Keep these chalakim, and give the carried hour to the hour-tally.

The hours that came up by your sign were three; add to them the carried hour, and the molad's hours become four. Add those onto the 18 hours [י"ח] that the molad already held: they make 22 [כ"ב] hours. And the five days of your sign, join to the day 4 [ד', Wednesday] that the molad held — your sign comes up in hand as: 2 [days], 22 [hours], 52 [chalakim — כ"ב נ"ב]. Cast out the seven [days] from them, and 1 [day] remains.

This is the molad of Tishrei for the year 5065 [$65 + 5000 =$ המשה אלפים ס"ה] from the Creation of the world, which falls *later* than the molad you held in hand by two hundred years.

Now, if you seek the molad two hundred years *before* your molad: discard the chalakim of your sign, which are 889 [תתפ"ט], from the chalakim that the molad holds, which are 244 [רמ"ד]. Since you cannot subtract a larger number from a smaller one, you add the chalakim of one hour [1080] onto the chalakim of the molad; the hours then remain at 16 [י"ו]. They [the chalakim] become 1324 [אלף 1324 = שכ"ד]; subtract from them the 880 [תתפ"ז — printed] of your sign, and there remain in hand 435 chalakim [תל"ה]. Likewise subtract the 4 hours of your sign from the 16 hours that remained in the molad, and there remain in hand 12 hours [י"ב]. Likewise add a [carried] week onto the days of the molad: they become 11 days [יא יום]. Subtract from them the 5 days of your sign, and 6 days remain. So the sign that comes up in your hand from these remainders is: 6 [days], 13 [hours — י"ג], 435 [chalakim — תל"ה].

And this is the molad of Marcheshvan for the year 4665 [ארבעת אלף תרס"ה] from the Creation of the world, which is two hundred years *before* the molad of Tishrei you held in hand — the molad whose value you wished to know.

By this procedure you may operate with every single molad, whether you wish to derive from one molad another that falls before it or after it. For the molad of the later years — which belongs to Tishrei [תשרי] — you proceed one way; and for the molad of the earlier years — which belongs to the month of Marcheshvan, on account of the twelve months [the lunar-year shortfall] — you proceed the other way.

[Explanation of why Tishrei goes forward and Marcheshvan backward across the cycle:] As for the ten cycles you held in hand: if you count them from the head of a cycle going *forward* in order, you find within them three intercalated [leap] years; but if you count them from the *end* of the cycle going backward, you find within them four intercalated years. This is why your derivation of the sign

across two hundred years was applied to the month of Tishrei going forward, and to the month of Marcheshvan going backward.

So conduct yourself thus with all the coming years. By this method you can check, from whatever year you begin counting, and there will become clear to you the count of the intercalations in those years; and you will keep your reckoning accurate and not stray in it, with the help of Heaven [בע"ה].

The Second Part — On deriving the moladot from the tables made for the intercalation [להעיבור]

Because there are many ...

[Continuation, top of next page:] ...the methods by which the reckoning is done are difficult, I have devised tables, so that whoever wishes may derive the moladot by means of tables. I have set the heads of the cycles and the moladot of the years and the months in these tables from the very beginning of the Creation of the world up to six thousand years; and I added to these years nothing beyond what was required for the proper construction of the tables. I could indeed have added more, but [I refrained] because of the saying of our Rabbis, of blessed memory [ז"ל], that "the world will exist for six thousand years" [שית אלפי הוי] — (Talmud, Sanhedrin 97a; Rosh Hashanah 31a).

The four tables. I divided these figures into four tables.

The **first table** is the table of the **double cycles** [מחזורות כפולות], each of whose cycles is 798 common cycles. On this table I wrote the moladot of the heads of the double cycles from the Creation of the world up to the head of the 22nd cycle [לכ"א] of the double cycles. I divided this table lengthwise into 21 [מחזור כ"ב] rows, by the number of the [double] cycles, and divided it crosswise into six columns. In three of them, the first columns, is written, for each one of the double cycles, the molad of its head — these are the moladot of the heads [מולדי ראשן] (that is, the principal moladot [מולדי העיקרים]). In the second [pair of columns] is the count of the simple cycles whose molad is that first molad, and the count of the years from the Creation of the world up to the year of the head of the cycle, inclusive. And in the [last] three columns I wrote the days, hours, and chalakim of the molad.

The **second table** is the table of the **simple cycles** [מחזורות פשוטות], whose molad is the [excess of] that first molad — the molad of the head [מותר מולד ראשן]. It is divided lengthwise into 46 [למ"ו] rows, by the number of the cycles of the double cycle, and divided crosswise into five columns. In the first I wrote the

count of the cycles; in the second, the count of their years; and in the [last] three columns, the days, hours, and chalakim of the molad.

The **third table** is the **table of the years [לוח השנים]**. It is divided lengthwise into 19 [לי"ט] rows, by the number of the years of the cycle, and is divided crosswise into five columns. In the first of them is the count of the years; in the second, the nature of that year — whether it is a common year [פשוטה] or an intercalated [leap] year [מעוברת]; and in the [last] three columns, the days, hours, and chalakim of the molad.

The **fourth table** is the **table of the months [לוח החדשים]**. It is divided lengthwise into 13 rows [על י"ג שטה], by the number of the months of an intercalated year, and is divided crosswise into five columns. In the first of them is the count of the months of a common year; in the second, the count of the months of the intercalated year [שנת העבור]; and in the [last] three, the days, hours, and chalakim of the molad.

How to use the tables. When you wish to determine a molad from these tables, realize how many years are counted from the Creation of the world, including the year you are currently standing within. Then look up those years in the table of the **double cycles**, in the column of the years from the Creation of the world. If you find a number equal to the count of years you hold in hand, take the molad-sign that stands opposite it — that is the molad of the year you seek, and that year is the head of a double cycle.

You can also know which [simple] cycle it is from the count of the cycles standing opposite it in that year. But if you do not find a number equal to your years in hand, take the number nearest to it that is *less* than your years, so that what is left over [your additional years] is added on; and take the sign standing opposite it — that is the molad of the head of the double cycle within which you are standing.

Then go and search for the years that remain to you in the **table of the simple cycles**. If you find a number equal to them, take what stands opposite it among the molad-excesses [ממותרי המולדות], and add it onto the molad of the head of the double cycle that came up in your hand earlier — and there comes up in your hand the molad of the head of the simple cycle within which you are standing.

And if there remain in your hand years that have not completed a [full] cycle, look them up in the **table of the years [לוח ג']**, take what stands opposite them among the molad-excesses, add it onto the molad of the head of the cycle, and

there comes up in your hand the molad of Tishrei of the year within which you are standing.

And if you wish to determine the molad of a month *other than* Tishrei, among the months of the year, realize how many months there are from Tishrei up to that month — not including it [exclusive] — and search for the count of [those] months in the **table of the months**. Take what stands opposite it among the molad-excesses, add it onto the molad of the year (which is the molad of Tishrei), and there comes up in your hand the molad of the month you seek, with the help of Heaven [בעזה"ש].

The Tables of the Moladot in the Simple and Double Cycles

Table title: "לוח המולדות במחזורים הפשוטים והכפולים" — *The Table of the Moladot in the Simple and Double Cycles*.

Table 1 — Double Cycles [מחזורים כפולים]

Columns (logical order, source reads R→L): index | Cycle no. [מספר מחזור] | Year-count from Creation [מספר השנים] | Days [ימים] | Hours [שעות] | Chalakim [חלקים].

Index	Cycle no.	Year-count	Days	Hours	Chalakim
א	טו (15)	רפה (285)	7	13	489
ב	ל (30)	תקע (570)	5	21	774
ג	מה (45)	תתנה (855)	4	5	1059
ד	ס (60)	א' קמ (1140)	2	14	264
ה	עה (75)	א' תכה (1425)	7	22	549
ו	צ (90)	א' תשי (1710)	6	6	834
ז	קה (105)	א' תתקצה (1995)	4	15	39
ח	קכ (120)	ב' רפ (2280)	2	32 [recte: 3 — printed "32" is impossible (hours ≤ 23); compositor stray-2 doubling]	324
ט	קלה (135)	ב' תקסה (2565)	1	7	609
י	קנ (150)	ב' תתנ (2850)	6	15	894

Ind ex	Cycle no.	Year-count	D a ys	Hours	Chala kim
יא	קסה (165)	ג' קלה (3135)	5	0	99
יב	קפ (180)	ג' תכ (3420)	3	8	384
יג	קצה (195)	ג' תשה (3705)	1	16	669
יד	רי (210)	ג' תתקצ (3990)	7	0	954
טו	רכה (225)	ד' רעה (4275)	5	9	159
טז	רמ (240)	ד' תקס (4560)	3	17	444
יז	רנה (255)	ד' תתמה (4845)	2	1	729
יח	רע (270)	ה' קל (5130)	7	9	1014
יט	רפה (285)	ה' תט[?] (415) → (5415)	5	18	219
כ	ש (300)	ה' תש (5700)	4	2	504
כא	שיה (315)	ה' תתקפה (5985)	2	10	789

Table 2 — Simple Cycles [מחזורים פשוטים]

Columns (logical order R→L): index | Year-count [מספר השנים] | Days [ימים] | Hours [שעות] | Chalakim [חלקים]. (15 rows — one double cycle = 15 simple cycles.)

Index	Year-count	Days	Hours	Chalakim
א	יט (19)	2	16	595
ב	לה (35) [recte: לה (38) — printed glyph is certainly 19+ ;(35) sequence requires 38; compositor he-for-chet]	5	9	110
ג	נז (57)	1	1	705
ד	עו (76)	3	18	220
ה	צה (95)	6	10	815
ו	קיד (114)	2	3	330
ז	קלג (133)	4	19	925
ח	קנב (152)	0	12	440
ט	קעא (171)	3	4	1035
י	קצ (190)	5	21	550

Index	Year-count	Days	Hours	Chalaksim
יא	רט (209)	1	14	65
יב	רכח (228)	4	6	660
יג	רמז (247)	6	23	175
יד	רסו (266)	2	15	770
טו	רפה (285)	5	8	285

Table 3 — Table of the Years [לוח השנים]

Columns (logical order R→L): index | Order of the years of the cycle [סדר שנות] — common (פשוטה) / leap (מעוברת) | Days [ימים] | Hours [שעות] | Chalaksim [חלקים]. (19 rows.)

Index	Year type	Days	Hours	Chalaksim
א	פשוטה (common)	4	8	876
ב	פשוטה (common)	1	17	672
ג	מעוברת (leap)	0	15	181
ד	פשוטה (common)	4	23	1057
ה	פשוטה (common)	2	8	852
ו	מעוברת (leap)	1	6	362
ז	פשוטה (common)	5	15	158
ח	מעוברת (leap)	4	12	747
ט	פשוטה (common)	1	21	543
י	פשוטה (common)	6	6	339
יא	מעוברת (leap)	5	3	928
יב	פשוטה (common)	2	12	724
יג	פשוטה (common)	6	21	520
יד	מעוברת (leap)	5	19	29
טו	פשוטה (common)	3	3	905
טז	פשוטה (common)	0	12	701
יז	מעוברת (leap)	6	10	210
יח	פשוטה (common)	3	19	6
יט	מעוברת (leap)	2	16	595

Table 4 — Table of the Months [לוח החדשים]

Columns (logical order R→L): Months of the common year [חדשי השנה פשוטה] | Months of the leap year [חדשי שנת העבור] | Days [ימים] | Hours [שעות] | Chalakim [חלקים].

Common-year month	Leap-year month	Day s	Hours	Chalakim
א	א	1	12	793
ב	ב	3	1	506
ג	ג	4	14	219
ד	ד	6	2	1012
ה	ה	0	15	725
ו	ו	2	4	438
ז	ז	3	17	151
ח	ח	5	5	944
ט	ט	6	18	657
י	י	1	7	370
יא	יא	2	20	83
יב	יב	4	8	876
—	יג	5	21	589

The Third Part — On checking the molad, whether there is an error in its reckoning or not

I copied this verification from the work of the Rabbi, R. Isaac bar Baruch, of blessed memory [ר' יצחק בר' ברוך ז"ל]. And thus he said in his composition:

"I have observed those who teach the science of reckoning checking their students' computations by a short method. Some of them check by the number seven: when one casts out the accumulated sum of the reckoning, multiplying the number seven by seven and keeping the remainder, and then casts out the multiplied number seven by seven — if the remainder [of the multiplied figure] equals the remainder from the [original] sum, it is known that the reckoning is sound and correct; but if one of them adds or exceeds over the other, he knows there is an error in the reckoning, and the teacher need not multiply the

reckoning out again nor labor over it. Others among them check by the number nine."

Now I examined and investigated the reckoning of the moladot until I derived a method for checking them by the number seven, and another method by the number nine.

Checking by seven. The method that depends on the number seven is as follows. Realize: the cycle has a distinct value under the number seven, [namely] two; the common year, six under the number; the intercalated years, three under the number; and the month, four under the number.

When you wish to check the molad, realize how many cycles, and years, and months, run from the Creation of the world up to the head of the month whose molad you wish to check. Cast out the cycles seven by seven, and double whatever remains in your hand short of seven — that is, add to it a number equal to itself. And if there is in your hand a count of years that have not completed a cycle, cast out the common years seven by seven; if they are more than seven, multiply the [remainder] by six — that is, reckon its number six times over. The intercalated years, multiply by three. And if you have in hand months that have not completed a year, multiply them by four.

Combine all these multiples, and add years to them always; cast out the whole seven by seven, and keep the remainder, short of seven, in your hand. Then return to the molad: cast out its chalakim seven by seven, and keep the remainder short of seven. The hours — cast those out seven by seven if there are more than seven among them; the remainder, multiply by two. The days, multiply by six. Combine these multiples together with the remainder from the chalakim, cast them out seven by seven, and the remainder [you keep].

If [this remainder] equals the excess you held in hand from the cycles, the years, and the months — neither less nor more — it is well, and you may know that the molad is not in error in its reckoning. But if it does not [match], you may know that the molad is mistaken in its reckoning; so go and search out that error until you find it. This is the explanation of the check by the number seven.

Checking by nine. After this check, the Rabbi R. Isaac derived another check, by the number nine. I have not expanded on its explanation, because — having seen that these two checks [by seven and by nine], and three or four other checks you might devise and check by, do not constitute a complete verification. For if you find the molad-remainders and the year-remainders not coming out equal as one, it becomes clear to you that the molad is in error; and one check suffices for you

in this matter. But if both come out equal as one, you may not [yet] trust that the molad is free of error — it may still be mistaken. If you check it by two checks and a third, and find that they do not [agree], you know by this check only that [the molad] is mistaken — but you do *not* know [whether] it is sound and correct.

A worked example. I give you an example: from the molad of Tishrei for the year 4883 [$883 + 4000 =$ ד' אלפים תתפ"ג] from the Creation of the world, [which is] the 19th year [י"ט שנת] of cycle 257 [רנ"ז למחזור]; and its molad is: day 1 [א'], 13 [hours — י"ג], 250 [chalakim — ר"נ].

These years, for the reckoning of the moladot, are 256 complete cycles [רנ"ו], twelve common years [י"ב שנה פשוטה], and six intercalated years [שש שנים מעוברות].

If you cast out these cycles seven by seven, there remain in your hand four [$256 \bmod 7 = 4$]; multiply them by two — they became eight. Cast out the seven of the common years [from the twelve], and there remain in your hand five; multiply them by six — they became thirty. The intercalated years [six], multiply by three — they became eighteen. Combine these multiples — they became 56 [נ"ו]; add the years onto them — they become 74. Cast them out six by six; there remain...

[The molad-verification worked example continues from the preceding page, mid-computation. The opening lines of p. 69 are a dense residue chain in degraded square type; numerals that are not crisply legible are flagged rather than reconstructed to close the arithmetic.]

—and these are the residues of the years. Now go back to the molad and cast out its parts [chalakim] seven by seven [ז' ז'], and you are left with five [ה'] in hand. Cast out the hours seven by seven [ז' ז'], and you are left with six [ו']; double them and they become twelve [י"ב]. Take the six that remain and add them, so that all these multiples together are twenty-three [כ"ג]. For the one day [ליום האחד] there is six [ששה], and cast them out seven by seven [ז' ז'], and there remains in hand two [ב'], which equals the residue of the years.

[Margin / interlinear words in the degraded top band are partly illegible: "... וקח"; the residue values 5 / 6 / 12 / 23 / 2 are transcribed as printed.]

But you should neither rely on this nor trust it, because it is possible there is an error here. For it could be that another molad would be named to you whose residue of the years is also two [ב'], yet it is not the molad of this year and is not its true molad.

For example: suppose the molad of the year were named to you as day 3, 14h [hours], 313ch [chalakim] (ג' י"ד שי"ג). You would cast out the chalakim seven by seven [ז' ז'] and be left with five [ה'] in hand; the hours all cast out and the days all cast out. The three [days] you would multiply by six and they become eighteen [י"ח]; add these to the excess of the chalakim, and there would remain in hand two [ב'] as the residue of the years; and you would find that the molad came out for you as day 7, 6h [ז' ו']. Cast them out seven by seven [ז' ז']: twenty-three [כ"ג] — this would be the molad of your year.

So too if the molad were named to you as day 4, 11h, 376ch (ד' י"א ש"ז), or day 4, 18h, 467ch (ד' י"ח תס"ז), or any number of other signs [simanim] for which there is no inquiry — whose residue would be two [ב'], like the count of the residue of the years that you hold — you would have to believe all of them, if you are relying on this verification. And so you now see that it does not testify with certainty but only [detects] error, and it does not yield certainty.

You are also able to know, by some means, which thing you are checking the cycle against by the count of years. The common year [carries the residue] six [בששה], the intercalated [year] three [בשלושה], and the month four [בארבעה] — if you are operating by the signs [simanim] of the cycle, and [of] the common and intercalated year and the month, according to the practice you have followed in the molad. Likewise, if you are operating by the foundation of the moladot, which is according to the practice of BaHaRa"D [Monday, 5 hours, 204 parts] — that practice will become clear to you, [namely] why the [residue] is always two against the residue of the years.

For this reason I have not expanded on their explanation, since it is a self-evident matter — all the more so since it does not hold so good [a guarantee]. And so said R. Isaac [bar Baruch], may his soul rest in Eden [נב"ע], at the end of this verification: "I do not say that there will be no error in the molad after this verification; but I admit that it is possible for there to be an error in it. And even if you check it by these two verifications, this error does not come about at the hands of those skilled in computation unless their intent is to err. And you must, at that time, return to the computation and reckon it from its foundation by the methods explained to you, until you know the truth in your computation."

The Seventh Gate [השער השביעי]

On the correction of the new-moon-day and the molad zaken [המולד הזקן]: what it is, and why it is called "old" [zaken] from midday and onward [מחצי יום ולמעלה]

Know that the moment which is, by the foundational principle, the beginning of the [new] month is the time of the molad. For when the moon, at the instant of its conjunction with the sun within a single [degree-]part, completes its course on its path and the past month has ended, it immediately separates from the sun and begins to renew the second month. It would have been fitting for the beginning of the [new] month to be reckoned from its own moment [of molad]. But people are not able to count the day in fractional [hourly] divisions, such that they would count one fraction from it for the old [month] and another fraction for the new month. Rather, we always count the months in whole days.

And Chazal [ורז"ל] were stringent in this matter: they counted the beginning of the month from the day of the molad, even if there remained of the day, at the time of the molad, only six hours and one chelek [part]. This is because [in that interval] the month could be renewed and the moon could appear somewhere in the [inhabited] world, in another place in the settled world [הישוב]. In honor of this matter they sanctified the entire day from its beginning, so that the [new] month would be counted from its start.

But if the molad falls from six hours and below [מישש שיעות ולמטה] — they used to count [the new-moon-day]—

—and they called it "intercalated" [or: "they deferred it"; the degraded word reads [העגליעו] [?]]. On the day [the molad falls], they fix the [month] and defer [the new-moon-day], if it is not fitting [for that day to be Rosh Chodesh]. And if it is not [so], it is the new moon [Rosh Chodesh]; for those who speak [the rule] concerning the molad [say]: a molad that is from eighteen hours [מי"ח שעות] and onward is a molad zaken [an "old" molad].

And this is [an "old" molad] because the light of the moon does not have the strength to appear by day, in a place in the world where the eyes [of an observer] can see it. Furthermore, [it is called "old"] because, since the day is verging toward evening, it is regarded like a man who is old [zaken], who is verging to depart from this world. But if the molad is before eighteen hours [קודם י"ח שעות], it is not called a molad zaken, because the moon can appear over another place of

the settled world while the day is verging toward evening. As they said: "When [a witness says] it was born before midday [נולד קודם חצות], it is known that it will be seen close to sunset; [when it was] not born before midday, it is known that it will not be seen close to sunset."

And the elder, the dayan [judge] R. Hasan ben Mar Hasan [ר' חסאן בן מרחסאן], of blessed memory, said: "From this halacha you see that our Rabbis, of blessed memory, used to reckon the moladot according to the perspective of those who dwell at the eastern edge of the earth [בקצה מזרח של הארץ]. For if you go round all the inhabited cities of the settled world to find a place where the sun and the moon are conjoined within a single [degree-]part at midday, and the moon would be seen close to sunset in the second place where the sun is — you do not find this situation [holding for any] place in the world, except between the eastern edge and the western edge [קצה המזרח וקצה המערב]: such that the molad is at the eastern edge and the visibility [of the moon] is at the western edge. From this it appears to you that the whole computation of intercalation is fixed according to the perspective of those who dwell at the eastern edge. And a proof for you of the truth of this matter — that he does not say 'it appeared to us' [but rather] 'it appeared to them' — is that he does not say 'it appeared close to sunset' [meaning to us], but rather says 'it appeared close to sunset' [meaning] it was seen in whatever place it could be seen."

The Rav [master], R. Isaac bar Baruch [ר' יצחק בר' ברוך], of blessed memory, said: "This is a position [taken up] from the elder, the dayan, my master R. Hasan ben Mar Hasan, of blessed memory; and his opinion in the interpretation of this halacha is a position that proceeds by the way of reasoning [סברה], and it has a fine appearance from the outside, but on the inside it is corrupt and deficient. For the moon that is seen at the western edge is of no use to the people of the east. [It would help] only if, upon every high mountain of the world's mountains, there stood men holding long poles of land-spanning length [כלונסות של ארץ ארוכים] [?] and oil-wood and flax-tow [ונעורת של פשתן]; and when they saw the moon at the western edge, they would kindle their torches toward the [next] mountain nearest to them, until the people of those mountains before them would see [it]; and they would do as they [the first] had done, until they reached the mountains of the east — as they did with the mountains of Israel, as is explained in the chapter [perek] 'If they do not know it' [אם אינן מכירין] — or [it would help] if one were able to send out emissaries from the western edge to all the lands as far as the eastern edge, to inform them of the sighting of the moon so that they might rely on it. But all this cannot be. And [even] if it could be, it would be of no use at all; for the moment of sunset at the western edge on the first day is the moment

of its rising at the eastern edge on the second day. So the people of the east would be sanctifying the [new] month on the first day, on the basis of a moon which appeared in the west at the beginning of the second day — and this departs from the way of reasoning.

"And had the reasoning that holds him [to this view] been correct, the Torah would be broken and contradictory for him; for the people of the west cannot sanctify the [new] month — nor [can] the people of any other place in the world — but only the people of the Land of Israel alone. As we say [in the Talmud]: R. Yehoshua, son of R. Yehoshua ben Pozi, said: 'What is the meaning of "you shall inquire of His dwelling-place [לשכנו] and come there" [Devarim 12:5]? When you inquire [of it], inquire only in the dwelling-place of the Omnipresent.' [Devarim 12:5] Moreover, the very point on which they grounded the reason of the halacha breaks that reasoning, as we say: 'What [practical] difference does it make? — Rav Ashi said: To contradict the witnesses [לאכחשי סהדי].' And if this testimony [of the moon] is not in Jerusalem, what use are Rav Ashi's words 'to contradict the witnesses'? But the matter that R. Hasan stated — that the moladot are transmitted according to the perspective of one place [the east], and the [moon's] visibility is stated for a second place [the west] — is a true and correct thing. Yet the place of the moladot is not [necessarily] the eastern edge, and the place of visibility [not necessarily] the western edge — but two different places. I am not able here, according to my opinion, [to settle this]; and if the place lengthens my days [ימותי], [שר נגיד ארוניני] [?] and may the Heavens aid me [ויסייעוני מן השמים] to explain —"

[The closing lines of p. 70 are degraded; the mid-clause flourish שר נגיד ארוניני is corrupt/obscure and flagged [?]. The surrounding clause "...if the place lengthens my days... and may the Heavens aid me to explain..." is recovered as text.]

—in the tractate Rosh Hashanah, where all these halachos are cited [מסכת ראש השנה], there I will come to explain my opinion, God willing, [on] all these matters. This is the end of the words of the Rav, R. Isaac bar Baruch, may his soul rest in Eden [נבֿֿע].

Now I, in the poverty of my opinion, find the words of R. Hasan, of blessed memory, correct. He informed us of his reasoning [as one] drawn out [in study] [פעמו ממושכה], and showed us his opinion concerning the [moon's] visibility, which arose in his mind. But this R. Isaac, of blessed memory, surprised us with a [too-]drawn-out expectation and did not give us a long [enough explanation] of his dispute, because the matter was, in his eyes, wondrous and strong [מופלאה] — and who knows whether it is so or not? When you examine all the

arguments by which he thought to refute R. Hasan's words, you see that they do not refute them. For long land-spanning poles of cedar [כלונסות של ארז ארוכות] and oil-wood and flax-tow do not enter into this [at all]: R. Hasan does not say that the people of the east rely on the people of the west for the sighting of the moon, nor that the people of the west sanctify the [new] month for the people of the east. Rather he says: any place where the molad is eighteen hours before [קודם י"ח שעות] the [end of the] day [?] — the people of that place are fit to set that day as Rosh Chodesh, because the molad is at the very beginning of the month. And it is known that if the molad is eighteen hours before [the day's end] at the eastern edge, all the places of the settled world will have it [the molad] before this. So you find that all the places of the world are fit to reckon the [new] month from that day, until [the day's end] reaches the people of the west; and that day will be fit for them by reason of two matters arising from the molad which had been [reckoned] — [first] from the moon that appears to them close to sunset, [and second from the molad itself]. And for this reason the Rabbis who were in the Temple [בבית המקדש] used to fix Rosh Chodesh for the whole diaspora when the molad was before midday at the eastern edge — not because they were waiting for emissaries from the western edge, nor for cedar poles, nor because they granted the people of the west authority to sanctify the month on the basis of [its] visibility. Rather, the dwellers of Jerusalem used to sanctify the month because the day was fit for that [purpose] by reason of the molad, and because they knew that the moon could appear on that day in some place in the world. And one cannot bring against us [a proof] from "you shall inquire of His dwelling-place and come there" [Devarim 12:5]. So too the proof that he brought against us from the words of Rav Ashi, "[to contradict the witnesses,]" — this is in fact a proof to confirm our words: for our Rabbis, of blessed memory, used to recognize the false witnesses, or [recognize] trustworthy witnesses, in the matter of the molad of the month. If [the witnesses] testified about a molad from which the moon could [actually] appear, [the Rabbis] knew that they were [either trustworthy, or, if it could not appear] that they were false witnesses. And this is the meaning of "to contradict the witnesses."

For example: if the molad were in 5 hours of the day [בה' שעות] at the eastern edge — over which the computation runs — and it is known that the moon cannot appear except in a place that is one hour to the west [שיעה אחת] [of there], so as to be eleven hours [י"א שעות] distant from the east; and witnesses came and testified about the moon, that it was seen close to sunset in Damascus [בדמשק] — which is four hours to the west [ד' שעות] and five hours to the east [ה' שעות] — they would not accept them, because the moon cannot appear in this place [Damascus at that molad].

But if the molad were two hours before [the end] of the day [שתי שעות], and the molad were in the first hour of the day [בשעה ראשונה], and two witnesses came and testified about the moon that it was seen close to sunset in Damascus — they would believe them and accept them, because the moon can appear in Damascus when the molad is in the second hour of the day, all the more so in the first hour. And it appears to you from the words of Rav Ashi "to contradict the witnesses" that [the witnesses] are aids to us and explain the matter [more] from its [own] substance.

So too is the [statement] we cite: R. Zeira said in the name of [R. Nachman]: "The moon is covered, for us, twenty-four [hours]" [סיהרא מכסי עשרין וארבע שעי] [Aramaic]; "for us, twenty-four [hours]; and for them, six [hours] of the old [moon] and eighteen [hours] of the new [שית מעתיקא ותמני סרי מחדתא]; and for them, six of the new and eighteen of the old [שית מחדתא ותמני סרי מעתיקא]." This helps to diminish [the difficulty] and testifies that the intercalation is reckoned according to the perspective of the eastern edge. For the one who examines this halacha could ask: by the words of R. Nachman, the moon is covered twenty-four hours [מתכסי כ"ד שעה]; according to the practice of the moon's course it would have been fitting that there be twelve [hours] of the old [moon] [תרי עשרה]. But [the Sage] counted—

—the sixth-portions [or sixths] of the moon, those which are hidden in front of the sun [השישית ... מוין]; for they are hidden behind the sun because of their course, which is always uniform in their firmaments [ברקיעיהן]. And why did this matter change here, that the moon was hidden of the [new] month more than what was [otherwise]? It [reads]: "she is hidden of the old [Hidden one] more than of the old, or of the old more than of the new."

And again, if this matter changed — why is it "for us, six of the old; and for them, six of the new" [לדידן שית מעתיקא ולדירהו שית מחדתא]? Now the covering of the moon is not a thing found on earth, such that it would differ among the places of the settled world; rather it is a thing found in the body of the moon — for its light turns away from the [surface of the] earth [שאורה פונה מנכח הארץ] — and there is no thing that changes its form in one place from [its form in] another place. And we cannot say that the halacha spoke contrary to what is found in the world, on a matter on which the world does not run. It is fitting for us to correct this halacha according to the form of the moon's course and according to what is seen in the world.

We find that all the sages who reckon the moon's course say that the moon cannot become covered beneath the light of the sun for less than eighteen equal

hours [פחות מי"ח שעות שוות], when it is at the end of its [swiftest] running and the sun at the end of its slowness [in motion]; and it cannot appear for less than this measure in any place in the world, whether before the sun or after the sun. And it is found from their words that the moon is covered by the light of the sun [for] thirty-six hours [ל"ו שעה]: eighteen [י"ח] of them after the sun and before the molad, and eighteen [י"ח] of them before the sun and after the molad. And because we have seen that the halacha sometimes assigns eighteen [hours] to the new [moon] [י"ח להחדתא] and sometimes eighteen to the old [י"ח לעתיקא], we know that the covering of the moon, in every place in the world, is thirty-six hours according to the opinion of the halacha.

And this is what R. Zeira said in the name of R. Nachman: "twenty-four hours the moon is covered" [עשרים וארבע שעי מכסי סיהרא] — these are the hours in which the moon is covered in all the places of the settled world and does not appear in any place in the world. And the remainder of the thirty-six hours [ושאר ל"ו שעות]: if it is covered in one place it appears in another place. And those twenty-four hours, [for] the first [portion] of them the moon is at the eastern edge [when it] comes to be hidden beneath the light of the sun and is hidden from the eyes of the world's inhabitants; and the end [last portion] of them [is] at the western edge, when the moon emerges from beneath the light of the sun and appears in the world. And this is what they said: "for them" [לדידהו] — and they are the people of the western edge, who dwell in the Land of Israel — they are reckoned from them, because of the breaking [of the line] at the Temple [שבירת המקדש] [?], which turns westward from the midpoint of the earth by one hour [מחצי הארץ], as we mentioned in the First Treatise [במאמר הראשון].

You will find that the moon is hidden from them [for] eighteen [hours] of the old and six of the new [תמני סרי מעתיקא ושית מחדתא]; and for us, who dwell at the eastern edge — from whom the computation begins — it is covered eighteen [hours] of the new and six of the old [תמני סרי מחדתא ושית מעתיקא], as though the molad were at the eastern edge at midday of the first day [בחצי יום ראשון]. And it is known that the moon is covered beneath the light of the sun eighteen hours before the molad [י"ח שעות קודם המולד]; and [it is known] whether it is in the east at the beginning of the first night [בתחלת ליל ראשון] [it is covered], and [it is known that] if it is [covered] in the east it is covered in all the world. From this we say that it is covered, in the east, [for] eighteen hours of the molad's time [?].

It is known [that] the molad's moment, if it is in the east at midday of the first day [בחצי יום ראשון], the molad will be in the west at midnight of the first night [ליל ראשון], and the moon is hidden beneath the light of the sun in the west, and

appears over them at the beginning of the second night [בתחלת ליל שני]. So it is found hidden from all the settled world [for] twenty-four hours — which are the whole of the first day [כִּד שעות שהם יום ראשון כליו]. And as for the people of the east, it is hidden from the beginning of the first night [מתחלת ליל ראשון]; and between it and the molad are eighteen hours [י"ח שעות], and there remains for the moment of visibility in the west only six hours [שש שעות] — as they said: "for them, six of the new and eighteen of the old" [לדידהו שית מחדתא ותמני סרי מעתיקא]. And for the people of the west it is covered six of the old [שית מעתיקא], because the molad was in the west at midnight of the first night and the moon began to be hidden from the beginning of the night; and likewise it is covered in the west eighteen hours of the new [י"ח שעות מחדתא] from the midpoint of the first night — in which the molad was, in the west — until the beginning of the second night, when the moon appears over them. And this is what they said: "for us, six of the new and eighteen of the old" [לדידן שית מחדתא ותמני סרי מעתיקא].

From these two halachos it appears that our Rabbis, of blessed memory, reckoned the moladot according to the perspective of the eastern edge, and reckoned the visibility according to the perspective of the western edge. The reason we stated has become clear to you, and it has been confirmed for you by example: that there remains in it no doubt at all [לא נשאר בו שום ספיקא] for one who acknowledges the truth, may He be blessed [למי שהוא מודה על האמת].

The Eighth Gate [השער השמיני]

On the full [שלמות] and deficient [חסרות] years and those that follow the standard order, and the doubled days [הימים הכפולים], with an explanation of their matters and their reasons:

The method customarily followed throughout the world by all who reckon the moon, and upon which they rely in their calculation, is one that is not exact: namely, that one month is full [מלא] — thirty days — and one month is deficient [חסר] — twenty-nine days. The reason they reckon by this approximation is that the true measure of the month is twenty-nine days, twelve hours, and 793 chalakim [תשצ"ג; chalakim, 1/1080 of an hour]. So if two months are 59 days plus one hour and 516 chalakim [תק"ו]: take from these the thirty days of the first month, and there remain for the second month twenty-nine days. And if you reckon twelve such months, their days will be 354 [שנ"ד] days; this is the measure of a year according to the standard order. Everyone who proceeds by this order makes one month full and one month deficient, as they said: "in a place where they do not know" the day on which the new moon's head [ראש החדש] was fixed

in its time — our Rabbis always made one full and one deficient, alternating, until the day on which the new moon's head was fixed became known. This usage continues forever without variation, because there remains beyond the 354 days that they reckoned — for the twelve full and deficient months, 8 hours and 876 chalakim [תתע"ו] over and above — so that over three years there remains one day plus two hours and 468 chalakim [תס"ח]. This day is added to the days of the year, and for the reckoning of that particular year it is deficient, and its measure will be 355 [שנ"ה] days, and it is called a "complete" [שלמה] year.

So the years, according to the order, are reckoned as full years and as deficient years, proceeding by the mean motion [המהלך השווה]. Now you should know that the sun and the moon — their motions sometimes change slowly and sometimes change moderately, and all these matters proceeding from their motion do not change the measure of the mean lunar month [מדת חדש הלבנה השווה]; for whether this one's motion is swift or that one's is moderate, they are found, as it were, proceeding in equal motion [במהלך השווה], and the year is found proceeding by them in equal motion. The deficient month is found, in the year in which it occurs, to be twenty-nine days, twelve hours, and 793 chalakim [תשצ"ג], proceeding moderately; and the sun proceeds moderately, and the moon does not adhere [אינו מדבק]. Sometimes the moon adheres to the sun at a measure of less than that, and that year is found to be seven full months and five deficient months — 353 [שנ"ג] days — and it is called a "deficient" [חסרה] year. And sometimes the moon will [?] [the line continues] —

[The following passage develops the three classes of the year — deficient (353), regular/in-order (354), and complete (355) — by month-counts:]

— that year will have seven deficient months and five full months; its days will be 353 [שנ"ג] days, proceeding moderately, while the moon does not adhere to the sun until it links up [?]. The measure of the month, and that year will be found to be seven months [ז' חדשים], such that that year requires completing in its order. That year will have eight full months and four deficient months [ח' חדשים מלאים], in which are found eight full months — and this is what is said: "more than seven" [יתר על ז']; that is to say, they did not find the order of the months' motion settling upon eight months. And if you find this matter to fall before or after [the point] where the year is complete, this deficiency or this excess does not occur by another path — and you find two years in which the deficiency is found by no other path than the path of the moon's motion. And because our Rabbis, of blessed memory, saw the forms of the motion of the luminaries —

This excess and the years that follow the order, they fixed for us; the years sometimes being complete and sometimes deficient, and sometimes the festivals [המועדות] falling on days proper for them — and this was not so that they would rely [merely on calculation]. And the year is found, according to the view of our Rabbis of blessed memory, to be divided as follows: if it is in its order, its measure is 354 [שנ"ד] days; if it is deficient, its measure is 353 [שנ"ג] days; and likewise in leap years [מעוברות], by three classes — if it is in its order, its measure is 384 [שפ"ד] days; if it is deficient, its measure is 383 [שפ"ג] days; and if it is complete, its measure is 385 [שפ"ה] days. And they [the Rabbis] complete the year if it requires completing and reduce it if it requires reducing, in order to set the months and the festivals aright — lest it lead to a profaning of the honor of Shabbos, or of another commandment, when the festivals fall upon a day [unsuitable]. For the festivals depend on their view, as it is written, "and on your appointed seasons" [Bamidbar 10:10], as was explained in the First Gate [השער הראשון].

The deficiency of the months and their excess between Tishrei and Nisan come from the renewal of the intercalation [מחדש העבור] and the filling-out of the months. It will be, on account of the intercalation, that sometimes the long way and sometimes the short way of the two sides [proceed], the difference between them in the full years being 176 [קע"ו] days. And the deficiency of the months and their excess between Tishrei and Nisan [exists] because we are not commanded to keep any one of the festivals until Tishrei — since all the festivals called "holy convocations" [מקראי קדש] proceed [from this]. And were the measure that lies between a festival and the festival standing opposite it [fixed], it would not change. And if you should say: But surely it is a commandment, by His word, that the measure stand upon one fixed quantity forever! — why is it not so?

[Here the author cites Scripture to ground the fixed counts:]

We say to you: because the Holy One, blessed be He — in Nisan, in which is the festival of Matzot, the first of the commandments concerning months [the new moons] — appointed that in Tishrei the measure should be kept that lies between the head of the months [ראש החדשים], all the festivals proceeding from their beginning to their end and the measure being found to be settled forever, neither adding nor subtracting; and it [the count] is deficient. And between the head of the month of Nisan and the head of the month [of Tishrei] there is no adding, and the measure that remains between Tishrei [and Nisan] —

— sometimes between them six months, and sometimes seven; and these six months, or the seven, will be one full according to the order and one deficient;

and sometimes they add a day to the order, when the year is complete; and sometimes they subtract a day from the order, when the year is deficient. That which lies between the head of the month of Tishrei and the head of the month of Nisan does not stand upon one fixed number; if the year is simple and complete, between them are two days; and if it is simple and deficient, by its order there will be between them three days. And if it is intercalated [מעוברת], by its order there will be between them four days; and if it is intercalated and complete, between them five days. The sign [סימן] for you, between Tishrei and Nisan, is ["1-2-3"] אב"ג for the simple year, and [for the intercalated] ["3-4-5"] גד"ה. From this you can know the distance between Tishrei and Nisan, or between Nisan and Tishrei — for any one of these signs is the fixed distance which you add or complete in full [בשלמה], and which you reduce in full or diminish from the deficiency.

[The author now turns to the months of Marcheshvan and Kislev as the variable months:]

You add to it [the count] always upon Marcheshvan, or you diminish: Marcheshvan being twenty-nine [deficient] and Kislev thirty [full]; and if the year [is such that] both of them are full — thirty [days each] — they fixed the deficiency and the excess. They could not fix it in Tishrei nor in Nisan, on account of the festivals; between Nisan and Tishrei, on account of the measure of the days that lie between them — one [year] adding and twenty-nine [?] deficient. As we said: "fifty days" [חמשים יום]; upon it there is no adding, and from it there is no subtracting, "and you shall bring a new meal-offering" [the text cites " ויקרא פג טז" / Vayikra 83:16 — recte Vayikra 23:16]. Fifty days from the giving of the Torah until the Tablets were broken; until the iniquity was atoned, forty days, as it is written, "and I fell down" [Devarim 9:18], "and I ate no bread nor drank water forty days" [Devarim 9:18]; and to them, the forty days during which Moshe stood there — namely the four [periods of] forty days and forty nights during which he ate no bread [Shemos 34:28]. So you have 121 [קכ"א] days [the line continues] —

[The author counts out the 121 days of Moshe's ascents:]

If the year is in order, then [the count proceeds] thus; and if the year is deficient, you now subtract from Kislev, and it will be [as follows]. This excess and deficiency in these two months is because the festivals do not [fall otherwise]; and likewise they could not fix the months whose measure between the festivals would not exceed [the proper count], as we said above. And forever, between Pesach and Atzeret [Shavuot], from it [the count] there is no subtracting, as it is written: "you shall count fifty days" [Vayikra 23:16]; and between Atzeret and the

Day of Atonement [Yom HaKippurim] there are 121 [א"כ] days. From when the Tablets were broken — 41 [א"ח] days; and from when the Tablets were broken, "and I fell down before [the Lord], the first forty days [as before], 'I ate no bread and drank no water on account of all your sin which you sinned'" [Devarim 9:18, paraphrased] — when he stood at the mountain [for] the last Tablets, as it is written, "and I [ate] no bread and drank no water" [Shemos 34:28]; and it is written: 121 [א"כ] days. And he came down from the mountain on the Day of Atonement — and we cannot add to this reckoning, that the excess and deficiency of the months and the count [be fixed] —

— and the excess and the deficiency in these two months, because [they do not fall] on account of the festivals; and likewise they could not fix the months, because [the measure must stand]. He came down from the mountain on the Day of Atonement, on which we are commanded [to fast and atone] — until the festival [comes] on a day proper for it; one adding, the other deficient. As we said above: "and one deficient and one full" [forever in the order of the variable months]. And forever, between Pesach and Atzeret you may not subtract, "for you shall count fifty days" [Vayikra 23:16]; and from it there is no subtracting, on account of the order — therefore, on a day proper for it [a festival falls]. And one is full and one is deficient: Marcheshvan twenty-nine [deficient] and Kislev thirty [full]; and if the year is such that both of them are full — thirty [days each] — they fixed the excess and the deficiency. They could not fix it in Tishrei nor in Nisan, on account of the festivals, between Nisan and Tishrei [?] —

[Here begins a passage on the two variable months and why only Marcheshvan and Kislev may be altered:]

The measure that lies between Tishrei and Nisan is in order [forever], and you are unable to alter it. There remain the months that are deficient or full between Tishrei and Nisan — sometimes between them six months and sometimes seven [as above]. The seven sometimes [proceed] by the order — one full and one deficient; and sometimes upon the order one day is full when the year is complete, and sometimes [a day deficient] when the year is deficient. Because of this the distance changes, and the head of the month of Nisan will not stand upon one number; if the year is simple and complete, between them are two days; and if it is intercalated and deficient, between them are three days [?]; and if it is intercalated and complete, between them are four days. And the sign for Nisan and Tishrei is ["1-2-3"] אב"ג for a simple year, and ["3-4-5"] גד"ה for an intercalated year. And you, if you add to it or subtract from it always upon Marcheshvan or Kislev — whether the year is in its order, you add to it upon

Kislev; and if the year is deficient, you subtract from it upon Kislev — there remain in your hand only three months, namely Marcheshvan, Kislev, and Teves, and these three serve in this matter —

[The author distinguishes which months are "known" full or deficient versus the two variable ones:]

— and our deficiency appears only at the head of the month that comes after it. The deficient month, whose past was full — and if the head of the month is one day [a single Rosh Chodesh] —. And now, if Marcheshvan is full, or deficient — it is not [yet] known; if Kislev is deficient, or full — it is not known but only made known by [the head of the next month]. These three months, namely Marcheshvan, Kislev, and Teves, are [the months] made known [נודעין; restored by the editor] from the heads of the months [מראשי החדשים]. This reason was given by the physician, **R. Yehuda ben Rakufel** [רקופל; identification uncertain [?]], may his soul rest, in the work he composed for it [the intercalation]. And there is for you to say [a further point]: from the month of Teves until Nisan, on account of the intercalation of the year [עבור השנה], so that [the leap-month] not be lacking; in Nisan the [extra] year is intercalated for that [year], lest it [the season] not come [too early]. These [matters], whether by [astronomical] cause [גורם] — perhaps the tekufah [תקופה] was drawn out [מושכת] when it did not draw out, or it did not draw out and we reckon it [as drawn] —

[A discussion of the tekufah-drift and the rule about intercalating Adar:]

— a new month, from Teves until Nisan, on account of the intercalation of the year, until [the season] would be lacking in Nisan; the year passes for that [reason] and the tekufah is not [yet drawn]. These [matters], whether by cause: perhaps the tekufah was drawn out when it did not draw out, or it did not draw out and we reckon it — and it does not require intercalation; or it requires intercalation. And in your hand are two months in which there is no intercalation as to this matter, [those that] our Rabbis of blessed memory fixed for them. Our intention in all these deeds was that the festivals occur on days proper to fix them; and a festival shall not come [on a wrong day]. Pesach does not come on the second day [Monday], nor on the fourth day [Wednesday], nor on the sixth day [Friday]; nor [does] Atzeret [come on] גה"ו ["3-5-6," Tuesday-Thursday-Friday]; and likewise Rosh Hashanah [shall] not [fall on] אד"ו ["1-4-6," Sunday-Wednesday-Friday]; the signs [סימנים] handed down to us from our fathers, so that the days [of the festivals] not fall [on days] unfit for them:

And the Gaon, R. Saadia bar [R.] Yosef, head of the academy [ראש הישיבה], said: The fixing [of the calendar] was [given] from Mount Sinai [?], so that there shall not be a Passover-day [or rather: so that] the Day of Atonement not be on Friday [ערב שבת] — for if it were [the eve of Shabbos, two days of preparation would conflict]; and if it were —

— on the eve of Yom Kippur, when the sin-offering [קרבן חטאת] which the priests are obligated to eat is offered, they could not eat it by day on account of the fast, nor at night on account of Shabbos — and they would be unable to leave any of it over; and likewise if Pesach were to be on the fourth day [Wednesday], such that Yom HaKippurim and the Sabbath-day [be back to back]. And so we say of Pesach that it does not [fall on a day] so that the *omer* [העומר] not be reaped on Shabbos; and furthermore, that complete burnt-offerings [שלמים] are not offered on Shabbos. The Holy One, blessed be He, obligated [their offering] at Atzeret: "yearling lambs as a peace-offering of well-being [שלמים]" [Vayikra 23:19]. And [Atzeret] does not come on the days בד"ו ["2-4-6," Monday-Wednesday-Friday], and Yom HaKippurim [does] not [come] on אג"ו ["1-3-6," Sunday-Tuesday-Friday]. For all these signs are [grounded in this]: that the ancients used to make Pesach on בד"ו and each [festival] —

[A counter-tradition is reported and refuted, citing the dispute over reaping the omer and offering the shelamim:]

— for they [the ancients] said the [scriptural] bones, and they [the elders] told that they burned [the leftover offering] on the [following] day; and the *omer* [העומר], which comes on the day after Shabbos, comes [duly]. And were [Atzeret] to fall on Shabbos, the seventh day, [which is] the eve [of Pesach], that fell on Shabbos — uncertainty [ספק] alone would arise. For all these halachos were stated [only as warnings, lest doubt arise], and not as fixed law — for you cannot find any one of them [the festivals] occurring [problematically] except [in rare conjunctions], such that one [year Atzeret] fell on Shabbos, or such that one [year] Atzeret fell on Shabbos, [requiring] explanation of what their [reasoning] was. And it will be clear and evident to you [that] the proof [ראיה] was [from] those who reckoned for the intercalation, relying upon it, as one relies on the fifty-day [count]. As is said in tractate Menachot [מסכת מנחות], R. Eliezer [ben Hyrcanus] [said]: the Torah said "count days and sanctify the new moon," "count days and sanctify Atzeret."

And R. Gamliel [רבן גמליאל] [said]: thus I have received from the house of my father's father, that the renewal of the moon is no less than twenty-nine days and a half, plus two-thirds of an hour [720 = שתי ידות שעה] and 73 chalakim

[וע"ג חלקים] — that is, 29 days, 12 hours, and 793 chalakim [720 + 73] in all. And in the Tosefta it is said: the renewing of the month makes one full and one deficient. And the moon, to show you that the sight [of the new moon] is not the essence of the [reckoning of the] new month; rather [the calculation is]. And the year is full and deficient from them at the time of constraint [בעת הדחק], and for the matter of necessity [הצורך], as when [there was] a deed that R. [Yehoshua?] did, [making] the year deficient — and in all this —

[The chain of reports closes with R. Saadia Gaon and a back-and-forth on the proofs:]

— the festivals [falling] on a day unsuitable for them; on this matter, and the like of it, R. Saadia of blessed memory [spoke] in the fixing of the festivals. And after he brought these proofs, and the like of them, from the words of R. Saadia of blessed memory in this work [בחיבורו] [namely, his *Sefer HaHakhara*], [he said]: "Let no man set me [as one who could ask] 'How can you [contradict] him?' — I say to you: surely he is a man greater than I in all wisdom, a [great] Gaon, the greatest in all Israel. And despite all this, [I do] not abandon — [as] Elazar the priest did not abandon completing the matter — [the priest] who did not [leave the matter] to the men of the army who came to war." On this point [there are] one or two [things], and how many [more]! For R. Saadia did not say [it]; as our Rabbis of blessed memory [held], they used to make Pesach and all [the festivals on the day proper for them] — a day proper to fix [it]; and one that is unfit is not proper. But [the matter] —

[The closing argument: the proofs from R. Saadia are not exact, and R. Isaac bar Baruch is invoked:]

— it is deficient, and they did not say [that] there is a place where they do not see the [new] moon; and they used to add to the full months out of necessity, when they were able to do so, as we said. And in all this they were careful that there should not be [a wrong day]; and the like of it issued from the words of the Gaon, our Master [namely R. Saadia]. After R. Isaac bar Baruch [ר' יצחק בר' ברוך] of blessed memory brought all [these], R. Saadia in this work [בחיבורו] said: "The words of the Gaon do not seem [correct] to me. How can you reply to a sage so great and wondrous —"; he was learned in all wisdom, and so too was our Master Moshe [Rabbenu] a servant [of God]. Elazar the priest did not abandon completing a matter that was not [left undone] — the priest [who attended] to the men of the army coming to war. On one [point] and how many, and how [much more]! R. Saadia did not say [it]; as our Rabbis of blessed memory [held], they used to make Pesach and all [the festivals] on a day proper to fix [it]; but one that

is unfit is not proper — and what the Gaon said: these are not exact proofs [אינן ראיות מדויקות].

*

For when Scripture says of the sin-offering of the Day of Atonement that it is no proof — since we do not find it written in the Torah how many days the eating of the sin-offering lasts — this is rather something explicitly stated in the Oral Torah. And our Rabbis, from whom we learned this measure, are the ones who said: "The goat brought on the eve of Shabbos of the Day of Atonement is eaten at night, and the Babylonians would eat it [raw]." Their reason is sound. So too the proof that one may add from the profane to the sacred [time], both on Shabbos and on the Day of Atonement, is no proof — for we do not add anything on Shabbos other than refraining from acts of labor; the keeping of this is mere abstention. And the proof that on Shabbos and on the Day of Atonement labor is forbidden — that, too, is not bound up with this matter; it is no proof.

For we do not add anything on Shabbos other than guarding against doing labor, and every act of forethought or of labor is forbidden on the Day of Atonement just as on Shabbos, and were it not [forbidden], one would have no occasion to attach a festival to it. According to his words, then, we were not establishing a festival; rather, only the labor of the [Temple] service was forbidden, and it was fitting [?]. So too the proof he brings — that the bringing-near of peace-offerings is not done on Shabbos — is no proof, for the peace-offerings [shelamim] that are forbidden on Shabbos are only freewill peace-offerings; but the first-fruits [bikkurim] are an obligation of the day, and they are offered on it, and on every day [of the festival] they are offered. There is no other burnt-offering or sin-offering of the additional [musaf] offerings that is offered on Shabbos. And likewise the omer, which is not reaped on Shabbos — about this, our forefathers taught us that it was reaped on Shabbos, as they said: "When they reaped the omer, it was reaped on Shabbos, by an individual, with one sickle, and in a single basket [b'goren echad u-v'kufah achat]."

Concerning these laws, which are stated about all these matters — if it were so, then they have no power to acknowledge to him on this point; for you do not find in any one of them an act that fell out [to be done] on Shabbos, and so forth. And I will show him an act, explicitly [stated], and it is this: about the willow-branch of the festival [aravah], when it fell out to be on Shabbos, they brought the willow of the eve of Shabbos — they recognized it among the willows [?] — and immersed it, and pressed it down beneath stones, and stopped it up under the stones [to keep it moist], and brought it and stood it upright at the sides of the altar. Yet

according to those who hold the view that the willow [rite] overrides Shabbos, there is no act here, and you have no clear act of which one might know, were one to search, whether [other] acts may be found like this one — as in this matter, whether it was so or not — that "it was" can be said of the condition, and there is no later [tradition] stated about the condition; and it seems to us that we have nothing to rely upon among the proofs he brings. But —

To acknowledge and to know that the whole time the Temple stood, they would reckon [the calendar] by sight [ra'iyah], and that astronomers reckoned and counted it [the calendar] by sight, and the Sanhedrin and the priests and the Levites would know how to give warning about it [the calendar], and about the guarding of the willow that was to come on Shabbos, on the day [that fell] —

And the holy spirit, with its aid and its power, stood by them, and they would set the words of the sages [?] — between [a month] that was seen clearly and one that was not seen — and the witnesses [edim] would see it, and the court [Beit Din] would investigate the witnesses. And likewise every man, you will see that they would count, by the words of their teachers, for the fixing of the calendar of the whole diaspora. They sanctified [the month], so that there should not be witnesses, by the calculation — and at times they relied on the sight, and at times by the appearance [as it appeared] to them, and according to the need of the hour. And so they did, until there were [years] in which they would make two and three years intercalated, and others not — neither Pesach was deferred... nor was the rest of the signs [siman]; the calculation was customary for them, established. And see that the festivals require a fixed, proper time, set for them, conducted according to the calculation; for the tradition was handed down to them, and they enacted for us all these enactments which we are obligated to keep, and to rely upon them, neither turning aside from them to right or to left.

For all of this was within their power to enact [?]; *HaKadosh Baruch Hu* [יהקב"ה] gave them authority over this, as it is written, "When they are sought out [k'asher dorshu], behold, He says: 'You [are the authorities]'..."

"three times — even if [you fix the months] unwittingly, even if deliberately, even if you err." And further they said: R. Akiva entered and found him [R. Gamliel] distressed; he said to him: "I have grounds to say that everything R. Gamliel has done is done [validly], as it is said, 'These are the appointed times of the LORD' (Vayikra 23:7 [recte 23:4]) — whether in their proper time, whether not in their proper time, I have no appointed times other than these." And He set up for us this calculation by wisdom and tradition that was in their hands, so that all the exiles of Israel might keep their festivals on one day in every place and locale —

when they made [the calculation] by wisdom, the boundaries they set, and we have no [power] to transgress them — as they said at first: at the willow of the eve of Shabbos the sages began to warm [the water], and they permitted them. They were yet washing in warm water [on the Day of Atonement], and they would say: "we sweat" [as a permission-formula]. They forbade them the sweating but permitted them the warm water; they forbade them the sweat but permitted them washing in the warm springs of Tiberias; and they would say "the hot springs of Tiberias" — they would still be washing in the warmth of the daylight and the warmth of the springs of Tiberias. And see from here that they made fence after fence; and so too they did concerning the testimony of the new month [edut ha-chodesh]: the trumpeters [?] when they would weigh the watch-fires [?] — the Kuthim [Samaritans] [?] when they began [false signals], so that they would [no longer] accept testimony of the new month all day; once, the witnesses were delayed in coming, and the Levites were thrown into confusion [?] in the song; and they enacted that the witnesses should not be received [save until the afternoon-offering], and so forth.

And in place [of this], after the Temple was destroyed, R. Yochanan ben Zakkai enacted that they should receive testimony of the new month all day; and behold, here is one enactment after another, fence after fence. And just as they perform their festivals every week [in their proper order], [the calendar would be] thrown into disorder; the pious ones enacted that the fast of the Day of Atonement should not fall adjacent to Shabbos — and not the willow-day on Shabbos — and from there they enacted the rest of the signs for all the festivals.

All the meal-offerings were kneaded one by one and offered up [?] one by one, and they said about the dough of Pesach [matzah], lest it become leavened, and they said: what is different about a meal-offering — and they answered and said: if [?]... You have said about this matter, if their teachers [?] enacted... and to warn about the precept of the willow on Shabbos, it was not stated, for the whole of this calculation which we reckon today [?]. For our Rabbis, when it appeared right to them, made for them a fence — were it not [for that] it would have been said "from Mount Sinai," for so we say of the precepts given on Mount Sinai. And on this matter these were the words of the master Rav R. Isaac bar Baruch, of blessed memory [711], and these words and those agree, and the science of the calculation that is in our hands — we have nothing to decide between them, and to weigh the words of the two of them; and on whichever of them one relies he does not depart from the path of faith, and on this all of them say: clear to the discerning, and upright to those who attain knowledge [Mishlei 8:9].

השער התשיעי — The Ninth Gate

[Subtitle:] On the exposition of the four "gates" [arba'ah she'arim] upon which is based the fixing of the first-days of the months and the festivals in all the years — the intercalated [me'uberot] and the common [peshutot].

that you may arrange and fix [the calendar] forever, in every year, and that year is [reckoned] from the molad of Tishrei [מולד תשרי], and from the gathering [the accumulation, mikbutz] of [the chalakim of] Tishrei [?]; you arrange the order of the new-months [roshei chodshei] of the year, and its festivals, and its deficiency [chisronah], and its excess [yitronah], and its progression [halichatah] upon Tishrei [?]; and the path of the fixing [tikkun] is upon this matter — if the molad falls on a day that is not fit to fix it upon —

[Facing column / Page 79 begins]

to the day fit for it [the molad]. And if the molad will fall on a day fit [to fix it], and the deferments [dechiyot] of the day do not require us to fix it on that day, then [we fix it on its day]; but if [?]. . . we fix [the New Year] by [carrying it forward to] the molad of the coming year, [reckoned] from the molad of the present year. And if the molad will be [18 hours = מ"ח, mem-yod-chet] or more [past midnight] [?]. . . or it should chance that there be something deferring it on another matter, [we defer it] one day.

And if the molad will be on a day fit [to fix it], but it [the molad] has not reached the [hour of] 18 [hours], we fix it on its day — but if [the molad] reached 18 hours [מ"ח] or more from the day fit [for it], we defer it to the day after it [the third day]; this is the path of fixing and its rationale. And see that the molad is deferred [from] 18 hours [מ"ח] and above from the day [that is] fit [for it], because they said: a molad born before midday [kodem chatzot] is known not to appear adjacent to sunset, as was clarified for you in the Seventh Gate of this Treatise [Ma'amar].

And the days that are fit to fix Tishrei upon are: the second day [Monday], the third day [Tuesday], the fifth day [Thursday], and the seventh day [Shabbos]; their signs are בגהזז [Beit-Gimel-Hei-Zayin = days 2,3,5,7], and they are called the four "gates" [arba'ah she'arim]. The first day [Sunday], the fourth day [Wednesday], and the sixth day [Friday], and the rest of the days of the week are not reckoned among them, because the fixing within them does not [follow] from [their being] unfit; and every one of these four "gates" may be either deficient [chaserah] in order, or full [shelemah], or in order [k'seder], in a common year,

or in an intercalated year. When you double these four "gates" into the three [variants] by the differences of the years, the total comes to בִּיךְ [reckoning] י"ב [12; the common years can amount to 12] י"ב signs [simanim], and so too the signs of the intercalated years. When one comes to examine this matter, you will find in them [signs] that can be found [in practice] and come to actual occurrence; and signs that can be found but do not come to actual occurrence; and signs that cannot be found and do not come to actual occurrence. And we examine these signs by the four "gates."

השער הראשון — The First Gate. Rosh HaShanah on the second day [Monday]: if the year will be deficient and common, Pesach will be on the third day [Tuesday], because there are no [?] between Tishrei and Nisan in a common deficient year [save 3 days]; and the year's sign will be בח"ג [Beit-Chet-Gimel = Rosh HaShanah day 2, year-type, Pesach day 3]. If it [the year] is intercalated, Pesach will be on the fifth day [Thursday], according to the fact that there are between Tishrei and Nisan in a deficient intercalated year ג' days, and the sign of the year will be בח"ה [Beit-Chet-Hei]. To complete [the count], the sign of [a deficient] year is ה' [day 5] to Nisan, and so too ג' to Nisan in a common year — I need not specify every sign one by one. By this path you understand the rest of the signs, and I need not specify each sign; if the year will be full and common, Pesach will be on the fifth day [Thursday] and its sign is בש"ה [Beit-Shin-Hei]; and the year [marked] בש"ה will not be deficient. If it is intercalated, Pesach will be on the seventh day [Shabbos] ז' [יום ז'] and its sign is בש"ו [Beit-Shin-Vav]; and this year will not be in order [k'seder]. If a year [marked] בכ"ד [Beit-Kaf-Dalet], Pesach is on the fourth day [Wednesday], and if intercalated, Pesach will be on the sixth day [Friday] from these days [?]. You will find in this gate that two of its signs can be found — בח"ג and בש"ה in a common [year], and בח"ה and בש"ו in an intercalated [year] — and one sign cannot be found: בכ"ד in a common [year] and בכ"ו in an intercalated [year].

השער השני — The Second Gate. Rosh HaShanah on the third day [Tuesday]: if the year is in order [k'seder] and common, Pesach is on the fifth day [Thursday] and its sign is גכ"ה [Gimel-Kaf-Hei]; and if it is intercalated, Pesach is on the third day [Tuesday] and its sign is גכ"ז [Gimel-Kaf-Zayin]. And if it is full it is intercalated, [and] Pesach can be on the first day [Sunday] and its sign is גש"א [Gimel-Shin-Aleph]; but Pesach cannot be on the first day in a common year, [since] there is no [such] Pesach that can fall on the first day. And so too the deficiency of the year cannot be found, [for] there is no [such] Pesach that can fall on the fourth day [Wednesday] nor on the sixth day [Friday], and you will find in the Second Gate two signs cannot be found — גכ"ה in a common [year] and the

two signs גכ"ז, גש"א in an intercalated [year] — and you will find within it one sign that cannot be found in an intercalated [year] but [can be found] in a common one.

[Note by the editor (Filipowski):] אמר המגיה — Said the editor:] The fixed dates [keviut] גש"א in an intercalated [year], even though it can be found [in theory], does not come to actual occurrence — not because of the Pesach in it, but only because Rosh HaShanah of the coming year, which would have necessarily to fall on the second day [Monday], would [then] lie between the two [boundary] intercalations of six days as a measure [?], as in order [k'seder]. See in the words of the master [Rav] further on, in the Fourth Gate of the "Gates of the Intercalated [Years]" [she'arei ha-me'uberot]. [Footnote ref:] 65.

השער השלישי — The Third Gate. Rosh HaShanah on the fifth day [Thursday]: if that year is in order and common, Pesach will be on the seventh day [Shabbos] and its sign is הכ"ז [Hei-Kaf-Zayin]; and if it was intercalated it will not be in order, because there is no [such] Pesach that can fall on the second day [Monday]. And if it is deficient and intercalated, Pesach will be on the first day [Sunday] and its sign is הח"א [Hei-Chet-Aleph]; and if it is common it will not be deficient, because there is no [such] Pesach that can come on the first day [?], and its sign is הח"א [Hei-Chet-Aleph]; and if it is full, [whether] common, Pesach will be on the first day [Sunday] and its sign is הש"א [Hei-Shin-Aleph]; and if it is intercalated it will be Pesach on the third day [Tuesday] and its sign is הש"ג [Hei-Shin-Gimel]. You will find in the Third Gate two signs marked: הכ"ז, הש"א in a common [year], and two years הח"א, הש"ג in an intercalated [year]; and one sign cannot be found — הה"ו — in a common one, and one sign — הכ"ב — in an intercalated one.

השער הרביעי — The Fourth Gate. Rosh HaShanah on the seventh day [Shabbos]: if [the year] is deficient and common, Pesach will be on the first day [Sunday] and its sign is זח"א [Zayin-Chet-Aleph]; and if it is full and common, Pesach will be on the third day [Tuesday] and its sign is זש"ג [Zayin-Shin-Gimel]; and if it is intercalated and deficient, the deficiency will make Pesach be on the third day [Tuesday] and its sign is זח"ג [Zayin-Chet-Gimel]; and if it is intercalated and full, Pesach will be on the fifth day [Thursday] and its sign is זש"ה [Zayin-Shin-Hei]; and it cannot be in order, because there is no [such] Pesach that can come on the second day [Monday] nor on the fourth day [Wednesday]. You will find in the Fourth Gate two signs marked: זש"ג, זח"א in a common [year], and two years זח"ג, זש"ה in an intercalated [year]; and one sign cannot be found, neither in a common nor in an intercalated year, and it is in order [k'seder].

And behold, here are for you all the signs of the common and the intercalated [years]. And there are among them [9] ט' signs (according to the warning [given] above [?], there ought to be [10] י' signs that cannot be found — [5] ה' in the common [years] and [6] ו' in the intercalated [years]) (צ"ל ה', ה' — "should read 5, 5") [?]. And you understand the rationale of the deferment [ikkuv] that prevents them — because Pesach is not to come on a day not fit for it; and there remain in the common [years] seven signs that can be found, and [those that] can come to actual occurrence in the intercalated [years] are eight signs (it should read [7] ז' signs) (צ"ל ז' סימנים) [?]. We must investigate them, [to determine] whether all of them come to actual occurrence or not, and [carry out] this investigation, whether [it] is the exposition of the "gates of the intercalated [years]." And we begin to expound the "gates of the intercalated years," and [examine] whether they all come to actual occurrence.

because the order of the signs [is such] that they can be found in it [practice]; and because the standing-place [ma'amad] of the intercalated [years] does not begin in every cycle [machzor], but rather it falls always between two common [years], one before and one after it; and so the common years — sometimes there are before [a common] year a common and an intercalated, and sometimes a common before and an intercalated after, and sometimes it falls between two intercalated [years] — the fixing-position varies because of this, and there is no [single fixed pattern] in the fixing of the intercalated [years], a variation. And because of this we begin with them.

שערי המעוברות — The Gates of the Intercalated [Years]

שער ראשון — First Gate. Every molad of Tishrei that falls [at] 18 hours [מ"ח, mi"ch] or more, from the [start of the] day

[Reading order note: the next portion is on the facing left column, which continues the sentence:] from the seventh [day] and onward, until 18 hours less one chelek before [?]; 18 hours from the second day [?], Rosh HaShanah is fixed on the second day, because you cannot let [it stand], for the molad's reaching 18 [hours] of the second day [means] the molad is "old" [molad zaken], and it has not [yet] come to the fixing — nor is it fit to fix the Rosh HaShanah upon it; and the need [arises] to defer it to the second day [Monday], and to fix it on the second day, all the time the molad has not reached 18 hours [ל"ח] from the day on which it is "old" [zaken] — this is the fixing of Rosh HaShanah. But the fixing [is such that] one cannot stand upon a single custom [as the limit of] the whole boundary of this gate. But all the time the molad's progression in the hours that remain [is] from the seventh day [Shabbos] until the twentieth [hour] (— עד כ')

20 hours and 490 chalakim [ות"צ] from the first day... [the molad] for the coming year will be later [acharah], on the sixth day [Friday] (according to [the reckoning] from the boundary of the sixth day, [namely] ט"ו תקפ"ט [15 hours, 589 chalakim] until ז' [day 7], י"ז [17 hours] [979] תתרע"ט — and it is deferred to the seventh day [Shabbos], and is fixed on it; and the [molad] of Rosh HaShanah of the coming year will be [5] ה' days — which is the measure [hashi'ur] — that remains between an intercalated year [and ...continues into next page].

[continued from the preceding page]... is deficient [the year between it and the year after it], and on account of this the year was deficient, and its sign is ב"ה [RH-day 2 (Monday), year-type *chaser* (deficient), Pesach-day 5 (Thursday)].

from day 1 [Sunday] until the end of the gate the year was complete [*shelemah*], because... and reaches **18 hours [י"ח שעות]** from day 7 [Saturday], and it is deferred to day 2 [Monday]; and the remainder of the year will be complete and intercalated [*me'uberet shelemah*], and Pesach will fall on the day...

Second Gate. Every molad of Tishrei that falls one chelek before **18 hours [י"ח]**, that is, from **3 hours [ג' שעות]** of day 7 [Saturday]... and its sign for the year is ג"ה [RH-day 3 (Tuesday), year-type *kesidran* (regular), Pesach-day 5 (Thursday)]. And from the position of the molad zaken [מולד זקן], which I have explained to you in [the preceding] gate, you will understand the reasoning for what was established in this gate. Rosh HaShanah of this gate is fixed on day 3 [Tuesday], and the year is regular [*kesidran*], and Pesach... [is fixed]. All of this follows the order, because there is no fixing of Rosh HaShanah... and between this year there are six days, the measure of a year...

Third Gate. Every molad of Tishrei that falls one chelek before **18 hours [י"ח]**, from **5 hours [ה' שעות]** of day 5 [Thursday], will be [fixed on day 5]... cannot be fixed at the beginning of the gate on day 3 [Tuesday], on account of [the rule] that it is not fitting [for Rosh HaShanah to fall there], and it is deferred to day 5 [Thursday]; and at the end of the gate... they are fixed on this day — this is the fixing of Tishrei. And in the fixing... it proceeds along the remaining hours from day 3 [Tuesday] up to **11 hours [יא' שעות]**... the year is deficient [*chaserah*] and Pesach is on day 1 [Sunday], because the year... on day 3 [Tuesday] by way of the molad. And [the measure] between the two years will be... and the sign for the year is א"ה [RH-day 5 (Thursday), year-type *chaser* (deficient), Pesach-day 1 (Sunday)]. And from **11 hours [יא' שעות]**... [up to the end of] the gate the year was complete [*shelemah*] and Pesach falls on it on day 3 [Tuesday], [Rosh HaShanah] being fixed on day 5 [Thursday]; and between them there are seven days, the

measure... the year is **הש"ג** [RH-day 5 (Thursday), year-type *shelemah* (complete), Pesach-day 3 (Tuesday)].

Fourth Gate. Every molad of Tishrei that falls... up to one chelek before **18 hours [ח"י]** from day 7 [Saturday], will be [fixed]... as I explained to you in the Third Gate, and the year was deficient [*chaserah*]... the molad reaches **20 hours and 491 chalakim [כ' ת"צ חלקים]** of day 6 [Friday] and... [Rosh HaShanah] is fixed on day 1 [Sunday]; and from **20 hours and 491 chalakim [כ' ת"צ]**... up to the end of the gate the year was complete [*shelemah*], and its sign is **זש"ה** [RH-day 7 (Saturday), year-type *shelemah* (complete), Pesach-day 5 (Thursday)], because the year that comes after it... and the measure remaining..., and the year is **זש"ז** [RH-day 7 (Saturday), year-type *shelemah* (complete), Pesach-day 7 (Saturday)].

These are the Gates of the Intercalated Years [שערי המעוברות], and the seven signs found in them. [Their order:] the signs which actually occur — seven in the intercalated [*me'uberet*] and seven in the common [*peshutah*] [year]. And when... one will find among the intercalated years one sign in order, and...

the matter that we need in order to complete the year, just as it was established... for we do not make the year deficient nor complete... the year which is intercalated [*ibrah*] or the molad of the year that follows... in order:

שערי הפשוטות — The Gates of the Common Years

First Gate. Every molad of Tishrei in a common year [*shanah peshutah*]... from day 7 [Saturday], Rosh HaShanah will be fixed on day 2 [Monday]. And if... Rosh HaShanah... on day 2 [Monday], up to **one chelek before 18 hours [חלק אחד]** [לפני י"ח] [?].... that is, the molad that falls **18 hours [ח"י]** or more from day 2 [Monday] up until [the point]... [so that] Rosh HaShanah would [otherwise] be fixed on day 3 [Tuesday]; and if the common year [*peshutah*] that was before it... was such that whatever came before it kept the order on day 5 [Thursday], and it [Rosh HaShanah of the common year] is not deferred — and the common year [*peshutah* of the following] stands on day 2 [Monday] and is not interchanged. But if it [the molad] would be... Rosh HaShanah was kept on day 2 [Monday], up until the molad reaches **16 hours and 589 chalakim [ט"ז שעות תקפ"ט חלקים]** of day 6 [Friday] **[so that then Rosh HaShanah of the year would be fixed on day 3 (Tuesday)]** — on account that the molad of the year that is before it... its fixing was on day 5 [Thursday]. And had we fixed this year... and there is no intercalated year [*me'uberet*] [following] a year, that after it... **[days]** — and on account of this one needs to defer the year... this is the boundary of the First Gate in the fixing of the common year [*peshutah*] on one extreme. But for as long as

the molad proceeds at **18 hours [מִי"ח שעות]**, that **204 chalakim [ר"ד חלקים]** from day 1 [Sunday] [or more], the year is deficient [*chaserah*], and its sign is **בּח"ג** [RH-day 2 (Monday), year-type *chaser* (deficient), Pesach-day 3 (Tuesday)], because the molad that comes after it does not reach **18 hours [מִי"ח]** complete from day 5 [Thursday]...

[is not interchanged], and this year [is one] which before it was intercalated [*me'uberet*], and after it the molad reaches **16 hours and 589 chalakim [ט"ז שעות תקפ"ט חלקים]** of day 6 [Friday] **[so that then Rosh HaShanah of the year would be fixed on day 3 (Tuesday)]**, because the molad of the year that is before it... was deferred to day 5 [Thursday], and had we fixed this year... and there is no intercalated year [*me'uberet*] [following] a year that after it... [there would not be enough days], and on account of this it is necessary to defer the year of this year from day 2 [Monday] to the day after it; and the molad that comes after it reaches **18 hours [מִי"ח]** complete from day 5 [Thursday]... between it and this year was the measure of a deficient [*chaserah*] year, and from **9 hours [ט' שעות]**... up until the end of the gate the year was complete [*shelemah*], and its sign is **בש"ה** [RH-day 2 (Monday), year-type *shelemah* (complete), Pesach-day 5 (Thursday)], because [the molad] falls **18 hours [מִי"ח]** or more from day 5 [Thursday], and it is deferred to day [7]... this [is the measure of] a complete year [*shanah shelemah*].

Second Gate. Every molad of Tishrei in a common year [*shanah peshutah*] that comes [after]... molad **49 hours [מ"ט שעות]** [?], **589 chalakim [תקפ"ט חלקים]** [?] from day 2 [Monday] — or a common year [*peshutah*] that comes after... **[a common year]** which would have its molad fall **18 hours [מִי"ח]** or more from day [2]... from day 3 [Tuesday], Rosh HaShanah is fixed on day 3 [Tuesday] and the year is regular [*kesidran*], and its sign is **גכ"ה** [RH-day 3 (Tuesday), year-type *kesidran* (regular), Pesach-day 5 (Thursday)]; the year that comes after it reaches **18 hours [מִי"ח]** from day 7 [Saturday]... this is the measure of a regular year [*shanah kesidran*].

Third Gate. Every molad of Tishrei that falls from... up until one chelek before **18 hours [מִי"ח]** from day 5 [Thursday]... of this gate, until the molad reaches **80 [?]**, **204 chalakim [כ"ד חלקים]** [?],... in order, and its sign is **הכ"ז** [RH-day 5 (Thursday), year-type *kesidran* (regular), Pesach-day 7 (Saturday)], because the molad of the year that comes after it [falls]... on day 2 [Monday], and it is fixed on day 2 [Monday], and between it and this year there are... **204 chalakim [כ"ד חלקים]** from day 5 [Thursday], up until the end of the gate the year was [complete]... the molad of the year that comes after it falls **18 hours [מִי"ח]** or

more... and it [Rosh HaShanah] will be between it and the year... this is the measure of a complete year [*shanah shelemah*].

Fourth Gate. Every molad of Tishrei that falls **18 hours [ח"י]**... one chelek before **18 hours [ח"י]** from day 7 [Saturday], Rosh HaShanah of the year... after it was intercalated [*me'uberet*], the year was deficient [*chaserah*] up until... **[its sign is] א"ז** [RH-day 7 (Saturday), year-type *chaser* (deficient), Pesach-day 1 (Sunday)], because the molad of the year that comes after it, which is intercalated [*me'uberet*], does not reach **18 hours [ח"י]** from day 3 [Tuesday]... and it is not deferred from day 3 [Tuesday]; and between them there are 3 days, the measure of... the year that comes after it [is] a common year [*peshutah*], the year was deficient [*chaserah*] up until... of day 6 [Friday], because there is no molad of the year that comes [next which is] common [*peshutah*]... that pushes it from day 3 [Tuesday]; and on account of this, if the molad... [is] first on day 6 [Friday]; and after it, [whether] a common year [*peshutah*] or from **9 hours, 204 chalakim [ט"ד]**... up until the end of the gate the year was complete [*shelemah*] and its sign is **זש"ג** [RH-day 7 (Saturday), year-type *shelemah* (complete), Pesach-day 3 (Tuesday)].

These are the Gates of the Common Years [שערי הפשוטות], and the signs that are marked in them; and there are explained **14 [י"ד]**... [signs]. And when you look into these signs, [you will find]... [together with the deficient ones], one regular sign and three deficient signs and three full signs [סימן אחד כסדר ושלושה סימנים חסרים ושלושה מלאים].

[Editor's / continuing discussion of the count and verification of the signs:]

the full [years], the product of the complete ones together with the deficient ones, one finds all... the order, and they are fitting for this, on account of the measure of the year [being] **589 chalakim [תקפ"ט חלקים]**, and they are close to **384 [משפ"ד]** days, which... And if you look into the signs of the common years [*peshutot*] you will find among them... two regular signs, two deficient signs, and three complete signs [שני סימנים כסדר ושני סימנים חסרים ושלושה סימנים שלמים]. The product taken from the complete ones [together with the deficient]... there remains in your hand one further sign in [the count of] the complete ones, and you need... the surplus chalakim [*chalakim ha-odfot*] in every common year [*peshutah*] over **354 [שנ"ד]** [days]... the complete years over the deficient years in every... the cycles to come, by way of the creation of the world...

this, [by way] of the rough reckoning, which is not exact, and if... every month of the cycle, which is **235 [רל"ה]** [months], a month by the measure of **29 days, 12**

hours, 793 chalakim [כ"ט יום י"ב ... תשצ"ג חלקים]... one finds all the intercalated years [*ha-shanim ha-me'uberot*] as if they were equal to... the measure of the intercalated year [*shanah me'uberet*] is **383 days, 21 hours, 589 chalakim [שפ"ד ... תשפ"ג יום כ"א שעות תקפ"ט]**... close to **384 days [שפ"ד]**, which is the number of the intercalated year [*shanah me'uberet*] in order, and you find in them two signs as deficient [*kesder*] and two signs... the product taken from the complete ones, [namely those] years that are deficient years... complete, and you need them on account of the **8 hours, 876 chalakim [ח' שעות תתע"ו]**... upon **354 [שנ"ד]** days, and they are fitting; and from here we [proceed] to give precedence to... the deficient ones in every cycle, as you will find in every...

[the matter of] the creation of the world up until now, and so until the end of the world. ...[and this is] exact, and if you would be precise about the matter, [its] essence comes out and is reckoned: the month, by the measure of one month, which is **29 days, 12 hours [ב' יום י"ב], 793 chalakim [תשצ"ג חלקים]**, and there will come into your hand the sum of six thousand days, **939 [תתקל"ט]**, day **16 [י"ו]**, hours... [days], when the seven full months are taken from the months of the cycle... one full and one deficient, take from them first **210 days [ר"י יום]** as seven full months, and a further **225 months [רכ"ה חדש]**, the deficiency [being] six thousand days, **726 [תשכ"ו]**... hours, **595 chalakim [תקצ"ה חלקים]**, that you now need to give precedence in every... the doubling of this surplus by the number of the days of the week, which... [will be] day **25 [כ"ה], 19 hours [י"ט], 925 chalakim [תתקכ"ה]**, which you now... investigating the surplus that is between the completing and the deficiency in the two... in your hand by a count of this — neither less nor more — on account of... intercalation, if you conduct yourself by the days of the week which will be... **2 hours [ב' שעות], 966 chalakim [תתקס"ו]**, and there will be in the seven [years]... one finds among the common years [*peshutot*] five years which... is a common year [*peshutah*], and there will be in each one of the complete ones...

241 chalakim [רמ"א חלקים], and there will be in the five years these... and one finds in them five other years before them... and each one of them is surplus in this matter — this day, **20 [כ']**... these years **9 days, 4 hours, 309 chalakim [ט' ימים ד' שעות ש"ט חלקים]** [?], and the two... after them an intercalated year [*me'uberet*] [whose] surplus is **3 days [ג' ימים]** between them... you now take the total surplus that is in the intercalated [*me'uberot*] and the common [*peshutot*]... **235 chalakim [רל"ה]** [?], like the number of the surplus of the cycle. * And you can... the signs which I explained to you, and the reckoning will become clear to you, and... the moladot, and [Rosh HaShanah] is fixed by it for the years; and [it concerns] the surplus and the deficiency [*ha-yitaron ve-ha-chisaron*]... [which]

takes you out from the established order, and not from the [proper] measure... of blessed memory, in [the matter of] the renewal of the moon [*chiddush ha-levanah*]. And do not let it be difficult in your eyes if...

[Editor's note — אמר המגיה, set below the rule; this footnote opens here and continues below the rules on the following page:]

*(* Inasmuch as the words of the master [Rabbi Avraham bar Hiyya] in this matter are difficult to understand, I [the editor] have said I would explain them according to my ability. If we look at the three boundaries of the complete years [*shanim ha-shelemot*]... the master's intention is this: those held between **day 1, 20 hours, 491 chalakim** [א' כ' תצ"א] and **18 hours** [י"ח], and between **day 4, 11 hours, 695 chalakim** [ד' י"א תרצ"ה] and **18 hours** [י"ח], and between **day 6, 20 hours, 491 chalakim** [ו' כ' תצ"א] and **18 hours** [י"ח], as is found in the table of the signs of the intercalated years [*simanei ha-me'uberot*]; they amount to **21 hours, 589 chalakim** [תקפ"ט חלקים], **day 1, 6 hours, 385 chalakim** [א' ו' שעות], and a further **21 hours, 582 chalakim** [תקפ"ב]; and their conjunction [*kibbutz*] all together will be **3 days, 1 hour, 483 chalakim** [ג' ימים א' שעה]... concerning this matter — the three boundaries in the years... תפ"ג

[Footnote continuation, set below the rule — editor's note continuing:]

the complete-year boundary **day 4, 11 hours, 695 chalakim** [ד' י"א תרצ"ה] (the boundary held between **18 hours** [י"ח] and **6 hours** [ו'], **20 hours, 491 chalakim** [כ' תצ"א]...), and the conjunction [*kibbutz*] of **2 days, 22 hours, 597 chalakim** [ב' ימים כ"ב שעות תקצ"ז]...)*

[Main-text resumption, p. 84 top — worked Adar/Shevat molad example:]

You see [now that] one head-of-month [*rosh chodesh*] of the [new] months falls [after the molad], and one head-of-month falls before the molad — as if you were looking into a common year [*shannah peshutah*]... **408 chalakim** [ת"ח חלקים] [?], from the first month, from day 6 [Friday], which is the year... [siman א"ב] [?], and its molad **6** [ו'], [י"ו ג"ו] **56** [?] before the [new] month, and you mark in the year... **20** [כ' א'], [ת"ץ] **490** [?], and Rosh Chodesh Adar is found [to be] [siman א"ב] [?], and its molad... And you will wonder and say: why was it that the beginning of day 30 [שלשים] for [the month of] Shevat... by the measure of **32 hours** [ל"ב שעות] [?], and in another year, another one is before the molad... as if we were holding day 29 [כ"ט] or day **25** [כ"ה] in the presumption [*chezkat*] of day... day **31** [ל"א] or **32** [ל"ב] in the presumption [*chezkat*] of day 30 [ל'], and these would [either] be deficient... complete, or we would be counting in order the deficient [days] [so that they would] not be fixed... one would say that he is

one who understands by way of the intercalation [*derech ha-ibbur*] and the secret of [its] reckoning... we are not making the year deficient or completing it... for the fixing of Tishrei and Nisan alone, [so] that they not be fixed on an invalid day [*yom pasul*]... we are concerned for the molad zaken [מולד זקן], that it is "old," only for [the purpose of] fixing Tishrei... we wait until [the moon] grows old [*she-yizkan*]. And if we were concerned for the molad in each... of the [new] month, on account that all the heads-of-months [*roshei chodashim*] of the year, their moladot would sometimes be... and they would not stand upon one [single] measure; and we would be making Pesach... and we would appear as if we were sanctifying the [new] month by [astronomical] computation [*ba-hotza'ah*]... the [new] month by [astronomical] computation outside the Land [*ba-hotza'ah la-arets*], transgressing the words [of Chazal].

[Footnote, set below the rule — continuation of the editor's note; deficient-year boundaries and summation:]

(...**day 4, 11 hours, 695 chalakim** [ד' י"א תרצ"ה], and the two boundaries (the boundary held between **18 hours** [הי"ח] and **6 hours** [ו'], **20 hours, 491 chalakim** [כ' תצ"א], the conjunction [kibbutz] of 2 days, **22 hours, 597 chalakim** [ב' ימים כ"ב שעות תקצ"ז]; and the surplus of the first conjunction over the second conjunction here is **966 chalakim** [תתקס"ו]... and so too, if three conjunctions are taken [nikbatz]... before them an intercalated year [me'uberet] and after them a common year [peshutah], which are **day 1, 6 hours** [א' ו']... **204 [ר"ד]** and the boundary at **15 hours** [בט"ו], **589 [תקפ"ט]** in the table of the signs of the common years [simanei ha-peshutot]... and **18 hours** [הי"ח], and **day 1, 17 hours, 672 chalakim** [א' י"ז תרע"ב] (the boundary between... **7 days, 8 hours, 853 chalakim** [ז' ימים ח' שעות תתנ"ג]. And if [taken] from the conjunction... **612 chalakim** [תר"ב], which is the conjunction that rises [from] the two boundaries of the deficient ones between **18 hours** [הי"ח] and **408 chalakim** [ת"ח]...); in the five last years which are before them common [peshutah]... the surplus is **2 days, 11 hours, 241 chalakim** [ב' ימים י"א שעה ורמ"א], which is **3 days, 2 hours, 468 chalakim** [ג' ימים ב' שעות תס"ח], less **1 day, 6 hours, 408 chalakim** [א' יום ו' שעות ת"ח], so that the surplus is found to be **1 day, 20 hours, 60 chalakim** [יום אחד כ' שעות ס'] over the conjunction of the deficient boundaries, in them **day 1, 17 hours, 649 chalakim** [א' יום י"ז שעות תרמ"ט], by the measure of **2 days, 23 hours, 1057 chalakim** [ב' ימים כ"ג שעות תתרנ"ז]; and their doubling will be, per the master's words, **3 days, 11 hours, 218 chalakim** [ג' ימים י"א שעות רי"ח] — and the equalization of these surpluses, one to another, I will explain at the end of the book [abaer be-sof ha-sefer — אבאר בסוף הספר].)

[End of the Ninth Gate.]

our masters, of blessed memory. But now, when we rely on the fixed and established reckoning — for the new moon is sanctified in the Land of Israel, since the beginning of the month is the head of all the months, as it is written, "This month shall be for you the head of months" (Shemos 12:2) — its sanctification will be by itself the sanctification of all the months. And we find in the received tradition that every molad [מולד] of Nisan that falls before [the threshold], and it is known that the moon can [first] be visible — that is, less than 43 hours [מ"ג שעות] and 686 chalakim [תרמ"ו חלקים], and above that it withdraws... that it is visible on Eretz Yisrael, less than 43 hours and 682 chalakim [מ"ג שעות תרמ"ב] and above that it withdraws.

The moon is fit to be seen on Eretz Yisrael [only when the molad falls] a certain number of chalakim [?] before sunset, if [the molad falls] at a point distant from the western horizons of Eretz Yisrael, by the measure of the distance of one [place] from the earth at the eastern edge [of the inhabited world] — and it will be verified for us regarding every new month, that we do not fix [the calendar] by the [observed] new moon as seen on that day for the people of Eretz Yisrael; rather we come and reckon [מנה] every... by the corrected reckoning that is [established] for Eretz Yisrael, since the head of the month is what is fixed by this computation.

For thus it is written, "This month shall be for you the head of months" (Shemos 12:2). And it is fitting that the sanctification be by itself the sanctification of all the months. And we do not find in the received tradition that is in our hands [a basis] to defer [the molad of] Nisan to a [later] day except [for the cases] in which the molad of Tishrei is deferred for that year, whether it is a common year [שנה פשוטה] or an intercalated year [שנה מעוברת]. And the gate at which you find [it]... whether it falls short of the gate or exceeds it, and they do not reach it — that is, if the molad does not attain its boundary [גבול], take the second of the two signs of the gate, if there are within it two signs; and if it exceeds it, take the second sign. And you will thereby know the fixing [תיקון] of all the months of the year and the rest of the festivals.

And so that I might know which day each new month falls on, I sketched out for you two tables [לוחות]: I wrote in one the fixing of all the months and the festivals according to the signs of the year, in the common and the intercalated [years]; and from this table you will find [the answer]. And the second table I wrote for the fixing of the new months and festivals, [arranged] by each sign and the signs of [the year]; and when you come, you will know the sign of the year. And do not

investigate [further] regarding the moladot of the rest of the months, and do not be anxious about them — rather, rely on the fixing of the second table [from] which you find the sign of the year.

For one who reckons this from the first table will know the fixing... that which is beneath the sign [is] in your hand:

THE TENTH GATE

On the fixing of the heads of the months and the rest of the festivals in the common years and the intercalated years, and the forms of the tables made for their computation.

The one who wishes to know the heads of the months from the [molad]... of Tishrei for that year, whether it is a common year or [intercalated], and the gate in which you will find [it]... the head of the gate, or [whether] they exceed it and do not reach... in that gate, if the molad does not attain the boundary of the second sign, which is in the gate... [take] the second of the two signs of the gate, if there are within it two signs; and if there will not be [a molad] equal to the boundary of the sign... it is possible to know from the sign... And because I saw [the need] to shorten the way in this matter, [I made] one [table] from which [you find] the boundary of the four gates and their signs... in it you will find the sign of the year. And in the [second] table... for every sign and the signs of [the gates]... the year, from the first table you will know the fixing... that which is beneath the sign — take it in your hand:

[Gate 10, opening section — the four special Shabbosos.]

And if you wish to know the order of the four parshiyot [the four special Torah readings of the season]: the first is Parshat Shekalim, read at [or before] the head of the month of Adar [adjacent to Nisan, in a leap year], if it [Rosh Chodesh] falls before [Shabbos] — if it falls on Shabbos itself; and the second is Parshat Zachor, which they read... it is read on Shabbos on which Purim falls within it. The third is Parshat Parah Adumah, and the fourth is Parshat HaChodesh.

[For Shekalim:] know that there is no Rosh Chodesh of Adar adjacent [to Nisan] — that is, whether [Rosh Chodesh] falls on one of the days of the [rest of the] week, or whether Purim falls within it... they read Shekalim on a Shabbos that coincides [with Rosh Chodesh or precedes it], and break off [i.e., omit a special reading] on the following Shabbos; and its sign is ו"בד [the days 2, 6, 4, 6]. And if it is a day of Shabbos, they read [Shekalim], and its sign is ו"פ [?]. And if the next [Rosh

Chodesh] day will be the second [day]... on the following Shabbos, and its sign is ב"ו. And if it will be the fourth day... on the following Shabbos, and its sign is ד"ד.

[They] break off on the following Shabbos, and on the third [Shabbos]... I sketched out for you one table, and I wrote in it the order of these parshiyot... they are read on every Shabbos, and they are the 52 [נ"ב] sedarim... from Asru Chag of the festival of Sukkot until [the next]... and it stands upon four chapters [pirkei]:

Chapter One

On the eve of Pesach [ערב הפסח] they read [the seder beginning] גו [?], in the common years... and its sign is פקיד ופסחי [pakid u-fischi]. At times... and in this year we are not righteous [enough] to combine... and the sedarim will exceed the [number]... and the practice in these two sedarim is that they shall be [the seder of] Vayakhel... and its sign is ויקח קרח [vayikach Korach].

[The reckoning:] they read 28 [כ"ח] sedarim from Bereishis until the [giving of] the Torah... between them there are 28 Shabbosos, like the number of the sedarim. And in this year they are divided, seder by seder, and these are the readings... seder by seder, Vayera until... [from] Atzeret [Shavuot], and the sedarim that are between them... [from] Sinai until [the wilderness], and its sign is מנו ו[עצרו] [manu v-atzaru]. You must, in this chapter, [arrange] for every common year... [the seder] "When a woman conceives" [Tazria] together with the Torah of the Metzora, after [it]... if they walk in My statutes [Bechukotai]. And in the intercalated years...

Chapter Two

From [Shabbos after] Pesach until Atzeret [Shavuot] there are 9 [ט] sedarim, and the Shabbosos between which fall... need... to read six sedarim... [the portion] with Kedoshim... they read in them six [sedarim]...

Chapter Three

From [Shabbos] Nassoh until these journeys [Masei], and at times... it exceeds by [one]... according to the Shabbosos... Shelach Lecha together with Vayakhel... and at times there are between them 9 [ט] sedarim, and one must... [its] sign is ויקח קרח / [the parshah] ויקח קרח [vayikach Korach].

Chapter Four

From [Shabbos] after the Ninth of Av [Tisha B'Av] until the eve... Va'etchanan until Ha'azinu... and at times there will be between them eight... Shabbosos, and one must... the sedarim, and they are divided in every sign... the common and the intercalated [years].

[The summary of the four chapters:] These are sedarim, set in order... 9 [ט'] Shabbosos... [and these] with these others, and they are... they need to be read in two... [combining] by way of joining. From the eve of the Sukkot festival, in which there are eight sedarim... in which there is no [exceeding]; it exceeds by eight Shabbosos... they need to divide seder by seder, and you are standing to read... I sketched out for you one table and I wrote in it [the matter] by way of... every sign and a sign of the years... [the years] the intercalated, by כעז"ה [?].

[The lookup tables for Gate 10 begin here. Pages 87–88 of the source.]

Table A — Signs of the years of the cycle, intercalated [לוח סימני שנות]
[המחזור ... סימני השנים המעוברות]

The intercalated-year (מעוברות) boundary table. Four columns: Gate (שער) · Sign + year-mnemonic (סימן + סיגלה) · boundary "from" (מן) · boundary "to" (עד). Each boundary cell is an index letter (א–ז) followed by a two-letter limit, and the "to" limits additionally carry a chalakim value; the word תצא ("[it] goes out") appears on two "from" cells. Reads right-to-left in the source.

Gate (שער)	Sign + mnemonic (סימן)	From (מן)	To (עד)
First (ראשון)	א — בחה	ז · יח	א · כ · הצ
First (ראשון)	ב — בשז	א · כ · תצא	ב · יז · תתרעט
Second (שני)	ג — גכז	ב · יח	ג · יז · תתרעט
Third (שלישי)	ד — ההא	ג · יח	ד · יא · תרצד
Third (שלישי)	ה — השג	ד · יא · תרצה	ה · יז · תתרעט
Fourth (רביעי)	ו — זחג	ה · יח	ו · כ · הצ
Fourth (רביעי)	ז — זשה	ו · כ · תצא	ו · יז · תתרעט

Table B — Signs of the common (ordinary) years [סימני השנים הפשוטות]

The common-year (פשוטות) boundary table — **a single table**, not two index-reconstructed sub-tables. Four columns: Gate (שער) · Sign + year-mnemonic (סימן)

· boundary "from...to" (each sign carries one or two from→to pairs, written as index letter · two-letter value · chalakim) · descriptor column headed שנים, לפניהן/אחריהן <N> — <index list> (a formula "כל השנים הפשוטות (+ סיגלה). Reads right-to-left.

Gate (שער)	Sign + mnemonic	Boundary "from...to" (מן...עד)	Descriptor (כל השנים הפשוטות)
First (ראשון)	א — בחג	מן ז · יח / עד א · ט · רג	—
First (ראשון)	ב — בשה	מן א · ט · רד / עד ב · טו · תקפח	א · ד · ז · ט · יב · טו · יז ... שבע שנים, לפניהן מעוברת
First (ראשון)	ב — בשה (2nd pair)	מן א · ט · רד / עד ב · יז · תתרעט	ב · ה · י · יג ... חמש שנים, לפניהן פשוטה
Second (שני)	ג — גכה	מן ב · טו · תקפט / עד ג · ט · רג	א · ד · ז · ט · יב · טו · יז ... שבע שנים, לפניהן מעוברת
Second (שני)	ג — גכה (2nd pair)	מן ב · יח / עד ג · ט · רג	ב · ה · י · יג ... חמש שנים, לפניהן פשוטה
(gate, ד)	ד — הכז	מן ג · ט · רד / עד ה · ט · רג	—
Third (שלישי)	ה — השא	מן ה · ט · רד / עד ה · יז · תתרעט	—
Fourth (רביעי)	ו — זהא	מן ה · יח / עד ו · תז	חמש שנים, אחריהן פשוטה ... א · ד · ז · טו · יב · טו · יז [?]
Fourth (רביעי)	ו — זהא (2nd pair)	מן ה · יח / עד ו · ט · רג	שבע שנים, אחריהן מעוברת ... ב · ה · ז · י · יג · טו · יז
Fourth (רביעי)	ז — זשג	מן ו · תח / עד ז · יז · תתרעט	חמש שנים, אחריהן פשוטה ... א · ד · ט · יב · טו · יז [?]
Fourth (רביעי)	ז — זשג (2nd pair)	מן ו · ט · רד / עד ז · יז · תתרעט	שבע שנים, אחריהן מעוברת ... ב · ה · ז · י · יג · טו · יז

Table C — The signs of the [special] parshiyot [לוח סימני הפרשיות]

The dates (in Adar/Nisan) on which Shekalim, Zachor, Parah, and HaChodesh are read, with the two "break" (הפסק) Shabbosos between them and the signs of the breaks. The table reads right-to-left in the source.

Year-sign (סימני השנה)	Parshat Shekalim (פרשת שקלים)	Break A (הפסק א)	Parah (פרשת פרה)	Parshat Zachor (פרשת זכור)	Break B (הפסק ב)	Parshat HaChodesh (פרשת ההחדש)
אדר א' / (הסמוך לניסן)	א' לאדר הסמוך לניסן [1 Adar adjacent to Nisan]	(ditto, ")	—	—	—	—
זשג / זחג	כ"ח לשבת לאדר [28 or]	[ו' לאדר 6 Adar]	כ"ב לאדר [22 Adar]	[ה' לאדר 5 Adar]	כ"ו לאדר [26 Adar]	כ"ט לאדר [29 Adar]
גכה / זשה	כ"ו לשבת לאדר [26 or]	ד' לאדר [4 Adar]	כ' לאדר 20 Adar]	[י"ג לאדר 13 Adar]	(ditto, ")	כ"ז לאדר [27 Adar]
גכז	כ"ח לשבת לאדר [28 or]	ב' לאדר [2 Adar]	י"ח לאדר [18 Adar]	י"א לאדר [11 Adar]	(ditto, ")	כ"ה לאדר [25 Adar]
(final row)	—	—	כ"ג לאדר [23 Adar]	[ט' לאדר 9 Adar]	[י"ו לאדר 16 Adar]	ר"ח ניסן [Rosh Chodesh Nisan]

Table D — The fixing of the heads of the months and the rest of the festivals, by the signs of the year [תיקון ראשי החדשים ושאר המועדים]
[בסימני השנה]

This grid gives, for each festival/month (rows) and each year-type (columns, each headed by an index letter א-ז and a three-letter siglum), the weekday on which it falls (Hebrew letter = weekday, א=Sunday ... ז=Saturday). Two-letter cells (e.g. גד, גה, אב, הו) mark events whose weekday splits across the years of that type. It is split into a **common-year** half [השנה הפשוטה] and an **intercalated-year** half [השנה המעוברת]. The table reads right-to-left in the source.

Common-year half [השנה הפשוטה]. Eight year-type columns; sigla (header band 2): זשה · השג · השא · הכז · [?] · הכז · גכו · בשו · בחה · [re-read at 600 dpi.]

Festival / month	זשה	[?] זחג	השג	הש א	הכז	גכו	בשו	בחה
Rosh Hashanah [ר"ה]	ז	ה	ז	ה	ה	ד	ד	ב
Sukkot [שופר וסוכה]	ז [?]	ז	ה	ז	א	ה	ה	ה
Fast of Gedaliah [צום גדליה]	ב	א	ב	א	ב	ב	א	ב
Yom Kippur [צום כפור]	ז [?]	ב	ז	ז	ב	ז	ז	ב
Marcheshvan [מרחשון]	גד [?]	וז [?]	וז	הו	וז	אב	ו	אב
Kislev [כסליו]	א	אב	ג	אב	א	ג	א	גד
Chanukah [נר חנוכה]	ז	ה [?]	ו	ה	ה	ה	ד	ו
Teves [טבת]	הו	דה [?]	גד	בג	[?] דו	גד	בג	דה
10th of Teves [עשירי בטבת]	ו [?]	א [?]	ו [?]	ו	ו	ו	א	ה
Shevat [שבט]	ז	ז [?]	ה	ה	ז	ה	ה [?]	ד
Fast of Esther [צום אסתר]	ה [?]	ה	ה	ד	ה	ה	ה	ד
Purim [פורים]	א	ז	ו	ה	א	ז	ו	ה
Nisan & Pesach [ניסן ופסח]	ג	א [?]	א	ו	ג	א	א	ז
Iyar [אייר]	דה	בג [?]	בג	אב	דה	בג	בג	אב
Sivan [סיון]	ו	ד	ד	ג	ו	ד	ד	ג
Shavuos [שבועות]	ד	ב	ב	א	ד	ב	ב	א
Tammuz [תמוז]	זא	הו	הו	דה	זא	הו	הו	דה
17th of Tammuz [י"ז בתמוז]	ג	א [?]	א	א	ג	א	א	א
Av [אב]	ב	ז	ז	ו	ב	ז	ז	ו
Tisha B'Av [תשעה באב]	ג	א	א	א	ג	א	א	א
Elul [אלול]	גד	אב	אב	זא	גד	אב	אב	זא

Intercalated-year half [השנה המעוברת]. Seven year-type columns; sigla: בחה · זשה · זחג · השג · ההא · גכז · בשז · The leap half also carries the extra month rows (אדר ראשון / אדר הסמוך לניסן). The two leftmost (gutter-edge) columns were recovered on a closer re-reading of the scan; their headers read **זחג** (6th col) and **זשה** (7th col) on direct re-read of the p.88 leap header band — **corrected** from

the review-007 reading זשג / זחא (a third-letter misread under the earlier seam crop). The correction is applied on the strength of the direct p.88 header read; the source apparatus varies across tables (Table A's Fourth-gate signs read / זחא [זשג?], and Table E prints a זשג/זחא-type form), so this is transcribed as printed for Table D rather than harmonized across the tables.

Festival / month	בח ה	[?] בשז	גכז	הה א	השג	זחג	זשה
Rosh Hashanah [ר"ה]	ב	ד	ד	ה [?]	ה	ז	ז
Sukkot [שופר וסוכה]	ה [?]	ה	ה	א	ז	ז	ז
Fast of Gedaliah [צום גדליה]	ב [?]	א	ב	ב	א	ב	ב
Yom Kippur [צום כפור]	ב [?]	ז	ז	ב	ז	ב	ב
Marcheshvan [מרחשון]	אב	וז	[?] וז	אב	אב [?]	אב	אב
Kislev [כסליו]	גד	ג	אב [?]	ג	[?] גד	גד	גד
Chanukah [נר חנוכה]	ו [?]	ה	ו	ה	ו	ו	ז
Teves [טבת]	בג	[?] דה	בג	גד	דה	דה [?]	[?] הו
10th of Teves [עשירי] בטבת]	ה	ו	ו	ו	[?] ו	ו	[?] א
Shevat [שבט]	ד	ה	ה	ז	ה	ה	ז
Adar Rishon [אדר ראשון]	—	—	—	—	—	—	— [blank in source]
Adar adjacent to Nisan [אדר הסמוך לניסן]	הו	וז	וז	אב	[?] הו	וז	אב
Fast of Esther [צום אסתר]	ד	ה	ה	ה	[?] ד	ה	[?] ה
Purim [פורים]	ה	ו	ז	א	[?] ה	ו	[?] א
Nisan & Pesach [ניסן ופסח]	ז	א	א	ג	[?] ו	א	ג

Festival / month	זשה	זחג	השג	הה	גכז	[?] בשז	בח
Iyar [אייר]	[?] דה	בג [?]	אב [?]	דה	בג	בג	אב
Sivan [סיון]	ו	ד	ג [?]	ו	ד	ד	ג
Shavuos [שבועות]	ד	ב	א [?]	ד	ב	ב	א
Tammuz [תמוז]	[?] זא	הו [?]	דה [?]	זא	הו	הו	דה
17th of Tammuz [י"ז בתמוז]	ג	א	א [?]	ג	א	א	א
Av [אב]	ב	ז	ו [?]	ב	ז	ז	ו
Tisha B'Av [תשעה באב]	ג	א	א [?]	ג	א	א	א
Elul [אלול]	גד	אב	זא [?]	גד	אב	אב	זא

Table E — The fixing of the sedarim read on the Shabbosos every year
[לוח תיקון הסדרים הנקראים בשבתות בכל שנה]

This table renders, in tabular form, the same four-chapter scheme of seder (Torah-portion) assignments described in the Gate-10 prose above. It is divided into the four chapters (פרק), each with a **common-year** [שנה פשוטה] and an **intercalated-year** [שנה מעוברת] column keyed by the year-sign mnemonics.

Chapter (פרק)	Span	Common-year sign	Intercalated-year sign
First (הראשון)	From Motzaei Sukkot to Erev Pesach [ממוצאי פסח] [סכות עד ערב פסח]	[pakid u-fischi] פקיד ופסחי	[?] סגיר ופסחי
Second (השני)	From Motzaei Pesach to Atzeret [Shavuos] [ממוצאי פסח עד עצרת]	[manu v-atzaru] מנו ועצרו	(same form)
Third (השלישי)	From Atzeret to Tisha B'Av [מעצרת עד תשעה באב]	[tzumu v-tzalu] / [?] קומו וצלו	(same form)
Fourth (הרביעי)	From [after] Tisha B'Av to Erev	[kumu u-tek'u] קומו ותקעו	(same form)

Chapter (פרק)	Span	Common-year sign	Intercalated-year sign
	Sukkot [מתשעה באב עד ערב סכות		

Within each chapter the body cells (keyed by year-sign זשה / בחה etc.) give instructions of the form "the years of [such-and-such] ... and [N] sedarim ... [combine] seder by seder." Recovered at 600 dpi ():

- Header: **תיקון הסדרים הנקראים בשבתות בכל שנה** ("Arrangement of the sedarim read on the Shabbosos of each year").
- Chapter One ... to Pesach | **common year (שנה פשוטה)**, sign מנו ועצרו, sigla זשה / בחה: "all the signs of the ordinary [years], six Shabbosos and sedarim; nine, Korach, completed — six Shabbosos, sedarim, שגיס [?] in every year."
- Chapter Two — from Motzaei Pesach to Atzeret | **common year**, sign מנו ועצרו.
- Chapter Three — from Atzeret to Tisha B'Av | **common year**, sign צומו וצלו / קומו.
- **Intercalated years (כל סימני המעוברות)**, sign מנו ועצרו, sigla בשז / החא / בחה: "all the signs of the intercalated [years], six Shabbosos and six sedarim; ... ten Shabbosos ... two sedarim ... חלק חתם."

The Third Maamar [המאמר השלישי]

It treats of the years of the sun, the reckoning of the tekufah [תקופה, the season/equinox], and all that depends upon the solar year [שנת החמה] in the reckoning of this work [החבור]. This Maamar [מאמר] is divided into ten gates [שערים].

- **The First Gate** — on the opening of the Maamar, the explanation of the term "year" [שנה], its definition, and the dispute that exists among the sages concerning its measure.
- **The Second Gate** — on the explanation of the term "tekufah," its meaning and its measure, by way of the motion of the sun, and the variable [true] motion [המהלך המתחלף] within the firmament — that is, the motion as it appears upon the earth.
- **The Third Gate** — on the tekufah of Shmuel [Samuel the Amora], its computations, and the form of the tables drawn up for it.

- **The Fourth Gate** — on the tekufah of R. Adda bar Ahava [R. Adda bar Ahava], its computation, and the form of the tables.
- **The Fifth Gate** — on which of these two tekufot was established by the [intercalation] cycle [מחזור] of the moon.
- **The Sixth Gate** — on the reckoning of the sabbatical cycles [שמיטות] and the jubilees [יובלות].
- **The Seventh Gate** — on the dispute that exists among the sages concerning the beginning of the creation of the world, and that which has settled among the people through this dispute.
- **The Eighth Gate** — on the reckoning by which we reckon the Exodus from Egypt and the sealing [completion] of the Second [Temple], the Vision [of the prophets], and the Destruction; and how one [of these dates] may be derived from the other.
- **The Ninth Gate** — on the explanation of the reckoning of the nations [the Gentile calendar], the days of their months and their years, and the dispute that exists between them.
- **The Tenth Gate** — on the reckoning by which the wicked kingdom of Edom reckons their years and their festival-dates [אידיהם], and the form of the tables drawn up for this reckoning. Here the work [החבור] is sealed [concluded].

The First Gate [השער הראשון]

On the opening of the Maamar, the explanation of the term "year," its definition and its measure:

The matters explained in any composition are of two kinds. Some are pleasant to hear, and some come for one reason or another; yet we are rich [in material] to expound them. In this gate, however, they are not so [merely] for hearing's sake; for our Sages of blessed memory [רז"ל] did not call the solar year by its name [merely] on account of its measure, but in order to fix the reckoning of the lunar year [שנת הלבנה] against the measure of the solar year, so that the two would come out together, equal at the end of every [intercalation] cycle [מחזור]. For this reason they came to explain and to search out the reckoning of the tekufot, and to scrutinize closely the whole course of the moon's motion, examining the measure of its renewal [its months] and its years. They were able [to do so], and had no

need to investigate it [the sun by itself]; for the [intercalation] cycle of the moon [מחזור הלבנה], which our fathers found for us, supplies all our needs.

[Since] our permission [authority] over the moon and over our years has been [established], the sun [follows] as it has passed [together with it] in the reckoning of the festivals and the new moons — [this] suffices for us, and there is no need [to turn] to this Maamar. Yet whoever wishes to give the matter its due weight, and to grasp the secret of this reckoning [סוד החשבון] thoroughly and how it was established at its beginning, must know the measure of the solar year. The matters explained in this Maamar would then be made clear with the help of God [בעזרת האל], and made clear here [too] would be all the matters that the [other] authors have left unexplained.

There are some among the chroniclers of the generation, the investigators [of this], who do not [reckon] the principal [reckoning] except by the solar year alone. [They hold that] at the end of every year it [the sun] returns; and as for the matter wherein the days are lengthened or shortened, and the cold and the heat — they investigated it. They found, without any variation, that it is written, and so it is the answer [the marker] of the [solar] year. They found a thing that is intended for the answer of the [solar] year — for they said: "there is no [definition of] 'year' except the solar year alone" — and the lunar year [שנת הלבנה], the years of days, as it is written: "*The days [shall be] this complete [year]*" — גָּאָלוּ [it may be redeemed] (*Vayikra 25:29*).

And our Sages of blessed memory said: "The Holy One, Blessed be He [הקב"ה], gave the householder permission to redeem [it for] days" — and He extended [the time] for him and waited for him until the completing — "*until the year of its sale is completed*" (*Vayikra 25:30*, "*ad tom shnat mimkaro*"). And he said at its end: our Sages of blessed memory [said] "a complete year" [שנה תמימה]; R. [So-and-so] says one counts [the days]. Thus, [it teaches] that the year [intended] is the solar year — it is the complete year. The lunar year does not stand upon one fixed point forever; sometimes it is shortened [falls short of] the measure of the solar year, and sometimes it is a leap [intercalated] year [מעוברת], exceeding the measure of the solar year. So we find in the Torah, in every place where one must complete the [lunar] year, that one adds upon the twelve lunar months ten days, which are the excess [כמותר] of the solar year, called "a complete year," over the [twelve] lunar months [as written, "the simple lunar year"]; and the leap year [is computed] as is written. And the intercalation [העברת] of the shofar — "sound the shofar in the seventh month, on the tenth of the month" (*Vayikra 25:9*, "*ten days*") — and immediately: "and you shall sanctify" [the fiftieth year].

[As the verse says of] the year of the fifty[th] year (*Vayikra 25:10*): and it is known that the head of the seventh month is the beginning [of the year]; the year was required to be intercalated, but they did not intercalate it, on account of [the rule] that the year is not intercalated either in the seventh [month] nor at the going-out of the seventh [year], nor at [the year of] completion. "And you shall sanctify the fiftieth year" — and so it was with the deed [generation] of the Flood [המבול]: in the six-hundredth year of Noah's life, in the second month, on the seventeenth day (*Bereishis 7:11*); and it is written: "in the second month, on the twenty-seventh day of the month" (*Bereishis 8:14*) — with the addition of ten days; [it teaches] that the year is not [counted] complete [from the lunar reckoning], but [the verse] reckoned a complete year. The reckoning of the moon [falls short] by [these] days. And it is written: "And the man Micah had a house of gods" — he went up [counting] from days to days (*Shmuel I — see note*)[?]. For the moon's reckoning [is reckoned by] full days, to bow down [worship], and to a tablet [לולין] [?]; and this bowing-down is the lunar year. The one who holds [otherwise] reasons that one does not call [it] "year" except the solar year alone, and [the other] holds the moon[']s reckoning] is [also] called "year." But there is no firm ground [for this] given in his hand [no decisive proof], for the [Scripture says] "[festivals] three times in the year [שלוש רגלים בשנה]" — and it is known that the festivals turn upon the lunar year — yet the festivals and appointed times are called "the year of the moon" [shnat ha-levanah]. But the holder [of the first view] has [a counter]: that [the phrase] is said specifically of the lunar year alone, and not said [of the solar year] — to grasp [it] firmly [requires] that if a man should say to him, "behold this [is so]" [?] — and "at the going-out of the period, after [two] years of days [years]" (*Divrei HaYamim II 21:19*)[?]; and "of days to days" (*Shoftim 17:10*, "and a suit of clothes, and your provision"). These [verses] are [said] of the lunar year alone — but they could all [equally] be [explained] of the solar year, and it could equally be [explained] of the lunar year.

[Footnote, marked *:] [In the manuscript: "a written year under [the word] 'days'," and these are the words "...of blessed memory thus..."[?] — a return [reference] back to the matter of the solar year and of the lunar year.] [?]

[The verse] "*behold this*" — [whether] a man should say to him, "behold this" [?]; and "at the going-out of the period, after years of days" (*Divrei HaYamim II 21:19*); and "of days to days, and a suit of clothes and your provision" (*Shoftim 17:10*) — these [are said] of the lunar year alone. But they could equally all be [explained] of the solar year, and one stands [firm] upon them [from] every constraint of this kind. For the two terms ["year"] could be [understood] of the solar year and could

be [understood] of the lunar year; these are the two terms [for] "year," and the [matter of] days is said in [this] composition.

But the holder of the first view has [a reply]: that since none of these [verses] is said expressly of the solar year — "of days you shall observe [it]" [?] — the first written [verse] which says "of days to days" [could be of either]. Its [supporting] words say "of days" — concerning days, [and] there is no mention [of "year"]. So it [the verse] does not speak of the solar year, but of the lunar year, [for "days" is the lunar year]; for the lunar year is reckoned in days, which is what the Israelites used to reckon [by].

[As one may] put it, [a verse] said of the [lunar] year is principally said of the solar year, [understood] by way of analogy [בדמיון] — for it is the principal [referent]. [Another verse] said by way of speech [literally] is said of the lunar year; and the whole matter and our reckoning depend upon it [one or the other] for one reason or another. He explains the [meaning].

Now we return to the need of this work [החבור], and we say: that the solar year is the time in which the sun begins, in its body [course], to revolve and to travel along [one fixed point of] the firmament, until it completes a full revolution [circuit] of the firmament and returns to the [same] point from which it began to revolve. This is the definition [גדר] of the year — the one who explains its reason. By this [year] the nations count their years, and all mankind [count] their years.

There is a great dispute among the wise men of the nations [concerning this]; and all the ancients sought to search it out and to establish it thoroughly — for they were unable [to grasp] the motion of any one of the stars except from within the motion of the sun. From within its motion they would understand its [the star's] course, and from the [solar] motion upon which they depend in [their] course. For this they were required [to investigate], and to establish [it] upon its foundation.

After all this investigation, [the people] divided concerning this matter into three parts [factions]:

The one part [faction] are the people of India [אנשי הודו], and all who incline [toward them], [who hold] the solar year is 365 days and a part [?]. [...continues] [?]

Page-by-page reading aids

[The following dense numerical passage on p. 92 treats the measure of the solar year according to the several schools.]

The first part [faction] are the people of India [אנשי הודו] and all who incline southward [toward the south]; and they say that the solar year is 365 days [שס"ה], and six hours, and a fifth of the hour, and one part of twelve parts [מי"ב חלקים] in a fifth of the hour [בחמישית השעה] (i.e. $1/12$, not $1/42$); and that is, by our parts, 234 parts [רל"ד] upon a quarter-day. There is none among the people of this science in this region [west] [who hold this]; but they say that the reckoning is confused for them.

For each one of the fixed stars set in the eighth firmament — which are like nails fastened [in place], that do not move from their place — even those [stars] are reckoned [as moving slightly]. So too is the view of the people of India and all who incline [toward them]: they had a [warning] notion concerning the points of the settled [fixed] firmament which is upon [above] the pole of the firmament; and they say that there is for them [a motion of] turning and returning, as I shall explain here. They were required [to come] to this view in order to fix [correct] the measure of the solar year, since they were investigating the measure of the solar year by means of the fixed stars set [below] the rising of light [the sun] — when it [a star] is distanced from the rising of the sun in the east until light [the sun] goes out from beneath it once more, and they investigated this over many years, one after another. [They reckoned] this [solar] year at its end, and took the excess [המותר] between them, and divided [it]; and there came up in their hands the measure of the solar year exceeding 365 days [שס"ה].

They did not desist [from this investigation], nor [agree to] the motion of these stars, for not every one of the fixed stars set [in the firmament] moves by [the same number of] parts in the firmament. According to the words of the ancients among the people of this science who investigated the motion of these stars and scrutinized it closely — each one of the fixed stars moves, every hundred years, one part of 360 parts [מש"ס חלקים] in the firmament [i.e. $1/360$ of a part per century]. According to the view of the ancients you will find every star among them moving in [its place] making [traversing] parts in one part of the parts of the firmament. You will find the sun, by this way, [that] there did not come up in their hands the measure of a year [exceeding by] the excess [over] the complete [year], in the measure of the sun's motion: in 36 [parts] [בל"ו], the parts called regain [רגעים]; and the sun travels in these regain, in [the amount needed] for

our reckoning. There came out [a figure] of 234 parts [רל"ד חלקים] which they added.

And the sun's rising in the east [continues] until light goes out from beneath it [the sun] once more — and this they investigated, over these many years, one after another, [reckoning] this year at its end. They took the excess [המותר] between them, and divided [it]; and there came up in their hands the measure of the solar year exceeding 365 days [שס"ה] and above [more]. They did not desist [from] the motion of these stars; for not [every one] of the stars set [in the firmament] moves by the [same] parts. According to the words of the ancients among the people of this science, who investigated the motion of these stars and scrutinized it closely — [each moves] in a hundred years by [an amount] like half a part of the parts of the firmament [the moderns' rate, distinct from the ancients' 1/360 above]. According to the view of the ancients you will find every star among them traversing parts in one part of the parts of the firmament; and you will find the sun, by this way, [that] there did not come up in their hands the measure of the solar year [merely], but the excess [המותר] remaining over the complete [year], by the measure of the sun's motion — that is, 36 [parts] [ל"ו], the parts called regain [רגעים]; and the sun travels in these regain by 261 parts [רס"א חלקים] of the parts of the hour, by our reckoning. There came out [a figure] of 234 parts [רל"ד חלקים] which they added upon the measure of the year, over 365 [שס"ה].

[Several of these closing lines on p. 92 are restated forms of the same computation; the values 365 (שס"ה), 42 parts (מ"ב), 234 parts (רל"ד), 261 parts (רס"א), 360 (מש"ס, the ancients' precession rate of 1/360 part per century), and 36 (ל"ו, the regain) recur.]

[...and if you] subtract from the year [שס"ה, 365] one full day, six hours, and twenty-seven parts [כ"ז חלקים], there will remain in your hand a day and a quarter. Thus by their account the solar year proves to be 365 days [משס"ה] and a quarter day; this is what they named it, and this is its measure — exceeding the [365 days and] quarter day [by an excess].

And if we are among the investigators who seek to know its measure according to the reckoners' view — namely, the ancients who reckoned for the settled [fixed] star a motion of one and a half parts [חלק אחד וחצי] every hundred years — they found the deficiency from the quarter of the day to be 144 parts [קמ"ד חלקים] of the parts of the hour. The year would then come out, on this basis, to 365 days [שה"ה], five hours, and 936 parts [תתקל"ו חלקים].

But it appears to us that the people of India, and all who rely upon them, blundered in their reckoning away from this [correct] path; and it has been made clear to us from what their error consists. These, then, are the words of the first faction among the gentile sages who speak about the measure of the solar year [שנת החמה].

The second faction is the majority of the Greek sages who are precise in this science — such as Hipparchus [אברכש = Hipparchus] and Ptolemy [בטלמיוס = Ptolemy] and all the sages of the [other] nations who attached themselves to them. They would say that the measure of the solar year is 365 days [שס"ה] and a quarter, less one three-hundredth of a part of a day [פחות חלק משלש מאות חלק — less 1/300 of a part per day]. When you convert this measure into our parts [חלקים], it comes to 365 days [שס"ה], five hours, 993 parts [ותתקצ"ג חלקים], and three-fifths of a part [ושלשה חמישיות החלק]. This is the measure of the year according to their words.

They came to investigate the error of the people of India regarding this, after they themselves had acknowledged their own error [in turn], and said: It is not fitting to investigate the measure of the sun's motion by way of its conjunction with another star or by way of its separation from another star — because we are afraid that we might be adding the star's motion onto the sun's motion. But we do indeed add [in our own method], for it is clear to us that every star has a motion of its own, and the star's motion is in excess over the sun's motion. [So if we measured that way] we would be inquiring into the measure of the complete [true] solar year [שנת החמה התמימה], and there would come into our hands the measure of a "cut" [shortened] year [שנה ערופה] — and this is not the [proper] way of inquiry.

Rather, we ought to investigate the sun's motion from the sun's own motion: if we fix for it a place from which its revolution in the firmament begins, until it returns to that very place — neither before it nor after it. And we find in the firmament four points fit for investigating this matter: two points at which the day and the night are made equal throughout the whole world — namely, the head of Aries [ראש טלה] and the head of Libra [ראש מאזנים]; the third is the point at which is the end of the fullness of the day and the deficiency of the night — namely, the head of Cancer [ראש סרטן]; and the fourth is the point standing opposite it — namely, the head of Capricorn [ראש גדי]. For at each one of these points the sun's motion takes on, in its character, one form distinct from another, and we are able to grasp its change [and tell] at what time of day it will occur — whereas you cannot grasp this from the configuration of the [other] places of the

firmament, since the sun does not shift from one character to another except at these four points.

All these considerations led [the Greek sages] to strengthen their view and to praise their method. And when they came to set out their works and the manner of their inquiries, Hipparchus among them said: For many years I investigated the hour at which the sun arrives at each one of these points, with the instruments I set up to investigate this and with the instruments that had been set up earlier at Alexandria [באלכסנדריא] for inquiring into this matter. And I found that the number [the excess] for the sun over the 365 days [שס"ה] is not a full quarter, but less than a quarter — a small thing that no person could discern in a single year, nor in two. And after it was made clear to me that my inquiry had been proper and correct, I compared it against the inquiries that I found set out in detail by the ancient sages, [made] over the course of two hundred years and more. I checked this excess against [the records of] these years, and found it to be a quarter of a day less one three-hundredth of a part per day [רביע יום פחות אחד חלק משלש מאות חלק ביום]. I did not rely upon this examination once or twice, but I checked it many times by means of inquiries that were [made] at the head of Aries and the head of Libra, and by means of inquiries that were [made] at the head of Cancer and the head of Capricorn. From [the totality of] these four points I investigated many times and found no variation in this matter — until it was made clear to me that this excess is a quarter of a day less one part out of forty-nine per day [רביע יום פחות חלק אחד מט' ביום], without doubt. [Note: Hipparchus's figure is usually rendered "1/300 of a day"; here the variant reading "less 1/49" (פחות חלק משלש מאות) appears alongside the earlier "1/300" (פחות חלק אחד מט). Both are transcribed as printed; the discrepancy is flagged below.] And just as [Hipparchus] did,

so Ptolemy [בטלמיס] did: he founded his own inquiries upon the inquiry of Hipparchus and upon the inquiry of the sages who preceded Hipparchus, and found no variation in this matter, and his view agreed with the view of Hipparchus. And upon their view all the sages who came after them, down to the kingdom of Ishmael [מלכות ישמעאל], agreed.

The third faction are those called the teachers of the science of observation [מלמדי חכמת החזיון]. They say that the measure of the solar year [שנת החמה] is a full quarter-day over the 365 [שס"ה]. Ptolemy said of them — the teachers of this science: they investigated the sun's motion in a single year, and did not find in the excess [anything] less than a quarter of a day; over a small matter, which on account of its smallness is not perceptible in a single instance, they decreed that it

is a full quarter. They did not trouble themselves to investigate it by a remote [long-term] method, and they did not look to the inquiries of the ancients that were before them — for their wish was not to establish the matter in its full precision, [but] only to teach the people the manner of inquiry and the form of the [sun's] motion; and for a student, a single instance suffices for examination, to know the matter and to proceed along the path. For this reason you find in their reckoning an approximation and an error.

Hipparchus said: I examined the words and the reckoning of these men, and I found that in every nineteen years [תשע עשרה שנה], which they reckon as the new [solar] years, they come out [agreeing] to a single view with the correct reckoning by which we reckon the [solar] years. But as for the reckoning of the [longer span of] years, there is between us and them one day in every three hundred years [יום אחד בכל ש' שנה]. For this reason it is not fitting to rely upon them concerning the measure of the solar year. Upon the view of Hipparchus and Ptolemy all the Greek sages relied; and upon this view were the ancients of the Chaldeans and the Babylonians [קדמוני הכשדיים והכלדיים], as appears from their words and from their practices, which they followed in the intercalation [literally "conquest"] of the year. For they would count every fourth year of their years as 366 days [שס"ו] and call it a "conquered" [leap] year [שנה כבושה]; and they followed this practice for three hundred years [שלש מאות שנה], then would skip once and make the leap [fall] at eight years [לשמונת שנים]. And they reckoned that in every 304 years [ש"ד שנה] there would be 16 lunar cycles [י"ו מחזורי הלבנה] — that is, 75 years [ע"ה שנה] — [forming] a "conquered" [leap-bearing] [period], and they had [in addition] 76 years [ע"ו שנה]. [Note: the relation among these figures — 304, 16, 75, 76 — is internally tangled; transcribed as printed and flagged below.] These reckoned the excess in the solar year as a full quarter-day [רביע יום שלם].

From this we see that their view inclined toward the view of the Greeks, and there is in their eyes only a very slight [difference] — namely, that these [the Chaldeans] count the deficiency from the quarter as one part out of three hundred per day [$1/300$ — חלק אחד מש' חלקים ביום], while those [the second faction] count one part out of 304 per day [$1/304$ — חלק אחד מש"ד חלקים ביום]. And now the views of the three [factions] who differ concerning the measure of the solar year have been set out: the first [the people of India], who count more than a quarter — one of the sages of the northern region [מחכמי פאת צפון] conceded to them; the second [recte: those] who count a full quarter, who were not precise in the reckoning; and those who count less than a quarter, to whom the majority of the sages conceded — though there is among them a dispute as to

the magnitude of this deficiency. I have not gone on at length to set out their dispute about it, for we have no need of it in the matter we are about to expound, with God's help.

The Second Gate

On the explanation of the term "tekufah" [התקופה], its meaning and its measure, by way of its motion [as it moves] in the firmament, and by way of its variable motion that is seen [from] upon the earth:

You already know that the sun varies in its motion, and through its [varying] motion it changes the character of the days and the nights. When it inclines, in the firmament, from the north of the equator [גלגל השווה] toward the south, and from the south toward the north, the day and the night vary in their measure. And because at one time it grows distant from the earth and at another time it draws near to it, its motion appears variable in the eyes of human beings. The cause of these two matters, and the reason for them, was set out in the First Maamar of this composition; [yet] we have seen [fit] to expound it [here]

a second time here, and the reason for this is the second of these two matters, on account of their being divided into four parts [נחלקים לארבעה חלקים], each one of which is called, in the holy tongue, "tekufah" [תקופה]. And this term resembles [the case of] men, of whom it is said [that] one is "valiant in his strength [תקיף]" [Esther 9:29 — תקף; "as in 'all the acts of his power [תוקף]' (Esther 9:29)"], whose meaning is the strengthening of the power. And [it is] as though, in saying "chazukah" [חזוקה], we said "tekufah" — that is, [something] strengthened [מחוזקת]. And they say that this time is called "tekufah" because the time has reached its end, [when] its power and its strength [are completed], and from here onward it shifts to another character.

But this reasoning is not correct in my eyes, for the strength of anything is found not at its beginning, nor at its end, but at its middle. And were the term "tekufah" taken from "tokef" [תוקף], which is strength, it would be said not of the beginning of the time but of its middle, when it is strong and gaining power. And [even] were we to grant their words — those who say this — [then] in the "tekufah of the year" how would the strength enter in here? And how could we say that the strength of the year is at its beginning or at its end? And likewise for the "tekufah of the days," what strength shall we set in it? And [moreover] the form [grammatical pattern] of "tekufah" here would be a *pe'ilah* [active/agent form, which does not fit].

Rather, we say that the term "tekufah" is taken from "hakkafah" [הקפה — encirclement/going around], whose meaning is going round, returning, and circling about — as it is written, "and all the men of war [went around] the city, encircling [הקף] the city one time" (Yehoshua 6:3); and likewise, "and the Ark of the Lord went around [ויסב] the city, encircling [הקף] it one time" (ibid. 6:11). From here you see that the "hakkafah" is the completion of the circling to its end; for the one who circles [merely] could go round part of the city and not complete [the circuit of] the whole city — and hence it said "encircle [הקף] the city," that is, complete the circling round it one full time. And likewise it is written, "when the days of the feasting had gone round [הקיפו] (Iyov 1:5), [meaning] they completed going round upon all the sons. And likewise, "dogs have surrounded me, a company of evildoers has encircled me [הקיפוני] (Tehillim 22:17), that is, they have spread upon me from all around me. And likewise it is written, "his going-forth is from the end of the heavens, and his circuit [ותקופתו] unto their ends" (Tehillim 19:7), whose meaning is: he goes out from [one] end and penetrates to the [other] end — which is the way of the sun's course, and none is hidden from its heat in all this course. So the form [pattern] of "tekufah" would be like "teshu'ah" [תשועה, salvation], whose root-meaning and [whose] own meaning are one and the same. The "tekufah of the year" would thus be the return of the year or the completion of the year; and likewise the "tekufah of the days" [is] the completion of the days. We call the four parts of the year "tekufot" [תקופות] because in each tekufah among them the time completes one matter of the measure of the night and the day — whether in their deficiency or in their increase — and begins anew in another matter; and likewise [the sun], in its motion and in its standing relative to the earth, completes one matter in each and every tekufah and begins anew in another matter.

The first tekufah [is that] when the day and the night are equal, and the day begins to add upon the night. At that time the sun is at the head of Aries [ראש טלה], upon the body of the equator [גלגל השווה], going up northward from the sphere of the zodiac [גלגל המזלות]; and it is at its middling distance from the earth, ascending toward its great apogee [גבהה הגדול]; and in its motion it is at the mean [motion] [המהלך השווה]. From every side it comes to ascend and to lengthen its course — both by way of its motion in the firmament and by way of its nearness to and distance from the earth. For this reason it was named "the head of Aries, the head of the zodiac" [ראש טלה ראש המזלות]. And this tekufah is the tekufah of Nisan [תקופת ניסן], because in most years it falls in the month of Nisan.

The second tekufah: when the sun reaches the head of Cancer [ראש סרטן], the day is at the end of its length and the night at the end of its shortness; and likewise

the shadow at noon is short at its end, and the sun's motion at the end of its slowness, and its standing relative to the earth is at its great apogee [גבהה הגדול]. From the point of the head of Cancer onward, the day grows shorter, and the night grows greater and lengthens and takes from the day [the portion] that the day had [previously] taken from it; and likewise the shadow at noon spreads and lengthens; and the sun's motion diminishes its slowness, hastening to bring it to the mean motion [המהלך השווה]; and the sun descends from its great apogee to draw near to the earth, diminishing its distance — that distance which it had made deep in the north — and inclines to return to the equator [גלגל השווה]. And this tekufah is the tekufah of Tammuz [תקופת תמוז], because in most years it falls in the month of Tammuz.

The third tekufah: when the sun comes to the head of Libra [ראש מאזניים], the day and the night are again equal as they were at the head of Aries — except that [now] the day grows less and the night takes from it and adds [to itself], and goes on increasing. And the sun comes [moving] toward the southern region, going [down] into the southern signs [במזלות הדרומיים], and turns from its middling distance from the earth to descend toward its near apogee [גבהה הקרוב — its perigee/lower apsis]; and in its mean motion [במהלכה השווה] [a motion] is added upon it, to hasten it. And the shadow at noon goes on increasing. And this tekufah is the tekufah of Tishrei [תקופת תשרי], because in most years it falls in Tishrei.

The fourth tekufah: when the sun comes to the head of Capricorn [ראש גדי], the night reaches the end of its length and the day the end of its shortness; and likewise the shadow at noon is long, up to the very end of the measure of its length at noon, in every place of the northern region [פאת צפון]; and the sun's motion is at the end of its hastening and at its near apogee [גבהה הקרוב] close to the earth. From the head of Capricorn onward, the day grows greater and lengthens and takes from the night [the portion] that the night had taken from it; and the night grows shorter after it had grown great; and the shadow at noon diminishes its length and grows shorter; and the sun's motion diminishes its hastening, and proceeds to bring it [back] toward the mean motion [המהלך השווה]; and the sun ascends from its near apogee [מגבהה הקרוב] toward its middling apogee [גבהה הבינוני]. And likewise it [thus] comes forth from the depth in which it had made itself deep in the south, to draw near to the line of equality [הקו השווה / equator]. And this tekufah is the tekufah of Teves [תקופת טבת], because in most years it falls in Teves.

The measure of these tekufot is not of one [single] regularity, but [depends] upon two matters. If you reckon them by way of the sun's mean motion [מהלכה השווה],

by which it moves along upon the sphere of its firmament, you will find their measure equal: each one of them about 91 days [צ"א יום] and about seven and a half hours [שבע שעות ומחצה]. But if you reckon them by way of the variable motion [המהלך המתחלף], you will not find their measure equal. And because the center of the sun's firmament [רקיע החמה] issues out from the center of the earth, the line that divides the sphere of the zodiac [גלגל המזלות] into two equal parts divides the sphere of the sun's firmament [גלגל רקיע החמה] into two parts that are not equal. For this reason the measure of these four tekufot does not appear equal in the sphere of the zodiac.

But when the sun is at the head of Cancer [ראש סרטן] it is near its great apogee [גבהה הגדול], as we mentioned above; and when it goes from the sign of Cancer [ממזל סרטן] [through] Leo and Virgo [אריה ובתולה], it travels more than ninety parts [יותר מתשעים חלקים] of its firmament-sphere [רקיעה], while there appear in the sphere of the zodiac ninety parts and no more [תשעים חלקים ולא יותר]; and it travels through them in 92 days [צ"ב יום] and about half a day [וכגון חצי יום]. This time is the one called "heat" [חום]. And when it travels from the head of Libra [מראש מאזניים] until the end of Sagittarius [קשת], it travels less than 90 parts [פחות מ־90 חלקים] of its firmament-sphere, while there appear in the sphere of the zodiac as though they were ninety full parts [תשעים חלקים שלמים]; and it travels through them in 88 days [פ"ח יום]. This time is the one called "autumn" [חורף — here "autumn"]. And likewise when it travels from the sign of Capricorn [מזל גדי] until the end of Pisces [דגים], it travels in its firmament less than 90 parts [פחות מ־90 חלקים], while there appear in the sphere of the zodiac as though they were ninety full parts; and the sun travels through them in about ninety days and a quarter [תשעים יום וכגון רביע יום]. This time is called "cold" [קור]. And when it travels from the head of Aries [מראש טלה] until the end of Gemini [תאומים], it travels in its firmament-sphere more than ninety parts [יותר מתשעים... חלקים], while there appear in the sphere of the zodiac 90 full parts [צ' חלקים שלמים]; and it travels through them in 92 days [צ"ב יום] and about half a day [וכגון חצי יום]. This time is called "summer" [קיץ].

You see that the measure of these days [periods] is not equal, and that any two of these times that are one after another are not equal to [another] two of the times named above. For example, if you take the measure of the summer [קיץ] and the heat [חום], it comes to 187 days [קפ"ז יום]; and there remain for the autumn [חורף] and the cold [קור] the measure of 178¼ days [קע"ח ורביע]. And likewise, if you take the measure of the heat [חום] and the autumn [חורף], they come to 180½ days [ק"פ וחצי]; and there remain for the cold [קור] and the summer [קיץ] 185 days less a quarter [קפ"ה פחות רביע יום]. Such is the matter of these times [periods] in

their succession one after another. And if you pair each [period] among them with the period that is its counterpart [its opposite], you will find the year divided into two equal parts. For the counterpart of the heat [חום] is the cold [קור]: these two periods together are 182 days and more than half a day [קפ"ב יום ויותר מחצי]; and likewise the summer [קיץ], the counterpart of the autumn [תמורת החרף]: the two of them together are likewise 182 days and a half [קפ"ב יום וחצי] and a little more [ומעט יותר].

and Scripture says further: "While the earth remains, seedtime and harvest, cold and heat, summer and autumn [חורף], day and night shall not cease" (Bereishis 8:22). Scripture here apportioned the year into six divisions: seedtime [זרע], when the sun travels through Scorpio and Sagittarius; and over against it harvest [קציר], when the sun is in Taurus and Gemini. Cold [קור], when the sun is in Capricorn and Aquarius; and over against it heat [חום], when the sun is in Cancer and Leo. Autumn [חורף], when the sun is in Pisces and Aries; and over against it summer [קיץ], when the sun is in Libra and Virgo — to teach you that, as long as a man is being kept in this revolving world all the days of his life, Scripture speaks to him of [the world's] alternation and its variation, and that the world does not stand upon a single form and is not conducted in a single fashion. HaKadosh Baruch Hu tries and tests it, only that a man should not despair of the good but should hope for his Creator and look to Him, putting his trust in Him, and should be on his guard always, lest perhaps his sins bring it about that the seasons fall out of their order. And [the world] would be standing upon a single order — for even the single day is itself a turning-over from one form to another, as it is said, "day and night shall not cease." So you find that at every time it changes, [each] one of them, together with its own alternation, and that no one of them is itself equal to its fellow: the measure of seedtime is not equal to the measure of harvest [קציר], but the measure of harvest [קציר], which is the good [season], is longer than the measure of seedtime; and so the measure of cold and the measure of heat — heat is longer than the measure of cold; and so the measure of summer [קיץ] and of autumn [חורף] — summer [קיץ] is longer than autumn [חורף].

Now Chazal [ורז"ל] commanded us to count from the beginning of Pesach, and they fixed for us a memorial of it from the first of [each] year, and these [extra] days are the greater part of the days of its alternation — for one of them is longer in the days of its alternation [than another]. And they fixed for us [the count] from Pesach, and between them [Pesach and the next], in a common year [שנה פשוטה], there are 169 [קס"ט] days; and for the portion of the intercalated [years], according to the years of the [intercalation] cycle, it comes to five days in addition; and in these months [or: and in these renewals]...

each one of them is shorter in its time than the time of its [own] alternation... the seasons [זמני] of the year and its parts being equal one with another — and because they saw that each one of these set times [together] with another, and its alternation, delivered to us the reckoning of the seasons [תקופות]... [it imposed] upon us the way of the reckoning, and they gave, among the days of the year, two traditions [מסורות]: the one, according to the opinion of the masters of the science [חכמה] who say that the solar year [שנת החמה] is 365 [שס"ה] days and a quarter — and this is the tekufah of Shmuel [תקופת שמואל]; and the second, according to the opinion of the investigators and the exact [astronomers] [המדקדקים] who say that the measure of the solar year is 365 [שס"ה] days and a quarter of a day less, and this is the tekufah of R. Adda [bar Ahava] [תקופת ר' אדא בר אהבה]. And [the sages] did not concern themselves to take pains over [literally "were not anxious to be concerned about"] the words of those who say [it is] 365 [שס"ה] days and more than a quarter, because their words are broken [i.e., do not reckon out properly]. And I [now] come to explain...

[The author here gives the two traditional values of the solar year: Shmuel's 365¼ days and R. Adda bar Ahava's 365 days minus a fraction; he rejects a third value of slightly more than 365¼.]

השער השלישי [The Third Gate]

[Heading, p. 98:] On the tekufah of Shmuel [בתקופת שמואל], the method of its computation, and the forms [צורות] of the tables [הלוחות] made for it:

The measure of the solar year [מדת שנת החמה] according to the opinion of Shmuel is 365 [שס"ה] days and a quarter of a day, a full [quarter] day. And when you cast off these days, 6, 6 [ו' ו', i.e., reckoning by remainders modulo 7], there remains in your hand a quarter [day]... [and] the days of the solar year, when divided [by the days of the week] ... the difference between one [year] and the next is 1¼ [day] [literally "one day and a quarter"], the days of the solar year being 365 [שס"ה] days and 7 hours and a half. And if you cast off these days by [sevens] ... there remains in your hand 1 day and 7 hours and a half. And if you cast off the days, [reckoning] by the tekufah within the days of the week [i.e., the weekly residue], you find that it [the solar year] exceeds the lunar year [שנת הלבנה] by 10 days, 21 hours, and 204 [ר"ד] parts [chalakim]; for the year of the sun [שנת החמה] exceeds [the year of the moon by these amounts].

The excess [מותר] of this [portion] — [dividing] this excess by four parts [i.e., per quarter-year tekufah], each part will be 2 days [ב' ימים], 17 hours [י"ז שעות], 321 parts [שכ"א חלקים], and this is the surplus [העודף] remaining for one tekufah

over three lunar months [על שלשה חדשי הלבנה]. Take the excess of the solar year over the lunar year and double it 19 times as the number of the years of the cycle, and in its doubling it will be 206 [קק"ו] days, 18 [י"ח] hours, 636 [תרל"ו] parts [chalakim]. Subtract from them [הוצא מהם] 206 [קק"ו] days, 17 [י"ז] hours, 151 [קנ"א] parts [chalakim], which are the days of the seven intercalated [years] [שבעה עבורים] ... And 485 [תפ"ה] parts [chalakim] are that by which the solar year exceeds the lunar year [in the cycle]...

the days of the solar year are the days of one tekufah, [reckoned] upon the [mean] motion [המהלך]. And if you cast off from them seven, seven [ז' ז', by sevens], there remains in your hand the tekufah within the days of the week. And by [this] knowing, the year of the moon [שנת הלבנה] — and between [the solar year] and the lunar year there are 10 days ... parts [chalakim], its excess [מותרת] over the lunar year. And if you [take] the one portion [for] 2 days, 17 [י"ז] hours, 321 [שכ"א] parts [chalakim]... one [tekufah-portion] over three lunar months [שלושה חדשי הלבנה]. And if you [take] the [excess of the] lunar year and double it 19 [י"ט] times, as the number of the years of the cycle, [it amounts to] 636 [תרל"ו] parts [chalakim] — there come out of them [the days of] the seven intercalated [years] [קק"ו ימי שבעה עבורים]; [these are] the seven intercalated [years] which were intercalated [עברו] in the cycle, and the tekufah [והתקופה]...

According to the words of the All [or: according to all opinions], it is the tekufah of Nisan [תקופת ניסן], when the sun was revealed at the head of [the firmament] at the beginning of the night of [the fourth, i.e.] Wednesday, when the luminaries were created — and the molad [מולד] was on the eve of the fourth [i.e., Tuesday night/Wednesday] [מליל רביעי]. And the tekufah preceded the molad of that Nisan, [according to] Shmuel, [by] 7 days, 9 hours [שעות], and 642 [תרמ"ב] parts [chalakim] — as though it were day 3 [יום ג'], [at] 151 [קנ"א] parts [chalakim]. And when all the traditions [המסורות] were [established] in your hand, and from it [the year] the tekufah was counted according to the opinion of Shmuel at every season that you wish — for from here [it follows] that the tekufah of Nisan never falls in the world except either at the beginning of the day or at the half of the day, because there is no [other possibility]; and if the first tekufah of Nisan was...

for another year, at the half of the second night; the second [tekufah] [falls] after a day and a quarter; and the fourth [tekufah falls] at the half of the day. And it returns in the fifth year to the beginning [of the cycle] as it was at first. This is the conduct of the tekufah of Nisan, which was at the beginning [of creation].

[On the tekufah of Tammuz:] The tekufah of Tammuz which comes after it [falls] at 2 hours [בן ב' שעות] and a half, on the eve of [the fourth, Wednesday] [מליל ד'];

the tekufah of Tammuz never falls in the world except either at 2 hours and a half between day [and night], on a [given] day, [or otherwise]. The first [tekufah of Tammuz] was at 3 hours [בג' שעות] from day 4 [מיום ד'], and it would be either at 2 or at 3 hours, or at 9 [hours] [בט'], between day and night; and at night it falls at ten [hours] and a half from day 4 [מיום ד'], and it would be either at 2 or at ... hours and a half. And this revolving [גלגול] and the tekufah complete [their cycle] in every 28 [כ"ח] years and return; for the tekufah of Tammuz, in 28 [כ"ח] years, the cycle is the greater cycle [מחזור גדול] of the sun, because the [set times] of the week in the solar year are completed and there comes out [a whole number] [וְיֵצֵא], 6, 6 [ז' ז', by sevens], in every 28 [כ"ח] years.

From here [too], if you wish to know on which day of the week the tekufah falls in [any given] year — by knowing how many full years there are from [the time that] Nisan was created at the [creation of the world]...

[from] the year 4883 [ד' אלפים תתפ"ג] from the creation of the world, to compute... and it is 4881 [ד' תתפ"א] [years], full, and six new [months]... [literally "and six new [months]"] ... Take the year 4881 [ד' אלפים תתפ"א] years, full, for whoever counts [from] Nisan... cast off these [years] by [twenty-eights] 28, 28 [כ"ח כ"ח]; there remains in your hand 9 [years]... and cast off [them], dividing them by 7 [ז']; there remains for you 4 [days], and a quarter... begin to count from the beginning of the eve of [the fourth, Wednesday] [ליל ד'], and they will be completed for you... the tekufah [falling] in it [is] at 2 hours, on the eve of the first [day] [מליל א']; and if you [take] 47 [מ"ז] hours and a half, on the eve of the fourth [day] [מליל ד'], and the reckoning comes out to 43 [מ"ג] hours from day 4 [מיום ד'], and it would be... you begin [counting] from 10 [מ"י, "from ten"] hours and a half from day 4 [מיום ד'], and you will reach... Teves. And concerning this matter you are able to know [the day of] any [tekufah]...

the year 4883 [ד' אלפים תתפ"ג] from the creation of the world, to compute; and it is 4881 [ד' תתפ"א] [years], full, and six new [months] from the creation of the world. Cast off these [years] 28, 28 [כ"ח כ"ח]; there remains in your hand 9 [years], and a quarter; and a quarter, cast off [it] from the [remainder], and there remains for you 4 [days]; and a quarter — begin to count them from the beginning of the eve of [the fourth, Wednesday] [ליל ד'], and they will be completed for you, [and] the tekufah falls in it [at] 6 hours, on the eve of the first [day] [מליל א'] [Hebrew: וְהָיָה הַתְּקוּפָה בֹּי שְׁעוֹת מְלִיל א']; and if you seek [the tekufah of] Tishrei [תְּשִׁירֵי, תְּקוּפַת תִּשְׂרִי], you reach ... day 4; and it will be at 9 hours from day 4 [מיום ד']. And you will know on which day [of the week] the tekufah [falls]...

and you reach day 4 [ד']; and the half [of the day] is on the eve of the second [day] [מליל ב'], and in it will fall the tekufah... you are able to know the day of the tekufah and its hour [from] the days of the week in every [year]... in which new-moon [month] [חדש] of the lunar months the tekufah falls... as you knew above how many years there are [from when] Nisan was [created]... [the head of the months] [ראש החדש], which is the head of the year's [reckoning], which you are seeking... these cycles of 19 [יט] years, every cycle and cycle, full, since the year [is] $365\frac{1}{4}$ — [for] which you seek... Take for every cycle and cycle 1[?] year and 485 [תפ"ה] parts [chalakim]... hours, and add them upon the hours, and keep the remainder... from them days, and add upon them 22 days, 3 hours [כ"ב יום ג' שעות]... the first tekufah [counting] from the molad of Adar [ממולד אדר], and the whole sum, and if...

[the tekufah] of the moon — keep the new [month] and guard [the remainder]; and know that that tekufah falls in the [new] month [in question]... the excess [המותר], if it stood in your hand [as] Adar, then [you have] added it... and if [it is reckoned] to Nisan, you have added it... that the cycle is not completed in [a whole number for] every year and [every] year, and you add upon it, [for] the cycles to be gathered, [for] the work of [one]... which passed from the cycle, and keep the remainder; and from the molad of Adar — if you did not add it upon the [tekufah]-excess [מותרי התקופה] ... or more than the [new] month of the moon [מחדש הלבנה], know that the tekufah ... one [new] month, and there remains in your hand the excesses of the tekufah [מותרי התקופה] upon the new [month]... of the moon, know that the tekufah falls in Adar [נופלת באדר], and... upon the molad of Adar [מולד אדר]. And when the [number for] the new [month] [is established] for you, which [is]... the hours of the molad and its parts [שעות המולד וחלקיו]: if [the days] go into [the count] full days, [whole] on the day, or — and on the night — know that...

the hours of the molad and its parts [שעות המולד וחלקיו] — if they go into [the count] as full days on the day, or — and on the night — know that your reckoning is established [מתוקן]; and if you find [it to be] parts [chalakim]... [whether] more or less than six... on the day, or on the night, know that, until it comes out so. And when the correction [תקון] of the reckoning becomes clear to you... [the count] of the days of the week, and how far it is from the head of the [new] month [מראש החדש]... [the day of] the molad, and the fixed head of the [new] months [מקבוע]. And if you wish to know the tekufah of Nisan, add upon the excesses of the tekufah of Nisan [מותרי תקופת ניסן] — [בי"ז] 17 [hours], 321 [שכ"א] [parts]... upon them the hours of the molad of Tammuz [מולד תמוז] and its parts, if the tekufah was...

the tekufah of Nisan falls in Adar [נופלת באדר], and the excess of the tekufah does not reach the tekufah... you add [to] the excess [המותר], which is hours and parts [שעות וחלקים], of the molad...

[Worked example, page 4:] ...Sivan [סיון]. And if there is in them more than the measure of a [new] month [ממדת חדש], you [reckon] upon the molad of Tammuz [מולד תמוז] and find the tekufah of Tammuz [תקופת תמוז], and they will be... either on the day or on the night. And by this way [also] the tekufah of Teves [is reckoned] from the tekufah of Tishrei [מתקופת תשרי]. And if you wish to make it easier for yourself, [reckoning] upon... 91 [צ"א] days and 7½ hours [שעות וז' וחצה]; and in [whatever] place it can come to fall... And by this way you compute from the tekufah of Tammuz to the tekufah of Teves.

And I [now] give you an illustration [דמיון] from the reckoning, [so as] to bring up for you in the reckoning [the tekufah] of Nisan, in which the world was created... and 4881 [ותתפ"א] [years]; and these are the cycles of 19 [י"ט] years ... that passed of the cycle of 256 [רנ"ו]. If you take for 256 [לרנ"ו]...

and 4881 [ותתפ"א] [years]; and these are the cycles of 19 [י"ט] years ... that passed of the cycle of 256 [רנ"ו]. If you take 256 [לרנ"ו]... in every cycle, there comes up in your hand 15 [days] [ט"ו] and ten hours and 1040 [תתר"ם] parts [חלקים] [Hebrew: בכל מחזור יעלה בידך ט"ו יום ועשר שעות תתר"ם חלקים] and... years that passed of the cycle: 21 [כ"א], [ר"ד] 204 parts [chalakim] for every year, of the intercalated [years] that passed [עברו] of the cycle — there remains in your hand 7 [ז']... [תפ"ה] 685 [parts]; in the cycles there will be 23 [כ"ג] days, 6 [days], 6 [ו'] hours ... [day] 3 [ג'] [יום ג'], [קנ"א] 151 parts [chalakim], which are the distance [מרחק] of the new month of the moon [חדש הלבנה], or less than them, 7, 9 [ז' ט'], [תרמ"ב] 642, which would be... [day] 21 [כ"א], [קפ"ח] 188 parts [chalakim], and likewise the excesses of the tekufah [מותרי התקופה]... the hours of the molad of Nisan [מולד ניסן] and its parts, which were 8 [ח'] hours and 892 [תתצ"ב] parts [chalakim] [from day 7]... 16 [י"ו] days and six hours [ושש שעות], and that is the distance of the tekufah [מרחק התקופה]...

and when you have drawn off [cast off] this distance [המרחק] from day 6 [מיום ו'], which is... at 6 hours, on the eve of the first [day] [מליל א'], and it is 9 [hours] [ט']; and to the new month [לחדש], the fixed [molad]... [the excess] over the excesses of the tekufah of Nisan, 17 [בי"ז], [תק"ט] 509, [י"ד] 14, [י"ח] 18 ... [שכ"א] 321; this is added to them, [namely] the hours of the molad of Tammuz [מולד תמוז]... 31 [ל"א] parts [chalakim], from day 3, [the tekufah of Tammuz] would be at 1 [?] [day]; the distance of the tekufah of Tammuz [מרחק תקופת תמוז]... and it is one hour and a half on day 1 [מיום א'], which is [the place] for knowing the tekufah of

Tishrei [תקופת תשרי]. Add upon the excesses of Tammuz [מותרי תמוז] 17... one [day], or add upon the excesses of Nisan [מותרי ניסן] — 685[?] — that...

the excesses of Tishrei [מותרי תשרי] [are] 21 [כ"א], 830 [תת"ל], 7[?]; and the molad of Tishrei [מולד תשרי] [is] 13 [י"ג], [a number of] hours and its parts [שעותיו], the excess being 21 [כ"א] [days] and... which is for the fixed new [month] [לחדש מקבוע]; and if it is sought [תדרוש] ... the excesses of Tishrei [מותרי תשרי], 17 [ה'], 642 [תרמ"ב] [מותרי ניסן] or upon the excesses of Nisan [מותרי ניסן], 321 [שכ"א], or upon the excesses of Teves [מותרי טבת], 24 [כ"ד] days and 1 hour [מיום ו'], and 71 [ע"א] parts [chalakim] from day 6 [מיום ו']; and if you add its hours and its parts [שעותיו וחלקיו]...

you reach the molad of Teves [מולד טבת], 3 hours [ג' שעות] and 469 [תס"ט] parts [chalakim]... the excess [המותר] is 24 [כ"ד] days and 1 hour [ושעה אחת], and 71 [ע"א] parts [chalakim]... on day 2 [ב' יום] [the molad of] Teves, the fixed [molad] [מטבת לקבוע]. And if you add its hours and its parts... 6 hours [ו' שעות], and the half, on the eve of the second [day] [מליל ב'], 22[?]... upon each one of these tekufot [מהתקופות האלה]: 91 [צ"א] days and 6 [ו'] hours [or: 7, ז']... the tekufah which [it is] after it [or: which is its alternation] [אשר אחריה / אדריה]. And you find, for the ancients [לקדמונים] and... [for] the people of the generation, several ways in the reckoning of the tekufot [התקופות]: [some] who begin their reckonings from the excesses of Tishrei [מתשרי], from [the time] the world was created — for [they hold] that Tishrei is the [point] from which we count for the creation of the world [לבריאת עולם], and they give the beginning...

of the tekufot 16 days [י"ו ימים], 16 hours [שעות] [י"ו], 589 [תקפ"ט] parts [chalakim] from [the molad of Elul]... And there are among them [some] who begin their reckonings from the tekufah of Tishrei [מתקופת תשרי], [from when] the world was created, and they give as the beginning of the tekufot [the value] 27 [כ"ז] days, 13 [י"ג] hours, 793 [תשצ"ג] parts [chalakim]... Elul [אלול], and they are 1 day and 23 [וכ"ג] hours [שעות] before the molad [לפני המולד]...

and if there is in them [a remainder] more than the measure of a [new] month [ממדת חדש], you [reckon] upon the molad of Tammuz [מולד תמוז] and find the tekufah of Tammuz [תקופת תמוז]; and they will be either on the day or on the night. And by this way [you reckon] the tekufah of Teves [תקופת טבת] from the tekufah of Tishrei [מתקופת תשרי]...

[for] for every cycle and cycle [there are] 1[?] year and 485 [תפ"ה] parts [chalakim]; and if you take [for] 256 [לרנ"ו] cycles [מחזור]... [it amounts to a

value], and if you add its hours and its parts... 24 [כ"ד] days [recte], and 1 hour [ושעה אחת], and the molad of Teves 469 [תס"ט] parts [chalakim] from day 6 [מיום ו']. And if you add its hours and its parts... 4 hours and a half [ד' שעות וחצי], on the eve of the second [day] [מליל ב'], 22[?]. Upon each one of these tekufot [מהתקופות האלה] — 91 days and 7 [ז'] hours, [each] the tekufah which is after it [אשר אדריה / אחריה].

other computations, which are simpler than these, yet they all come down to one and the same thing — except that the most upright is the one that proceeds according to the order of the creation of the world. For in my view, this path, which I have set out for you, is the one that I am inclined to suppose corresponds to the creation of the world, namely that the world came into being in Nisan; and it resembles the view of our Rabbis, of blessed memory, in their convention of reckoning the tekufah [תקופה] from Nisan. They reckoned [it] from the Flood onward as from Tishrei; and likewise they reckoned [it] to the creation of the world as from Tishrei, which is one year before [the Nisan epoch] — because of a difference of one day in a year, when one computes a year as we have learned from them. And likewise [there is a difference] of every six months, and because most people prefer to make it easier for themselves, [therefore] I have set out the computation that I sketched for you in six tables.

From them [you derive], for every cycle from the creation of the world up to cycle 315 [שי"ה], how many cycles [there are] — among them [some] are intercalated and [some] are simple cycles. And in the second table I have written out the double cycles, as I worked them out for the molad-values. In the first table and in the four tables that remain, I have written down within them the excesses of the four tekufot for the 19 [בי"ט] years in which the world was created, and whose beginning is from Nisan, in which the world was created. And after the reckoning by which we reckon from Tishrei — and when you wish to know how many years have passed since the creation of the world up to [a given year] — [you will find] among the cycles [some] of 19 [מי"ט] years that are [counted] from Tishrei. And the complete [years] will be either 19 [י"ט] years, or fewer than 19 [מי"ט]...

[so that] you may know how to compute with these tables. [Up to] the year at which you stand, know by it how many [years and cycles have elapsed]; and the years that remain in your hand after the [completed] cycles [will be] fewer than 19 [מי"ט] years. Take these years and bring [them] into the first table, and you will find before them, in that same row, the [value]. Add to it that which is gathered together [the accumulated total], [namely] 35 hours [משעה] and 485 [ותפ"ה] chalakim [חלקים] for each [cycle], as I did with the molad-values. Bring

these years up [and add] for each of them what has gathered together, and take out from the total that excess [המותר] of the tekufah over the molad of the [new] month. If there is none to add to the new [month] which falls before that year — [then] if there is in it more than one new [month, you] subtract from it the measure of the second [month], for the [new] month that falls before the tekufah; and from it you will know [how to proceed]. By the procedure I showed you above — and behold, you will know the day and hour of the tekufah, and whether it falls...

Now know that this tekufah is not regulated, and it is not built upon the variable (true) motion of the sun, which differs [from the mean] — because we do not find the sun, at this time, [at the head of Cancer at the moment of the Cancer-tekufah]; and the day and night are equal throughout the world, 12 [י"ב] days before [the tekufah]. We find the sun [appearing] at the head of Cancer some days before the tekufah of Tammuz according to the words of Shmuel [Samuel the Amora, 3rd c. CE]; and likewise we find it [appearing] at the head of Libra and at the head of Capricorn some days before the tekufah [of Tishrei and of Teves] according to Shmuel. From here [it is clear] that this tekufah does not follow the [true] reckoning [of the sun's place].

One could say that it follows the [mean] reckoning — the mean motion [המהלך השווה] — [for] the variable (true) motion [המהלך המתחלף] is at this distance [from the mean]; that is to say, [it depends] on the entry of the sun to the heads of these zodiac-signs. But until the time grows strong [advances], the increment will appear over the length [of the interval]. This [interval] stands upon a single fixed measure, and does not add nor subtract anything in the days that pass — for the interval between the sun's entry to the head of the sign of Aries and the tekufah of Nisan, according to the words of Shmuel, [is] 12 [י"ב] days before the tekufah of Nisan according to the words of Shmuel. And likewise, [when] the sun [enters] the sign of Cancer, the day reaches its longest by about ten [days before the tekufah of Tammuz] according to Shmuel. And it is close to this matter that the sun is found some days before the tekufah of Tishrei and the tekufah of Teves [respectively]. And you will find that it follows the order of the days and nights and their interchanges.

We are not [dealing here] with the mean motion, for there is no [difference] between the mean motion and [the true]; that is to say, that they did not found this reckoning [upon the true motion]. But the distancing of the tekufah from the heads of the zodiac-signs — whether in the length of the day, or in its deficiency — were this distancing [a quantity that] adds and does not subtract, or [one that]

subtracts and not so [add] — [it would be otherwise]; but if you examine the sun's setting at the heads of these zodiac-signs — yet until the time grows strong, and the increment appears over the length [of the interval] — this [interval] stands upon a single fixed measure, and adds nothing nor subtracts anything from it in the days [that pass] as before. Such is the time that went out among our forefathers from Egypt, between the sun's setting at the head of the sign of Aries and the tekufah of Nisan, for it is only two days that the tekufah [precedes or follows the heads of the zodiac-signs, whether before them or after them as later]. In the days that come after, we [will] find it [the tekufah] still pressing upon the [same] distance, [and] nothing remains for us to say except that this tekufah is built upon [the distance] that the nations reckon for their seasons. And [the scholars] transmitted to us the reckoning of the tekufah by this method...

and they relied [it] upon the asking-for-rain [the petition for rain in prayer], so that a person should [begin to ask for them on the sixtieth day] from the tekufah of Tishrei according to the words of Shmuel — and this is the matter that compelled [them] to explain [it] in this work. And as for all that you hear [said] — if the tekufah falls at the hour of [the rising of] a [certain] star, [so] that So-and-so will be in the world thus and so — do not concern yourself about it, for it is not said about this [present] tekufah, but it is said in actuality about another tekufah; [namely], upon [the basis of] knowledge of all those who delve into this science. But it [this tekufah] is [the one that follows the order of creation], or [it follows] this [present] tekufah if you reckon it on another path. And so is the custom that is followed in the lands of God, that a person guards himself from drinking water at the time [of the tekufah] — for no man is able to know the [true] hour of the tekufah at its place, [for it is found] at its place along the length [of the meridian] at the edge of the east; and this is not possible for everyone. As to this matter, there would have been an advantage in the words of the ancients, had he had [something] to point to about it — [but] since it is not found in their words, we have nothing to be concerned about regarding it.

[Filipowski editorial gloss — same passage rendered with the parallel column readings, where the right-column variants are preserved:] a person would begin to inquire about them on the sixtieth day [ביום ס']; ...the matter that is necessary for this reckoning, and on its account I needed [to explain it]; ...[when] you hear whether the tekufah falls at the hour of a star [rising], do not concern yourself about it, for it is not said about this tekufah, but it is said in actuality about another tekufah; ...[follow] it on another path; and so is the custom that is followed [of guarding against] drinking water at the time of the tekufah — the matters that follow are, in my view, [as I have said]; ...at its place, if he does not

know how far [the distance is]; ...so this is for every man — and were a man to find [it], he would have [something] to point to about it, and to set down the reason; but now [we have nothing] to be concerned about regarding it.

The table of the gathering [accumulation] of 35 hours and 485 [תפ"ה] chalakim, for the double cycles and the simple [cycles].

[The page sets two tables side by side. The right-hand table is headed **מחזורות פשוטות** ("Simple cycles"); the left-hand table is headed **מחזורות כפולות** ("Double cycles"). Both read right-to-left in the source; columns given here in logical right-to-left order. Each "Cycles" column holds a serial Hebrew-letter index; "Years" holds the accumulated whole years (gematria); then the accumulated days / hours / chalakim. The two tables share the rightmost "double cycles" index column.]

Simple cycles [מחזורות פשוטות]

Columns (right→left): Cycles [מחזורים] | Years [שנים] | days [ימים] | hours [שעות] | chalakim [חלקים] | Double cycles [מחזורים כפולים]

Cycle	Years	D ay s	Ho urs	Chala kim	Double cycles
(1) א	(19) י"ט	0	1	485	(17) י"ז
(2) ב	(38) ל"ח	—	2	970	(34) ל"ד
(3) ג	(57) נ"ז	—	4	375	(51) נ"א
(4) ד	(76) ע"ו	—	5	860	(68) ס"ח
(5) ה	(95) צ"ה	—	7	265	(85) פ"ה
(6) ו	(114) קי"ד	—	8	750	(102) ק"ב
(7) ז	(133) קל"ג	—	10	155	(119) קי"ט
(8) ח	(152) קנ"ב	—	11	640	(136) קל"ו
(9) ט	(171) קע"א	—	13	45	(153) קנ"ג
(10) י	(190) ק"צ	—	14	530	(170) ק"ע
(11) י"א	(209) ר"ט	—	15	1015	(187) קפ"ז
(12) י"ב	(225) רכה [recte: / רכ"ח 228 — source typo against the +19 progression]	—	17	420	(204) ר"ד
(13) י"ג	(247) רמ"ז	—	18	905	(221) רכ"א

Cycle	Years	Days	Hours	Chalukim	Double cycles
(14) י"ד	רס"ו (266)	—	20	310	רל"ח (238)
(15) ט"ו	רפ"ה (285)	—	21	795	רנ"ה (255)
(16) ט"ז	ש"ד (304)	—	23	200	רע"ב (272)
(17) י"ז	שכ"ג (323)	1	0	685	רפ"ט (289)
(18) י"ח	שמ"ב (342)	1	2	90	ש"ו (306)
(19) י"ט	שס"א (361)	1	3	575	שכ"ג (323)
(20) כ	שפ"פ (380)	1	4	1060	ש"מ (340)
(21) כ"א	שצ"ט (399)	1	6	465	שנ"ז (357)
[last index row]					[?] שע"ד (374)

Double cycles [מחזורות כפולות]

Columns (right→left): Double cycles [מחזורים כפולים] | Years [שנים] | days [ימים] | hours [שעות] | chalakim [חלקים]

Double cycle	Years	Days	Hours	Chalakim
(17) י"ז	שכ"ג (323)	1	0	685
(34) ל"ד	תרמ"ו (646)	2	1	290
(51) נ"א	התקס"ט (969)	3	1	975
(68) ס"ח	א רצ"ב (1292)	4	2	580
(85) פ"ה	א תרט"ו (1615)	5	3	185
(102) ק"ב	א תתקל"ח (1938)	6	3	870
(119) קי"ט	ב רס"א (2261)	7	4	475
(136) קל"ו	ב תקפ"ד (2584)	8	5	80
(153) קנ"ג	ב תתקנ"ז (2907)	9	5	765
(170) ק"ע	ג ר"ל (3230)	10	6	370
(187) קפ"ז	ג תקנ"ג (3553)	11	6	1055
(204) ר"ד	ג תתע"ו (3876)	12	7	660
(221) רכ"א	ד קצ"ט (4199)	13	8	265
(238) רל"ח	ד תקכ"ב (4522)	14	8	950

Double cycle	Years	Days	Hours	Chalakim
רנ"ה (255)	ד תתמ"ה (4845)	15	9	555
רע"ב (272)	ה קס"ח (5168)	16	10	160
רפ"ט (289)	ה תצ"א (5491)	17	10	845
ש"ו (306)	ה תתי"ד (5814)	18	11	450
שכ"ג (323)	ו קל"ז (6137)	19	12	55
ש"מ (340)	ו ת"ס (6460)	20	12	740
שנ"ז (357)	ו תשפ"ג (6783)	21	13	345
שע"ד (374)	ז ק"ו (7106)	22	13	1030

The excesses of the four tekufot for the 19 [בי"ט] years of the first cycle.

[A single wide table with four tekufah-groups across the page — from right to left in the source: **תקופת תמוז (tekufah of Tammuz)**, **תקופת ניסן (tekufah of Nisan)**, **תקופת תשרי (tekufah of Tishrei)**, **תקופת טבת (tekufah of Teves)**. The leftmost narrow column is the year-index (א-י"ט). Within each tekufah-group there are three sub-columns, read right→left: the month-and-value "**after the molad**" [**אחרי מולד**] (i.e. the named month plus chalakim), then **hours [שעות, written vertically]**, then **days [ימים, written vertically]**. The four groups are transcribed below as four sub-tables; rows are keyed by the shared year-index. Table reads right-to-left in source.]

Group 1 — Tekufah of Nisan [תקופת ניסן] (columns right→left: month + chalakim "after molad" | hours | days)

Year	Month / chalakim	Hours	Days
א (1)	אדר (Adar) 151	3	22
ב (2)	ניסן (Nisan) 642	11	3
ג (3)	ואדר (Adar II) 846	8	14
ד (4)	אדר (Adar) 1050	5	25
ה (5)	ניסן (Nisan) 461	14	6
ו (6)	ואדר (Adar II) 665	11	17
ז (7)	אדר (Adar) 869	8	28
ח (8)	ואדר (Adar II) 280	17	9
ט (9)	אדר (Adar) 484	14	20
י (10)	ניסן (Nisan) 975	22	1

Year	Month / chalakim	Hours	Days
(11) י"א	ואדר (Adar II) 99	20	12
(12) י"ב	אדר (Adar) 303	17	23
(13) י"ג	ניסן (Nisan) 794	1	5
(14) י"ד	ואדר (Adar II) 998	22	15
(15) ט"ו	אדר (Adar) 122	20	26
(16) ט"ז	ניסן (Nisan) 613	4	8
(17) י"ז	ואדר (Adar II) 817	1	19
(18) י"ח	ניסן (Nisan) 228	10	0
(19) י"ט	ואדר (Adar II) 432	7	11

Group 2 — Tekufah of Tammuz [תקופת תמוז] (columns right→left: month + chalakim "after molad" | hours | days)

Year	Month / chalakim	Hours	Days
(1) א	סיון (Sivan) 472	20	24
(2) ב	תמוז (Tammuz) 983	4	6
(3) ג	סיון (Sivan) 87	2	17
(4) ד	סיון (Sivan) 291	23	27
(5) ה	תמוז (Tammuz) 782	7	9
(6) ו	סיון (Sivan) 986	4	20
(7) ז	תמוז (Tammuz) 397	13	1
(8) ח	סיון (Sivan) 601	10	12
(9) ט	סיון (Sivan) 805	7	23
(10) י	תמוז (Tammuz) 216	16	4
(11) י"א	סיון (Sivan) 420	13	15
(12) י"ב	סיון (Sivan) 624	10	26
(13) י"ג	תמוז (Tammuz) 35	19	7
(14) י"ד	סיון (Sivan) 239	16	18
(15) ט"ו	תמוז (Tammuz) 730	0	0
(16) ט"ז	תמוז (Tammuz) 934	21	10
(17) י"ז	סיון (Sivan) 58	19	21

Year	Month / chalakim	Hours	Days
(18) י"ח	תמוז (Tammuz) 549	3	3
(19) י"ט	סיון (Sivan) 753	0	14

Group 3 — Tekufah of Tishrei [תקופת תשרי] (columns right→left: month + chalakim "after molad" | hours | days)

Year	Month / chalakim	Hours	Days
(1) א	אלול (Elul) 793	13	27
(2) ב	תשרי (Tishrei) 204	22	8
(3) ג	אלול (Elul) 408	19	19
(4) ד	תשרי (Tishrei) 899	3	1
(5) ה	תשרי (Tishrei) 23	1	12
(6) ו	אלול (Elul) 227	22	22
(7) ז	תשרי (Tishrei) 718	6	4
(8) ח	אלול (Elul) 922	3	15
(9) ט	אלול (Elul) 46	1	26
(10) י	תשרי (Tishrei) 537	9	7
(11) י"א	אלול (Elul) 741	6	18
(12) י"ב	אלול (Elul) 945	3	29
(13) י"ג	תשרי (Tishrei) 356	12	10
(14) י"ד	אלול (Elul) 560	9	21
(15) ט"ו	תשרי (Tishrei) 1051	17	2
(16) ט"ז	תשרי (Tishrei) 175	15	13
(17) י"ז	אלול (Elul) 379	12	24
(18) י"ח	תשרי (Tishrei) 870	20	5
(19) י"ט	תשרי (Tishrei) 1074	17	16

Group 4 — Tekufah of Teves [תקופת טבת] (columns right→left: month + chalakim "after molad" | hours | days)

Year	Month / chalakim	Hours	Days
(1) א	טבת (Teves) 321	18	0
(2) ב	טבת (Teves) 525	15	11

Year	Month / chalakim	Hours	Days
(3) ג	כסלו (Kislev) 729	12	22
(4) ד	טבת (Teves) 140	21	3
(5) ה	טבת (Teves) 344	18	14
(6) ו	כסלו (Kislev) 548	15	25
(7) ז	טבת (Teves) 1039	33 [numerical impossible: hours run 0–23; printed thus in source — see Numerical impossibles]	6
(8) ח	כסלו (Kislev) 163	21	17
(9) ט	כסלו (Kislev) 367	18	28
(10) י	טבת (Teves) 858	2	10
(11) י"א	כסלו (Kislev) 1062	23	20
(12) י"ב	טבת (Teves) 473	8	2
(13) י"ג	טבת (Teves) 677	5	13
(14) י"ד	כסלו (Kislev) 881	2	24
(15) ט"ו	[טבת] (Teves) 292	11	5
(16) ט"ז	טבת (Teves) 496	8	16
(17) י"ז	כסלו (Kislev) 700	5	27
(18) י"ח	טבת (Teves) 111	14	8
(19) י"ט	טבת (Teves) 315	11	19

The Fourth Gate [השער הרביעי]

On the exposition of the tekufot of R. Adda bar Ahava [R. Adda bar Ahava], and the computation, and the forms of the tables made for it.

The measure of the solar year according to the words of R. Adda bar Ahava — as a person understands it of his own accord, and as we have seen [it] expounded in the Baraita that is recited [the Baraita of Shmuel] in his name — is 365 [שס"ה] days, 5 [ה] hours, and 997 [תתקצ"ז] chalakim and 48 [מ"ח] regaim [רגעים]; that is, 365 [שס"ה] days and six hours less 82 [פ"ב] chalakim and a further 28 [כ"ח] chalakim, [namely] 46 [מ"ו] regaim. So in each part [quarter], the days of one tekufah would be, by his words, 91 [צ"א] days, 7 [ז] hours, 519 [תקי"ט] chalakim

and 31 [ל"א] regain. And the excess [מותר] of the tekufah over three lunar months [ללבנה] would be 2 days [ב' ימים], [י"ז] 17 hours, 300 [ש'] chalakim and 31 [ל"א] regain. To the moon, the [excess for] two [tekufot is] 5 [חמשה] days, 10 [עשר] hours, 404 [ת"ד] chalakim, 62 [ס"ב] regain... ...[the year being] 365 [שס"ה] days, 5 [ה] hours, 997 [תתקצ"ז] chalakim and 48 [מ"ח] regain — which is 365 [שס"ה] days and six hours less 82 [פ"ב] chalakim and more [than that] — for each part [quarter] the days of one tekufah would be, by his words, 91 [צ"א] days, 7 [ז] hours [519 chalakim and 31 regain]; and the excess [מותר] of the tekufah over the three months would be [17 hours], 359 [שנ"ט] chalakim and 31 [ל"א] regain. And the excess for two tekufot [is] 564 [ס"ד] — read with chalakim] chalakim, 62 [ס"ב] regain; and for three tekufot [it is] 8 [ח'] days...

7 [ז] hours, 891 [תתקצ"א — read תתקצ"א] chalakim, 17 [י"ז] regain. And for the four tekufot [the total is] 121 [קכ"א] chalakim, 48 [מ"ח] regain. This is the excess of the solar year [over twelve lunar months according to R. Adda]. And if you double this excess 19 [י"ט] times, you will find in it the measure of seven months which are [intercalated] in the leap years [of the cycle], with nothing more; and there remains to the sun, at the end of the cycle, an excess over the [reckoning of the] year of the sun. But the years of the sun and of the moon would be equal as one — and when a person knows the position of the tekufot according to the words of R. Adda, [he can carry it over] in their reckonings to another cycle, because the tekufah recurs...

[the moment] at which the new [moon] stood at the hour of its [first] visibility and the tekufah, at the time the luminaries were created, was the tekufah of Nisan; and the sun was created [at the head of Aries] on the eve of the fourth [day]. And the tekufah preceded the molad of Nisan, according to the words of R. Adda, by only 9 [ט'] hours, 642 [תרמ"ב] chalakim — because the moon, in [its place] in the sky, when it was created by HaKadosh Baruch Hu [HaKadosh Baruch Hu], and this small portion [of light] was with the sun, and its light was at once growing and increasing... and the sun [was created so] that the light which is found in it [the moon] should diminish and be hidden. This is the diminution by which it [the moon] was made not to be of great body, but [merely so that] most people [should think] it is light [-bearing]; but it is [in fact] the diminishing [one]. Scripture [calls it] by two names — "great" and "small" — "great" because its body would be full of light, and "small" because its light, [when] HaKadosh Baruch Hu created it, and the light within it still diminishing — this was the diminution [of] the chalakim. This measure is more than half the time...

that the light of the sun, which is 18 [י"ח] hours, as we have explained; and [in] these hours by which the tekufah preceded the molad [by] 5 [ה] chalakim [and] 25 [כ"ה] chalakim [computed] from the sign [from the zodiacal position], and the cleaving [of the light to the sun]; we find [it] in the moon, [the light] found from the moon at the time of its [first] visibility being more than half [the disk] over the earth. And the light was diminishing and going [on] until it cleaved [to the sun]; and from here onward it [the light] returns and grows and increases until it [reaches its full], so as to give light over the earth [for] 3 [ג] hours, 642 [תרמ"ב] chalakim [for] the moon, near to the setting of the sun on the fourth day, [over] most of the inhabited [world]. The fourth [part] of the meridian, by about three and a half hours and half [more] — until the end of the [meridian] — these themselves are fit to be called by two names: a great luminary at the time of its [first] visibility, and a great [light] because [the sun's] light is greater [and gives more light]...

[but] this is not the concern of the tekufah, of which we were speaking — [we were speaking] about what appeared to us, and about what we heard from the mouth of sages, and [we return] to the matter and we say:

One who wishes to know the day of the tekufah and its hour according to the words of R. Adda bar Ahava: know in which year of the cycle of the moon [you] stand, and reckon [from] the head of [the first cycle from which the cycles are counted] to the world from Nisan; and this reckoning — it is possible for you, if you subtract [it], to [obtain] your reckoning which [you sought] alone. For example: if you reckon this [year], from Tishrei, [as] year 18 [י"ח], the years [from the molad of Nisan] would be 19 [י"ט]; if you reckon [from Tishrei] 18 [י"ח] years and six months, [and] reckon from Nisan, you will find in Tishrei that this is all six months, between the two reckonings — for [it is] only six months. And when you bring [it]...

[parallel column — R. Adda reckoning continued:] ...According to the words of R. Adda bar Ahava, know in which year [of the cycle you are], from which [the cycle] is counted to the world from Nisan; and this reckoning... if you reckon from Tishrei [for] six months — this is 18 [י"ח] complete years to the cycle, and it [the beginning] is the start [of six months only, from Tishrei]; and it will begin [the count from] year 18 [י"ח] of the cycle, [and there is no remainder]. And when you know the reckoning of the years...

This is the way to do it. If you are standing at the end of the cycle [מחזור] and you wish to know the tekufah [תקופה] of Nisan, then know the head of the cycle, for this tekufah falls before the molad [מולד] of Nisan by 9 hours and 642 chalakim

[תרמ"ב; chalakim, 1/1080 of an hour]. So subtract these hours and chalakim from the molad of Nisan, and you will find that the tekufah falls 29 days, 50 hours, and 121 chalakim [קכ"א] after the molad of Adar.

But if you are not seeking the tekufah of Nisan for the head of the cycle, then know how many full years from the head of the cycle you must reckon. For each year take 10 days, 21 hours, 131 chalakim [קל"א], and 48 regaim [ח"מ; regaim, 1/76 of a chelek]. Sum up the regaim, and make of them chalakim — 76 regaim to a chelek — and add them to the chalakim; keep the remainder of the regaim that did not complete a [full] 76. Likewise sum up the chalakim, make of them hours, and add them to the hours; keep the remainder of the chalakim that did not complete an hour. Sum up the hours, make of them days, and add them to the days; keep the remainder of the hours that did not complete a day. Sum up all the days, and from the remainder take out the 40 hours and 642 chalakim [תרמ"ב] that you kept — these being the amount by which the tekufah precedes the molad at the head of the cycle — and there will come up in your hand the distance [marchak] of the tekufah.

If in this distance there is not the measure of a [full] month of the moon, this can happen to you in two of the years. It may fall at the end of the first year: when you are seeking the tekufah of Nisan for the second year, you will know that the tekufah falls in the month of Nisan, and this distance is the distance of the tekufah from the molad of Nisan. And it may fall at the end of the second year: when you are seeking the tekufah of Nisan for the third year, you will know that it falls in the month of Adar Sheni [Second Adar] — because that year is a leap year, and there is no measure of the intercalated month in the surplus of those years — and the distance will be the distance of the tekufah from the molad of Adar Sheni.

But if there comes up in your hand more than [one] month, then know how many lunar months are contained in it, subtract them from it, and keep the remainder; this is the distance of the tekufah from the molad. If the months you subtracted are fewer than the intercalated months [chodshei ha-ibburim] that have passed in the cycle, then know that the tekufah of Nisan falls in Adar [Sheni]; and if the months equal the number of the intercalated months, know that the tekufah falls in Nisan. There is no need to say that, if the months are more than the intercalated [months] — for this cannot occur, and you will always find the tekufah of Nisan, in every leap year, falling in Adar Sheni, and in every common year falling in Nisan, except in two years alone, namely year 1 and year 9.

When you know in which month the tekufah falls, then know the molad of that month, add to it the hours and chalakim you kept, and from them you will know the day of the tekufah — that is, the day of the week and the days that have passed of the month — just as I showed you in the reckoning of the tekufah of Shmuel [Samuel the Amora, 3rd c. CE].

When you know the tekufah of Nisan and come to find the tekufah of Tammuz, add to the distance of the tekufah of Nisan 2 days, 16 hours, 300 chalakim [פ"ש], and 31 regaim [ל"א], and there will come up in your hand the distance of the tekufah of Tammuz in that year from the molad of the fourth month from the month of the tekufah of Nisan. If, with this addition, the distance of the tekufah of Tammuz exceeds [the measure of] a lunar month, subtract from it [one] lunar month, and the remainder will be the distance of the tekufah of Tammuz from the molad of the fifth month from the month of the tekufah of Nisan — as if the tekufah of Nisan had fallen in Adar [Sheni] and the distance had not stretched to [a full] lunar month, as in year 1 and year 9, when the tekufah of Tammuz will be in Sivan. But if the distance adds [up] beyond the measure of a lunar month, the tekufah of Tammuz will be in Tammuz; yet if [the tekufah of Nisan was] alone in Nisan, the tekufah of Tammuz will be in Tammuz, and the distance does not stretch to [the next] lunar month. When you know the month of the tekufah of Tammuz, follow with its distance the practice you followed for the tekufah of Nisan, and you will know the position of the tekufah by the days of the week and of the month.

Do likewise if you are seeking the tekufah of Tishrei, except that you add to the distance of the tekufah of Nisan 5 days, 10 hours, 600 chalakim [פ"ת], and 62 regaim [ס"ב], and the tekufah will fall in Elul or in Tishrei. And if you are seeking the tekufah of Teves, add to the distance of the tekufah of Nisan 8 days, 3 hours, 901 chalakim [תתק"א], and 17 regaim [י"ז], and conduct yourself with them by the practice you followed in the tekufah of Tammuz and Nisan; the tekufah will fall in [Kislev or Teves, as the table shows].

[The tekufah will fall] in Kislev or in Teves, or in its [proper place]. This is the method of the reckoning of the tekufot according to the words of R. Adda [bar Ahava]. Now I have drawn up for you four tables: I have entered into them the distance of the four tekufot from the molad of the months by which they fall, for every year of the cycle. By means of these tables you can know the day of the tekufah and its position for whatever year you wish. If you seek the tekufah of Nisan, look it up in the table of the tekufah of Nisan; the tekufah of Tammuz, in the table of the tekufah of Tammuz; and likewise for the two remaining tekufot,

seek them in their tables, in whatever year of the cycle you wish. You [will then have] the distance of the tekufah from the molad of the month written before you for that year, and you need not compute it — only [take] the molad of the month and combine its hours and chalakim with the hours and chalakim found in the distance of the tekufah you are seeking. You will find the day on which it falls in the week, and how many days of the month have passed — for any tekufah, in any year you wish, and in every cycle of the days of the world.

This tekufah is built upon the mean motion of the sun [מהלך החמה השוה], and between it and this [mean] motion there is no difference at all. Everyone who computes the tekufot by this reckoning will be able to discern the lengths of the days and the nights: he will know that on the day of the tekufah of Tammuz, according to R. Adda, the day begins to shorten and the night to lengthen, and on the day of the tekufah of Teves the day begins to lengthen and the night to shorten; likewise the day and the night are nearly equal at the tekufah of Nisan and of Tishrei — before Nisan and after Tishrei — by one fixed measure that neither adds nor subtracts, ever, in all the years of the cycle. They are about two days, which is the motion of the sun through two chalakim of the parts of the firmament [chelkei ha-rakia] — these being the distance of the center of the sphere of the sun from the center of the earth. And in every single cycle there is no variation through all the days of the world, neither addition nor subtraction to the reckoning you compute. This tekufah testifies to the soundness of the science of the lunar cycle [chochmat machzor ha-levanah] that our Rabbis, of blessed memory, transmitted to us. This is a sign for you that the [reckoning of the] sun, and the lunar cycle, was handed down to Moshe at Sinai, as it is a tradition in our hands.

The Four Tekufot of R. Adda bar Ahava

[The two tables below sit side by side on the source page, reading right-to-left: the tekufah of Nisan on the right, the tekufah of Tammuz on the left. Each is indexed by the year of the 19-year cycle (rightmost column, Hebrew letter-numerals א-יט). The column "after the molad" (אחרי מולד) names the month whose molad is the reference point; the remaining columns give days (ימים), hours (שעות), chalakim (חלקים), and regaim (רגעים). Column order below follows the source logical order: days · hours · chalakim · regaim · month.]

Tekufah of Nisan [תקופת ניסן]

Table reads right-to-left in source; rendered L→R below.

Year	Day s	Hour s	Chalakim	Regai m	After the molad of
(1) א	29	3	151	0	Adar
(2) ב	10	11	559	48	Nisan
(3) ג	21	8	681	20	Adar Sheni [ואדר]
(4) ד	2	17	9	68	Nisan
(5) ה	13	13	921	1	Nisan
(6) ו	24	11	253	12	Adar Sheni
(7) ז	5	19	661	60	Nisan
(8) ח	16	16	783	32	Adar Sheni
(9) ט	27	13	905	4	Adar
(10) י	8	22	233	52	Nisan
(11) יא	19	19	355	24	Adar Sheni
(12) יב	1	3	763	72	Nisan
(13) יג	12	0	885	44	Nisan
(14) יד	22	20	1017	16	Adar Sheni
(15) טו	4	6	335	64	Nisan
(16) טז	15	3	457	36	Nisan
(17) יז	26	0	579	8	Adar Sheni
(18) יח	7	8	987	56	Nisan
(19) יט	18	6	29	28	Adar Sheni

Tekufah of Tammuz [תקופת תמוז]

Table reads right-to-left in source; rendered L→R below.

Year	Day s	Hours	Chalakim	Regaim	After the molad of
(1) א	2	7	738	31	Tammuz
(2) ב	13	4	860	3	Tammuz
(3) ג	24	1	981	51	Sivan
(4) ד	5	10	310	23	Tammuz
(5) ה	16	6	930	69	Tammuz
(6) ו	27	4	553	43	Sivan

Year	Day s	Hours	Chalakim	Regaim	After the molad of
(7) ז	8	12	962	15	Tammuz
(8) ח	19	10	3	63	Sivan
(9) ט	0	18	412	35	Tammuz
(10) י	11	15	534	7	Tammuz
(11) יא	22	12	655	55	Sivan
(12) יב	3	20	1064	27	Tammuz
(13) יג	14	17	105	75	Tammuz
(14) יד	25	14	227	47	Sivan
(15) טו	6	23	636	19	Tammuz
(16) טז	17	20	757	67	Tammuz
(17) יז	28	17	879	39	Sivan
(18) יח	10	2	208	11	Tammuz
(19) יט	20	23	329	59	Sivan

Tekufah of Tishrei [תקופת תשרי]

Table reads right-to-left in source; rendered L→R below.

Year	Day s	Hours	Chalakim	Regaim	After the molad of
(1) א	5	0	1038	62	Tishrei
(2) ב	15	22	80	34	Tishrei
(3) ג	26	19	201	6	Elul
(4) ד	8	3	610	54	Tishrei
(5) ה	19	0	154	24	Tishrei
(6) ו	29	21	853	74	Elul
(7) ז	11	6	182	46	Tishrei
(8) ח	22	3	304	18	Elul
(9) ט	3	11	712	66	Tishrei
(10) י	14	8	834	38	Tishrei
(11) יא	25	5	956	10	Elul
(12) יב	6	14	284	58	Tishrei

Year	Day s	Hours	Chalakim	Regaim	After the molad of
(13) יג	17	10	406	30	Tishrei
(14) יד	28	7	528	2	Elul
(15) טו	9	16	936	50	Tishrei
(16) טז	20	13	1058	22	Tishrei
(17) יז	1	22	386	70	Tishrei
(18) יח	12	19	508	42	Tishrei
(19) יט	23	16	630	14	Elul

Tekufah of Teves [תקופת טבת]

Table reads right-to-left in source; rendered L→R below.

Year	Day s	Hours	Chalakim	Regaim	After the molad of
(1) א	7	18	259	17	Teves
(2) ב	18	15	380	65	Teves
(3) ג	29	12	502	37	Kislev
(4) ד	10	20	911	9	Teves
(5) ה	21	17	1032	57	Teves
(6) ו	3	2	361	29	Teves
(7) ז	13	23	483	1	Teves
(8) ח	24	20	604	49	Kislev
(9) ט	6	4	1013	21	Teves
(10) י	17	2	54	69	Teves
(11) יא	27	23	176	41	Kislev
(12) יב	9	7	585	13	Teves
(13) יג	20	4	706	61	Teves
(14) יד	1	13	35	33	Teves
(15) טו	12	10	157	5	Teves
(16) טז	23	7	278	53	Teves
(17) יז	4	15	687	25	Teves
(18) יח	15	12	808	73	Teves

Year	Day s	Hours	Chalakim	Regaim	After the molad of
(19) יט	26	9	930	45	Kislev

The Fifth Gate [השער החמישי]

On which of the two tekufot [calculations] this lunar cycle was instituted

You can understand this matter from the reasons set out in the gates that have already passed. But because most of the learned authors, on account of the intercalation, and the investigators into its secret, have spoken of this matter — each of them giving a reason unlike his fellow's reason — I have seen fit to expound this matter according to my own opinion, and afterward to make known their reasons that have come down to me. I say: the intention in the lunar cycle was to equate the solar year with the lunar year, so that the surplus [ha-motar] between them might be consumed in the intercalated months. We see, according to the words of R. Adda bar Ahava, that the surplus between the two years is consumed and added up at the end of every cycle, and the years for the sun and the moon turn out equal as one. But according to the words of Shmuel, we find between them 1 hour and 485 parts [ותפ"ה] in every cycle, [a surplus] that remains over for the moon. This surplus, from the Exodus from Egypt down to the end of cycle 257 [רנ"ז] — in which we now stand — amounts to 7 days, 17 hours, and 520 chalakim [תק"כ]. This surplus is thus more than a twelfth of the measure of the tekufah, if we reckon it from the Exodus from Egypt. And were we to reckon it from the Creation of the world, it would be 15 days, 12 hours, and 445 chalakim [תמ"ה], which is more than a sixth of the measure of the tekufah.

It is known that, in the time when the Temple stood, our Rabbis, of blessed memory, used to intercalate the year on the basis of many signs [simanim], as they said: "We do not intercalate the year except

[Continuation of Maamar Shelishi, Gate Five — the Talmudic criteria for intercalation, in progress from the previous page.]

they recite over it [the prayer] later in the day, and the one who delays it beyond its proper time. But if one recites the Shema before the rising of the sun, we do not say of him that he transgressed the commandment and sinned. Likewise we are permitted to say the blessing over eating [the food], up to the tekufah of Teves, even though one is not keeping the commandment [in its proper season].

So too with unleavened bread [matzah]: he fulfills the commandment of matzah, but he does not perform the Pesach in its [proper] time.

And if you should object: "Did our Rabbis, of blessed memory, not say at the time of the [Hadrianic] persecution [שמד] that...?" — those of whom it was decreed that they should not intercalate were prevented [by force], for they were under compulsion, and were coerced not to intercalate among themselves and not to keep their appointed seasons. But [in the matter of] how Pesach is called "in its time" — and they made it [fall] within the tekufah — our Rabbis, of blessed memory, said only: "to keep the tekufah of the spring [aviv], so that the tekufah should fall within the renewal of [the moon, i.e. the new month] of Nisan." And how can it be said that "our Rabbis, of blessed memory, transmitted to us" a tradition that brings upon us any doubt? "This is nothing other than a willing heart" [cf. Shemos 35:5]. And all these objections and the [resulting] doubts are brought upon us only [if we hold] that Shmuel's tekufah is the essential one [reckoning] and rely upon it. But if we say that the tekufah of R. Adda is the essential one, every difficulty is resolved and the doubts are dispelled, and you will find the intercalations [עיבורים] proceeding in their proper order and according to their rule, and no one can find any flaw in them.

For consider: in the **eighth** year of the cycle [מחזור], when the distance of the tekufah from the molad reaches its furthest remove — up to **16 days, 16 hours, 783 parts** [chalakim, תשפ"ג], which are more than **sixteen** [שיתסר, i.e. past the sixteen-day threshold] in the [new] month — we intercalated the year. **And in the sixteenth year of the cycle, when the distance of the tekufah from the molad was 87 days [פ"ז], 3 hours, and 457 parts [תנ"ז], 3 chalakim [ג'] — we did not intercalate** [לא עברנו], because the remove had not reached sixteen [שיתסר] in the [new] month. And by the words of R. Adda you never find the second day of Pesach falling before the tekufah of Nisan, nor the eighth day of the festival falling before the tekufah of Tishrei — the tradition which our Rabbis, of blessed memory, transmitted to us. And you see from this that the tekufah of R. Adda bar Ahava is the essential one [reckoning].

* And there is yet another way: the Sages of the nations [also] inquired by it. [The matter] was transmitted into their hands [by] a clearer [proof] than this measure, established and explained in the second Maamar. Nor were all the Sages of the nations and their ancients able to rely on the true [length] of the lunar month except after great toil; only after great toil did they arrive at the truth of [the length of] the lunar month, by a long and difficult inquiry. And in the end, all their inquiries relied upon the measure that was transmitted into our hands; and

likewise we find no [grounds] to say [otherwise] in [the matter of] the measure [that was] transmitted into our hands. And so too they inquired into the measure of the solar year — but the true [length] of its measure was transmitted to them just as [the measure of the lunar month was]. And we find the measure of the solar year, according to the words of the Sages of the nations who investigated it — that all its days are **365 days [שס"ה] and a quarter of a day, less one part [chelek]** of a day out of three hundred [parts] in a day, approximately; thus they said in their words. And this measure, by our reckoning, is **365 days [שס"ה], 5 hours, and 993 parts [תתקצ"ג chalakim], and about 46 regaim [מ"ו רגעים]**. And the words of R. Adda [give] **4 parts [chalakim] and 2 regaim** in every year. And this remainder which is between them would not gather one day except after **six thousand years and about four hundred and forty years** [ארבע מאות שנה]; and it would have been fitting for this measure to be disregarded on account of its smallness. And because the Sages of the nations could not arrive at it precisely, they said "less" [i.e. "a quarter less," in approximation], and so, approximately, [their reckoning] is the same [as ours]. And it sufficed us, in all these arguments, to show that the tekufah of R. Adda bar Ahava is the essential one in the secret of intercalation [סוד העיבור]. *

And so too R. Isaac bar Baruch [R. Isaac bar Baruch], of blessed memory, said: "[Those who] reckon the [reckoning] of the sun are to be counted among those who reckon according to the words of Shmuel." The secret of this matter — know that there does not remain at the end of [a] cycle [anything], according to the opinion of Shmuel. And the proof of this matter: the words of R. Adda bar Ahava in [their] modesty [reckon] and the tekufah of Shmuel [reckon] openly. And you see from this that the tekufah of R. Adda — which they kept hidden, and did not wish to reveal — was the precise [reckoning], and that on its secret intercalation depends; and upon it our Rabbis relied, [as] R. Isaac bar Baruch, the dayan [judge], of blessed memory, said: "It is comparable to most people..."

[There follows a passage developing the contrast.] ...in the cycle, [there is] no excess of the moon over the sun, just as there remained between this [reckoning] — these are his words, that they said: "There are two tekufot — the tekufah of [R. Adda hidden] and the tekufah of Shmuel openly [b'farhesia]." And you see from here that...

and that the tekufah of Shmuel [was reckoned] openly [b'farhesia], because of the great [reliance...]; and today we no longer need to refine the [exact] moment of the tekufah. By the established way that we reckon it, [the tekufah of R. Adda] — we have no [way of] questioning it, and it is no great commandment that we

should be innovating about it; and there is no agreement upon it [concerning] a time that is not variable, as is explained in the chapter "From what [time] do they inquire" [Talmud, Sanhedrin? / Mishnah on this subject]. And in the books of the ancients, [it says] that he said: "I asked my Rabbis — why? They said to me: 'Because everything that is to be in the world is dependent upon the molad and the tekufah'; and the Sages were apprehensive lest a man arise [who would alter it]." And I incline with all my heart to this matter, and it is known that it is in the wisdom of the tekufah of R. Adda — in which there is no [doubt] — that is the true [reckoning]. * And the words of those who err and of the heretics [minim], which are sometimes [reckoned] before the tekufah and sometimes after it — these are the words of R. Isaac bar Baruch, may his Rock keep him; and [so are] the words of Mar Hasan, may his Rock keep him, in his composition [chibbur]. But the Great Gaon [Saadia], by another path, composed a book to refute [these], [those] who objected against us concerning this halacha. And this is it:

"The Rabbis taught [tanu rabbanan]: We do not intercalate [the year] except..." [— a baraita on intercalation criteria]. The tekufah is deficient [by] most of [a] month, and as much as most of the [renewal? by] two days into the [new] month, [as] R. Yose says: "I reckon sixteen [י"ו]..." [and] as much as [in the matter of] its smallness fourteen [יד]. And he said: "This category [min]..." — by [some?] four measures: 14 [יד], [כ"א] 21, [כ'] 20, [י"ו] 16. As much as what...[and how] were they divided in a matter in which they [were] reckoning...?" He said, "There is in this no division between them; but all who reckoned upon it at first — when it came out [on] the 14th of Tishrei [ב'י"ד בתשרי]..." they reckon until the building of the First Temple [bet rishon]; the excess arises [in such-and-such of] days. They returned to count from the First Temple, [from] the 11th [ל"א] of the [new] month, counting until [the year] in which the Mishnah was written — [the interval being] in keeping with 130 years [ק"ל], 1 hour [שעה], and 485 parts [chalakim, תפ"ה] before [the holiday?], up to twenty [ע"ר עשרים] into the [new] month — and that is the measure of the fourth [tekufah], up to the 22nd [כ"ב] of the [new] month, which is the end of the days of the holiday, [the] fifth [day?], for we are confident in their form, that he [the sun] arises...

[The passage continues, weighing the two camps.] ...[the excess] of 130 years [ק"ל], 1 hour, and 485 parts [תפ"ה] up to twenty into the [new] month, and that is the measure up to the fourth [tekufah]; up to the 22nd [כ"ב] of the [new] month, which is the end of the days of the holiday, the fifth [day], for we are confident in our form, that he [the sun] arises, so that the tekufah of the intercalation [תעבור] should not pass beyond the days of the holiday. These are the matters [discussed by] the heretics [minim], and to dispel them is the practice

of the [proper] response — if it seems good to one to break their words. [That excess] falls in the days of our Rabbi Saadia [Saadia Gaon], on the 25th [בכ"ה] of Tishrei and on the 16th [בכ"ו], and [it does not pass] beyond the days of the holiday; but it was rather his will to dispel [these claims], and not to reveal his opinion concerning the secret of intercalation [סוד העיבור]. And if you see matters of this kind, let no doubt arise in your heart; and let it be for you [a means of] dispelling the words of those who object and protest. But it shall be [established] by the reckoning of our appointed seasons; on this day [there is] no doubt at all, and no [tradition] in it — in the days of Moshe our Teacher, peace be upon him. And this is the reckoning, by which in every cycle nothing avails [to alter] and nothing harms...

by every cycle nothing avails and nothing harms.

But the one who delves into the matter knows that the tekufah was [on] the 25th and 26th of Tishrei [?], and how can one say that the tekufah of the intercalation does not pass [beyond]? — [this is the means of] dispelling the words of that wicked man against whom — and not [against] his father... And if you see [this] in [the words] of one of the Sages and the Geonim, let no doubt arise in your heart; and know that they are spoken by way of example. But it shall be [demonstrated as] reasonable to you, and held fast in your hand, that there is no [error]... and no tradition of those things [in which] they were established — by the reckoning that they reckon [as] 1 hour and 485 parts [תפ"ה] in parts, [which] neither avails nor harms in the establishment of the appointed seasons.

Gate Six [השער הששי]

On the reckoning of the sabbatical and jubilee cycles [בחשבון השמיטים והיובלות]

Because I saw that all the authors who composed [works] on intercalation [עיבור] [and the sabbatical years and] jubilees conducted their practice and proceeded by their [own] way, [and the men of] Israel were counting toward the jubilee from the time that they took hold of their portions [in the Land] — [in] three respects: From the time they entered the Land they did not count until [they had completed apportioning it]; after fourteen [יד] years from when they had entered it, [the counting began], for seven years they conquered and in seven years they apportioned [the Land], as is explained in tractate Arakhin. And they entered the Land in the year [2488 AM, in the second?...], and at the end of the year 2452 [אלפים תנ"ב — recte 2482 תפ"ב? see anomaly] the cycles [began] to

count sabbatical years; and in the year 2459 [ב' אלפים תקנ"ט] they sanctified the first jubilee... [See note: the values across this seam are difficult to align — flagged.]

Because I saw that all the authors who composed [works] on intercalation [עיבור] proceeded by their [own] way to explain this reckoning, I [shall] also say: Because they took hold of their portions in the Land and this reckoning was changed in their hands — they did not begin to count until they had apportioned and completed the dividing up of the Land — for seven years they conquered and in seven years they apportioned [the Land], at the time that he [Joshua] entered the Land in the year 2488 AM [ב' אלפים תפ"ח — to the creation of the world]; [they began] to count sabbatical years and jubilees. And [Israel] counted its first sabbatical [year] and its first jubilee in the year 2552 [ב' אלפים תקנ"ב], which was the year of the jubilee from the [reckoning of the] count; and they sanctified the second jubilee in the year [...] until [the tribes of] Reuben and Gad went into exile; and these were...

toward the jubilee, just as it was said: "the [tribes of] Reuben and Gad and the half-tribe of Manasseh went into exile in the [jubilee], as it is said: 'and you shall proclaim liberty [throughout the land]'" (Vayikra 25:10), "at the time that all its inhabitants are upon it" — but they were not sanctifying the jubilee [unless] it was the year of the jubilee arising [in due course?]. He says: the fiftieth year [שנת חמשים] arises here and there [i.e. on both sides of the count], and [it] was completed [נמשך] in the year 3037 AM [ג' אלפים ל"ז — recte 3038 — see anomaly]. The First [Temple was built] in the year 3038 [ג' אלפים של"ח — recte? see anomaly], when they entered the Land [a] second time and began to [build the Second Temple — no:] the [count] of the jubilee in [the second...]; [it was] in the days of Ezra, at their entry, in the days of Joshua...

[The passage develops the counting of jubilees across the two Temples.] ...and [jubilees], and they sanctified the walled cities and became obligated in the tithe; and [in the days of Ezra] they sanctified the walled cities and became obligated in the tithe. They [did this] because not all its inhabitants were upon it; and they began to build the Second Temple in the year 3[...] AM [ג' אלפים...]; [the men of] Israel counted sabbatical years and jubilees. And if you ask [about] the years — that our fathers were counting at first when they entered [the Land] — count [thus]:

[Reckoning rule:] ...explicitly, from the count of the years that you count for [the jubilee]: fifty, and whatever remains in your hand, if it be [the number of years remaining in a jubilee] — [that] is the jubilee, [as it is] in their reckoning. And if it

is less than fifty, and they all be — every seven of them is one sabbatical [shemittah], and what remains from the week of the [next] sabbatical that is coming. [Proceed] in this matter in this way:

From the year 3042 AM [ג' אלפים תק"ב — recte? see anomaly] they began to count toward the jubilee, and when there remained from the count the beginning of the hundredth year [שנת המאה]; two years and the rest of the reckoning is clear to you:

* And if you wish to count toward the jubilees that the [tribes of] Reuben and Gad [reckoned]: the sanctified jubilee is taken — take from every hundred [years] that is in your hand as if it were taken as one year for every fifty [years]...

in the year 3038 AM [ג' אלפים תל"ח — to the creation of the world] in all three of these times. And if you wish to count toward the sabbaticals and jubilees by [this] count — [from when] they entered the Land and sanctified the jubilee — then count toward the creation of the world by two-year [units]: and bring out the whole [sum]: if there be fifty, know that that year is the year [of the jubilee]; and if there remain in your hand fifty, [reckon its] parts [chalakim] into sevens, [for] seven [years] are one [sabbatical], and what remains [if it be] less than seven — these are the years entering [the next cycle]. This matter shall be [reckoned] in your reckoning, and its meaning is that in the year [...] of the jubilee, and when it [the count] draws onward from this number, you will find years [reckoned] toward the hundred; and therefore you redeem [the count] forever, [by] the order of Seder Olam.

and the reckoning is clear to you:

[A further rule for the Reuben-and-Gad count:] ...[the tribes of] Reuben and Gad, who were counting toward the sabbaticals and [jubilees], and [count] that which is in your hand toward the creation of the world by two-year units for every hundred... [text continues across the page].

Gate Seven [השער השביעי]

[The body description — verso of the gate heading reads:] On the division that exists among the Sages concerning the beginning [of the world's reckoning — בחלת בריאת עולם].

It is already known that according to the opinion of the Sages, the consensus [is] that the world [was created — that the molad of Nisan]: this was on the night of the fourth [day], 22 hours [כ"ב שעות], 642 parts [chalakim, תרמ"ב]. And here the

Sages divided concerning the intercalation [עיבור]. There are among them [those] who began [the count of the molad from] Nisan, and said: "After it [we] reckon the [new] year," and every [...] of it [is] less than the molad of Nisan; this [is] 2 days [ב"ד], 138 [תל"ח? — recte 438 תל"ח], which is a sign [siman]... [given] into their hands [is the formula] 5 hours [ה' שעות], 204 parts [chalakim, ר"ד], [which is] the second [molad], and this is for them [the molad of] BaHaRa"D [בהר"ד]. And upon this reckoning all the men of the [western?] lands reckon: in the evening [maariv], and they intercalate in the cycle [the months?] by the sign [siman] [so that the renewal] does not fall [before] these six months; and they began to count [the molad] from when the world was created. And because this [reckoning] adds to it six months in the time [of...]; and [the count] arose in their hands [from] the molad of Tishrei that is after this Nisan [— this is reckoned as 14? י"ד...] — and they began to count by the order of the world [by] this [molad of] Tishrei. And these are the [men], and the years [reckoned] in the cycle [are] BaHa"Z [בהו"ז] = Monday/Tuesday, 7? — siman]. And between them and the [other camp]... And this division does not bring any doubt into the reckoning of the appointed seasons. And there are among the earliest [authorities those] who were apprehensive lest doubt arise. Saadia [Gaon], of blessed memory, [recorded the] memory of this division in his composition called the Sefer HaHakhara [ספר ההכרה — The Book of Distinction], [whose] words contain the explanation of this matter; "the [reckoning of] this year [is the one] upon which we stand."

[The body — opening of Gate Seven, continued across the seam:] ...because the world was created at the tekufah of Nisan, and the molad of Nisan [was on the night of the fourth day, 22 hours, 642 parts [תרמ"ב]], and we count [the head of the year — Rosh HaShanah] from Tishrei. [There are among them those] who began to count from Tishrei, which was before [Nisan]... [for] a year, and all the more so [reckoning] six months — and because that is a sign [siman] of six months in the [moladot of the] new moons; and there arose for them [a] molad of Tishrei which was before Nisan. And concerning all these men of the lands, who are the men [of the east?], they reckon upon the sign [siman] GU"Ḥ A"D Z"Ṭ [גו"ח א"ד ז"ט — the siman], and there are among them [those] who began to count from the [molad of] Tishrei that comes after this Nisan, [the] second [Nisan?]... and [they reckon] the six new moons by the moladot upon the molad of Nisan, [so] that after this Nisan [it is] 14 [י"ד], and these hours complete from the sixth day [מיום ששי]; and these are the men of the east, and they intercalate the [year]... and [those] between them, and [those who are] men of the west [reckon] by a reckoning of a different year, in [their] reckoning — not by the [established] intercalations of the years and not in [a] fixed [manner]... lest doubt arise. And we found the Gaon R. [Saadia] in his composition called the Sefer HaHakhara

[ספר ההכרה], and he said in the Arabic tongue: "[as for] this year on which we stand, [we are reckoning] from it...".

today is the year 1238 [רל"ח] of the kingdom of Alexandria [the Seleucid era], which is the year 4686 [ד' תרפ"ו] from the creation of the world according to our reckoning. But there are others who reckon today as the year 4687 [ד' תרפ"ז] from the creation of the world. Do not let this trouble you that this reckoning [might] be correct, for our predecessors handed down to us a tradition that between Seder Olam and the kingdom of Alexander there are, by single units, some years; some say [the discrepancy is] two years [שני שנים]. And you will find that between [the remainder of] 8 [ח'] years — which are [the figure of] the others — at the year 1238 [רל"ח] of the kingdom of Alexander, and [the remainder of] 390 [ש"צ] years — which are [the figure of] the others — at the year 4686 [ד' תרפ"ו] from the creation of the world according to our reckoning, [there is a difference of] two years [שתי שנים].

This is according to the words of our predecessors, and there is no [substantive] disagreement among them in the reckoning of the later [authorities]; rather [the difference is that] one [reckons] a year that is not according to the words of [the other] — that is, the others reckoned it less by one year, or one camp said the year was less than the other, [a difference] reduced from the count of years in Seder Olam [סדר עולם]. And were it [otherwise], we would have to examine these matters [to determine] how they stand.

These are the words of R. Saadia [ר' סעדיה ז"ל], of blessed memory. And our master Rav Hai Gaon [רב האי גאון], of blessed memory, [explained] that this matter is set out explicitly in [his work], in the Assyrian tongue [i.e. Hebrew], from the beginning of the question to its end. [It is] a question put to him, on which he reconsidered the matter and said that he had seen it several times. This reckoning is one that was not in our hands from [the days of] the first man [Adam], and we do not know how the first man performed it; and thus I say —

[Filipowski's note: this concerns] why one returns [in the reckoning] to compute from [the molad] BaHaRa"ד [בהר"ד] — and these [variant figures] are not exact. Know that this reckoning is one that was not in our hands from the days of Adam, the first man, and we do not know in the days of Adam the first man how it was done. And thus I say: [?]

Here is the wording of the question put to Rav Hai, of blessed memory, that this matter is explained in [his responsum], from the beginning of the question to its end. This is a question concerning [the reckoning], and [Rav Hai] said that he had

seen it several times: this reckoning that is in our hands is not from [the days of] the first man, and we do not know in the days of Adam the first man how it was done. And thus I say that the secret of this matter [the secret of intercalation] — [namely] that Moshe Rabbeinu [Moses our teacher] taught it to Israel — its root was [transmitted] by the mighty ones from the days of Adam, and until [?] that time [it was preserved], even though [?]; for [some say] it preceded [the others], and others [say it came] after. When you join this matter [to the question of] when this reckoning was instituted in the days of Moshe Rabbeinu, even though it was not given to them [explicitly], — yet [the answer is]:

When you arrive at understanding the basis [of the matter] in the days of Moshe Rabbeinu, [you may ask] whether it was already in existence [as a reckoning]; and [the answer is] that they [the Sages] had a tradition reaching back to [the time] when the Sanhedrin was in existence, from whom they had [received] the reckoning [?]. That is to say: at a time when [the months] are not yet distant from the [solar] tekufah [תְּקוּפָה], and if the father [of the court does not] [?] — [this is] the order of the reckoning, as it is taught in the baraita: "On three signs [simanim] [a year is intercalated]." And concerning the tekufah, and concerning the ripening of the fruit of the trees, and on [the basis of] all three of them — together with [the position of] the moon — [the court intercalates the year].

And we know that the earliest [authorities] already grasped, in the reckoning, the [solar] tekufot for every cycle [מחזור], and the cycle [מחזור]. They grasped, for every cycle, [the value] B"YV [בי"ו, recte 12 = בי"ב] [for the] tekufah [?], even though [?]; and this concerns the earliest years from [the days of] Moshe Rabbeinu, and also [reckoning] from the year 1270 [תר"ע] of the [Seleucid] contracts [למנין שטרות / the reckoning of contracts]. When you hear of this, do not let it trouble you, for it is no error: this reckoning was in their hands, because at the end of the earliest reckoning they were learning the Seder Olam [סדר עולם] from this reckoning. For every [authority] of the ones who reckon [it] computes from [a slightly different epoch] [?], and his name [?] is the essential [count], which is the one closest to [the truth].

It was in their hands [as the end of the reckoning], because at the end of the first reckoning they were learning the Seder Olam from this reckoning. For every one of those who reckon counts from a [slightly different epoch], and what is essential is whichever is closest to [the truth]: that there was neither deficiency nor excess [in it], and they were accustomed to intercalate according to [it]. For the sake of the intercalation of the year, this cycle was brought near [adjusted], and the leap year [שנה כבושה] was begun, and they were accustomed to [the simanim] AD"U

[אד"ו] [and] PB"H [פ"ב ה"ז, the molad-siman] [?] — to show the disciple how we bring near the year of the moon [שנת הלבנה], and again [how] to set up one foundation [from which] to understand the matter — and they were accustomed to [the siman] G"NG GB"G [ג"נ גב"ג, the leap-year-distribution siman] [?]. And in all this, [the matter] does not [come to error].

For along this way, since R. Eliezer and R. [Yehoshua] divide [in their views], — when the world was created [in Nisan or in Tishrei] — and our Rabbis, the Sages of Israel, count the years [from creation], and the explanation of "Flood" [מבול] stated here [refers] to "years," that is — [?]

R. Yehoshua [ר' יהושע] says: in Tishrei the world was created [נברא העולם]; [the count runs] until the Flood, according to R. Eliezer; for the tekufah [reckoning], according to R. Yehoshua. And the explanation of "Flood" stated here [is]: to reckon the tekufah by the count [of years], and the molad of the years from Tishrei. — That is, [the matter is that] before [the molad of] Tishrei, according to R. Yehoshua, [stands its position]. And from where do we count [?] — for as 2 in Adar [בכ"ב באדר], at the beginning of the night of the 4th [day] [?].

[The figure for] this [molad] is the tekufah of Nisan, and it is the position of the reckoning of the sun [חשבון החמה]. And after 642 chalakim [תרמ"ב חלקים] was the renewal [the molad] of that Nisan; [it] is found to be on the night [of the] 4th [day] [at] 9 hours [ליל רביעי ט' שעות], and you [arrive] at his position. And from there, with the addition [of the standard offset] B"D TL"Ḥ [2, תל"ח, 2 days 438 chalakim], [we reach] the beginning of the third hour from the day of the sixth [day], which is the renewal [molad] of Tishrei — its position from which we do not reckon now. Therefore the molad of Tishrei [stands as it does] — for we grasp [it by] the wholenesses [the complete cycles] of the years, which exchange [one into another], in the manner that [follows]:

We grasp [as the count] 3 [thousand], 448 [ג' תמ"ח] with the year 303 [שנ"ג], to see their excesses. To reckon the tekufah of Nisan of that very year — since it stands [there] — we are asked [to find it], and we seek [it]: the tekufah of Nisan of [Adam] [?], as if it were Nisan of the year 304 [שנ"ד]. And we need to grasp [this].

Therefore, when they saw that some of these reckonings [were given] with this variation, [the students] learning and beginning upon them [were confused], because they did not see [the matter clearly]; [some] are seeing that there is [a discrepancy] [from] the year 303 [ש"ג] of the [Seleucid] contracts [מנין שטרות] up to the end of [the period]; and when they are taught it, [it is shown to] them. The

year 303 [ש"ג] grasps the year 303 [ש"ג], — and [for] the tekufah of Nisan of the year 304 [שנת ש"ד] upon them — set [it] for the learners as the prior position, [for] here it is the tekufah.

[The reckoning of] the sun: after the count, on it 9 days, 9 hours [ט' ימים ט' שעות] [?] — found [to be]: at 9 hours [and] 642 chalakim [תרמ"ב חלקים], the night [?] of [the] 4th [day, hour] TL"Ḥ [תל"ח], which is the portion [reached after] six months [מנת ששה חדשים מגיע]; — [it] reaches the renewal [molad] of Tishrei of the first year [שנה ראשונה], and it is [?]. Therefore, at the time we are not asked to know the molad [?] — that exchanges [one for another], as when we ask to know the molad of the year 303 [מולד שנת ש"ג], to see their excesses, [how] much they are; and when we come [?]: that before the molad of Nisan, [stands the molad] before Tishrei [?] — this is according to the words [?]. [The molad] of Nisan, [the one] after which is Tishrei, we see [it as] that [?] — we grasp [as the count] the year 1303 [אלף ש"ג שנים] with 3 [thousand], 448 [ג' תמ"ח]; this exchange comes to error and to false reckoning, to compute by [it] [?]. [Those] who see that there is in Nisan a beginning, [in fact] are [merely] seeing that [?] — its renewal [molad] [?].

If [we reckon] the molad of Tishrei of the year 303 [מולד תשרי דשנת ש"ג], we grasp [it] [as] 1303 [אלף ש"ג] together with 3 [thousand], 448 [ג' תמ"ח]; and if [we reckon] the tekufah of Nisan of the year 303 [תקופת ניסן דשנת ש"ג], we grasp [it as] 1303 [אלף ש"ג] together with 3 [thousand], 448 [ג' תמ"ח] — [by] the intercalation-sign [סימן עיבור] GU"Ḥ A"D Z"Ṭ [גו"ח א"ד ז"ט] — and the matter does not come to error. This matter is a position [established] for the disciples, [whereas] in fact [in] the order of the world [סדר עולם], the essence of the matters is not known. So whatever you hear of an exchange [of] the matter [?], or among [other] things, do not rely upon it; rather [rely] on what we have indicated and explained to you. And further, [the Sages] guard for the disciple [the rule that] after two years and a half [the molad] remains for the sun [the solar reckoning], so that [the disciple may] bring [it] near. For not everyone knows why one reckons a second year [as he does], in this reckoning of ours, for [the siman] BHZ"Ṭ GU"Ḥ [בהז"י גו"ח]; for it is so that there should remain, [as] the surplus for the sun, the [value] 485 [תפ"ה] hours which is left over of the sun from every cycle; [from] creation up to now. For behold we are near, in the molad, to the tekufah, [and] near [in] the cycle to what it was at first [in the very beginning]. And corresponding to the year 18 [שנת י"ח] —

the position of our reckoning [is the siman] BHZ"Ṭ GU"Ḥ [בהז"י גו"ח], — for it is so that there should remain, [as] surplus for the sun, the [value] 485 [תפ"ה] hours

which is left over of the sun from every cycle, [from] creation until now. For behold we are near, in the molad, to the tekufah, and the cycle [is near] to what it would be at first. And corresponding to the year 18 [שנת י"ח], we rely [on the tradition] that the redemption of Israel is near, [that there] will come a teacher of righteousness [מורה צדק] in our days and in your days.

[Filipowski's note — אמר המגיה:] These are his words, of blessed memory. And I have written them out because they explain the matter pertaining to this Gate, and they are grateful for the [explanatory] passages that have passed by in this composition. :

[the reckoning of] the year of the moon [שנת הלבנה] which already stood [at] [?] from every cycle, [from] that very hour which is the beginning [?] [of the] molad of the tekufah; and the more so in a second year [it stands] from [?] the year 18 [שנת י"ח], which is also itself a second [year], retroactively [?] [there] will come a teacher of righteousness [מורה צדק] in our days and in your days. This is the end [of the matter].

[Filipowski's note — אמר המגיה:] These [are points] which they explain regarding the matter of this Gate; and they are grateful for the [explanatory] passages that have passed by in this composition. :

השער השמיני — The Eighth Gate

[Heading, p. 3:] **The [Eighth] Gate** [השער השמיני]

[Sub-heading:] On the reckoning upon which we reckon for the Exodus from Egypt, and for the destruction [of the Temple], and how one knows [how to convert] one [reckoning] from the other:

All the affairs of the world, and the [Seleucid] contracts [שטרות], and the events that occur in these lands — we count them [dating] from the creation of the world. And there are places that are accustomed to [date] from the destruction of the House [the Temple], and there are some that occasionally are accustomed to [date] by the reckoning of contracts [מנין שטרות / the Seleucid era] — and that is the beginning of the kingdom of Alexander of Macedon [אלכסנדרוס מוקדון]. They called the beginning of his reign "the reckoning of contracts" [מנין שטרות], because he compelled all the nations and the kingdoms to be [subject] to him, [so that they began] to reckon [dates] by his reign. And we have found it written [in books] [?], and we come in this Gate to make known how many years there are between each one of these reckonings.

And I say: the reckoning of contracts [מנין שטרות], which is the sealing of the prophetic vision [חתימת חזון] — which was sealed in the days of the prophets Haggai, Zechariah, and Malachi [חגי זכריה ומלאכי] of the Second Temple [בית שני], and which is the beginning of the days of the Men of the Great Assembly [אנשי ג' אלפים] — [reaches], with the forty years after it, the year 3,450 [ג' אלפים] from the creation of the world, [the era] by which we reckon.

The beginning of the kingdom of Alexander of Macedon [אלכסנדרוס מוקדון] is the sealing of the prophetic vision, [the vision] sealed in the days of the prophets Haggai and Zechariah of the Second Temple, and it is the beginning of the days of the Men of the Great Assembly. [Counting] from the [year of the] world: between the creation of the world and the sealing of the prophetic vision, the complete years in our reckoning [לחשבונו] are 3,449 [ג' תמ"ט] — the molad-base BaHaRaD [בהר"ד].

[On this Seleucid epoch, the Talmud states:] R. Pappa said [אמר רב פפא]: even Tannaim [are uncertain whether] [?] [it is so] — and this is the count by which one reckons for [the era of] contracts. [As] R. Pappa [further] reckoned [?]: for the Tanna [the question is] how much was reckoned and how much remains [נטפי], [in order] to be stringent [?]; and "even a Tanna" [?] [means] R. Pappa [holds] [?] to ask of [the elder Sage] the Tanna how much [is the difference], and he found by it forty-eight [מ"ח / ארבעין ותמי], and the matter is settled for him so as to be stringent [לחומריה].

And these forty-eight [מ"ח] are the excess [העודפות] over [the] 3,400 [שלושה אלפים]; and the destruction of the Second Temple, [at which] the will [should have been] [?], was [in the year] 312 [312 = שי"ב] [?], and between us [now] and the reckoning of contracts [מנין שטרות], [it is] the year 380 [ש"פ שנה] ([Filipowski's note in parentheses: 'נ]). [?]

To know one of these reckonings from the other — if you know the later [one], you can deduce [?] the earlier; and if you know the earlier, you can derive [?] the later. As if you had in your hand the count of Seder Olam [סדר עולם], [then if] something is deficient, [the order of the world] subtracts [?] 3,449 [ג' תמ"ט]; and [if] there remains in your hand the [number of years] [?] — by [the reckoning of] contracts add upon it 3,449 [ג' תמ"ט], [and it] will be in your hand [the] Seder Olam [count].

And [if] you seek to know [the count from] the destruction of the Second Temple, [then] subtract from the order of the world 3,448 [ג' תתכ"ח, recte = ג' תכ"ח] 3,428? — the printed letters read [תתכ"ח] [?]; [and what] remains in your hand is

the [count from the] destruction of the House. And if you have in your hand [the count from] the destruction of the House, add upon it 3,448 [ג' תתכ"ח] and it will come up in your hand [as the Seder Olam count] [?]. [If] you are reckoning by [the era of] contracts and seek to know the count of the destruction of the House: [the year] 380 [ש"פ] ([note: ג' שע"ט]) years [subtract], and it will remain [in] your hand the count of the destruction [מנין החרבן]; for [the reckoning of] contracts is greater than the count of the destruction [by] 380 [ש"פ] of the reckoning of contracts. And know that the Exodus from Egypt [was] [?] between the destruction of the House of the Second Temple [and the reckoning]: 2380 [שני אלף] [ש"פ] complete years ([note: ג' שע"ט]). And you are able to derive each one [reckoning] from the other; if you add or subtract from it the excess [היתרון] [that lies] between the count of contracts and the count of the destruction and the count of the creation of the world.

[The same in detail:] ...the [count from the] order of the world is in your hand, and you seek [the count of] the [reckoning of] contracts: [from the figure] there remains in your hand the [reckoning of] contracts; — [the year] 3449 [תמ"ט] [?] years, and you arrive at the count of the order of the world. And [if from] the destruction of the Second Temple, subtract from the order of the world 3,448 [ג' תתכ"ח]; and [whatever] is in your hand is the count of the destruction of the House, and you [then] seek the count of the order of the world; and likewise if you [reckon] [?] from the destruction of the House [add it back]; for [the era of] contracts is less than the count of the destruction [by] 380 [ש"פ], [counting] from the destruction. And if you reckon for the destruction of the House and seek [?], [from the era of] the destruction [subtract] 380 [ש"פ] ([note: ג' שע"ט]) years and it will come up in your hand [the count of the Exodus] [?]; [for] the Exodus from Egypt [was] in the year 2,448 [ב' תמ"ח, i.e. 2448 AM] [?], and between us and between the sealing of the prophetic vision: 1,380 [אלף ש"פ] ([note: ג' שע"ט]) years. And between us and the sealing of the prophetic vision [there are these years]: you can derive each one from these reckonings and bring it out from each one of them, just as I have done [for you] in [the reckoning of] the creation of the world, [to derive] one from the other. :

השער התשיעי — The Ninth Gate

[Heading, p. 4:] **The Ninth Gate** [השער התשיעי]

[Sub-heading:] Telling the order of the reckoning of the [foreign] nations, [and] in what their renewals [of the month] [?] differ from the renewals by which we reckon [?] — which of them [reckon] by the sun and which reckon by the moon:

Know that most of the nations near to us, whose ways we know, [date events] and let their leaders [?] reckon by the sun [the solar calendar]; and there are some of them — even though [they reckon by the sun] [?] — who reckon by the moon. But we do not know of any nation that reckons [purely] by the moon and does not [also] reckon by the sun [?], except for the kingdom of Ishmael [the Arabs] alone — and all who enter in [join] with them [reckon as they do]. [Each nation has] its ways of reckoning explicit [for] its [own] renewals [of the month] from the beginning, because their renewals [of the month] are [reckoned] anew, and they resemble the reckoning of [our own]: the order of their reckoning is set out [as] the way of those who reckon by the sun, and we [will set it out] [?].

[The Arabs] say that in the kingdom of Ishmael they began this reckoning from the start of the wickedness of Muhammad the wicked [משונע הרשע], who led them astray [אשר החטיא אותם]; and the beginning of his error [טעותו] was in the month of Av [בחדש אב] of year 12 of cycle 231 [משנת י"ב למחזור רל"א], which is the year 4,382 [ד' שפ"ב] from the creation of the world, by the reckoning by which we reckon.

For [the era of] the world by [the reckoning of] the moon [שנת הלבנה], a year of 12 months [שנת י"ב חדש], one full and one deficient [חדש מלא ואחד חסר]: seven months are full [שבעה חדשים מלאים] and five deficient [וחמשה חסרים]; and they call [such] a year a year of 351 days [שלשים — recte? the figure reads "שלשים 11...30 / "שנה י"א"], the year 11 [שנה י"א] [being] a leap year [שנה כבושה]. And these are the ones who reckon by [the moon]: among them are the men of the west and the east [מערב ומזרח], [and] some of them are [those who reckon by] [?] the [phases of the moon] for their renewals [of the month] [based] on the sighting [על הראייה]. And [these] are the heads [beginnings] of these renewals of the month [ראשי חדשיהם] for their lands, and these are the names of their renewals of the month [שמות חדשיהם].

These are [the month-names] [?]: Al-Muḥarram [אלמחרם], and after it the fourth, the first [?] [recte Ṣafar — צפר], and after [Ṣafar] [comes] [?], called "the first" [ראשון], and it is [Awwal / Rabī al-Awwal] שני ... הוא ש, recte the first of two months called Rabī'; and the second is called [Rabī' al-Ākhir] [אכר]; and after [it] Jumādā the First [גומאדי ראשון] [and it is Jumādā al-Ūlā]; and after it [Jumādā al-Ākhirah?] [?]; and it is the sixth of their renewals [of the month] [הששי לחדשיהם]; and after it Rajab [רגב]; and [after it] the [ninth] of their renewals [of the month] [התשיעי מחדשיהם], and they are stringent about it [fasting] every year [?]. And [?] this [month] is the lesser Īd [אידם הקטן] — Īd al-Fiṭr; and after it Dhū al-Qa'dah

[דואלקדה]; and after it Dhū [al-Hijjah] [דו...]; and on the tenth day [וביום י'] of this month is the greater ʿĪd [אידם הגדול] — ʿĪd al-Aḏḥā.

And the one who wishes [to know], among the Ishmaelites, in which of their months a given [?] [day] stands — let him reckon: the beginning of the year [for them] is the [month] in which it stands; and [he] brings out [derives] from it [?] [the count]. R. [?] [a named authority] makes from it [a count of] cycles [מחזורים] of 19 [years] [של י"ט], each cycle of [?] each year [?].

And the one who wishes to know how many years there are in the reckoning [?] — let him reckon the years from when the world was created [שנברא העולם] up [to his point]; [whatever] comes out of it [as a remainder] of [?] [is] the year 4382 [ד' שפ"ב] [?], and [whatever] remains in his hand [?] [of the] cycle [מחזור] — and take, for every cycle [לכל מחזור], 7 [renewals of the] months [ז' חדשים] [?] which are [intercalary?]. And if there remain years that have not completed a cycle, count them [as] M"YB [מי"ב, recte? "12"] [?]; and onward [from there] take, for each year, a leap year [שנה מעוברת] that comes [?] [based] on the intercalated [months] of the cycles [מעוברי המחזורים] [?]. And [whatever] remained of the year from the beginning [is reckoned as] an error [?] [in] reckoning, and [it is] collected [?] — whatever of the year he stands in [?]; and he makes [?]. And [the months] are added to the years which [belong] to the cycles, and they will come up in his hand [as] error [?]. And if there remain renewals [of the month] that have not completed [a cycle] [?] [in the reckoning] of the Ishmaelites mentioned above, [reckon them] upward, and [he] begins to count from the month of Al-Muḥarram [מחדש אלמחרם]; and the [new] month, [which] he is able [to fix] in this reckoning, is the [new] month — [for] they rely [on the sighting] [?] for their renewals of the month [based] on the sighting [על הראייה]; and because [their renewals of the month] are near, perpetually, to [our own] renewals of the month for Israel [לראשי החדשים לישראל] — [therefore] they reckon [?]...

[The figures involved:] the year 4382 [ד' שפ"ב] remains; and there remain in his hand [for] the cycle 7 [renewals of] months [ז' חדשים]; [whatever] has not completed a cycle [he] reckons [as] M"YB [12" ב, מי"ב] [?]. [In] the intercalated [year] [שנה מעוברת] that comes, there falls to his hand one month, and he adds [those] [?] [to the count of] the cycles, and he adds to them two months [ב' חדשים] perpetually [as] error [?], and [it is] collected, and the whole [count] [?] is brought near, and he attaches it to the renewals of the month [?]; and he makes, of every [count of] 12 years [י"ב] [?], a [new] month [?]; and there will come up in his hand the count of the years for the beginning [of the period] [?] [in] error [?]. [If] they have not completed [a cycle], [reckon them] upward [?] [on] the names of their

renewals of the month [שמות חדשיהם]; — the [new] month Al-Muḥarram [אלמחרם], which is the head [beginning] of their renewals of the month [ראש חדשיהם]; the [new] month [which] he is able [to fix] [?] in [their reckoning] is [the one] in which it stands of their renewals of the month [?], [based] on the sighting [על הראייה]. And because of this, these are the heads [beginnings] of their renewals of the month [ראשי חדשיהם]; — and they reckon by the sun [לחמה] [those that are] of three kinds [של שלשה מינים]...

The nations who reckon by the sun

Among them are the Greeks [Yevanim], and the remainder are the Chaldeans [Kasdim], who reckon by the kingdom of [Alexander, counting from [Alexander [of Macedon]]]; and they reckon by the sun — 365¼ days, a full year [שס"ה יום 365 ורביע, days and a quarter] — and they take no account of the moon. So too do the Egyptians' year, but they do not reckon by the kingdom of Alexander [?]; rather, they begin from a different [point].

And among them are the Persians [Parsiyim], and the remainder of the Medes [Madai], whose [year is] full, no more, and who do not reckon by the moon. And among them [are others].

They reckon the solar year as the Greeks reckon it, except that they [...]; they begin to explain the manner of the Greeks' reckoning, which is [...]; And the beginning of their reign, which they reckon, fell on the second day [Monday], the 26th day [כ"ו] from the new-moon of Tishrei, year 3450 [שנת ג' אלפים ת"נ, 3450 AM] from the Creation of the world by our reckoning. And the beginning [of their months], which is the head of the year [ראש השנה] for them, is [the month] called *Tishrin Rishon* [Tishrin I], and the Romans call it October [אכתובר], whose days are 31 [ל"א]. After it, *Tishrin* [II] — and the Romans call it November [נובמברון], and its days are 30 [ל']; and on the 22nd [day] [כ"ב] of it the cold begins to ascend, and in it [...].

[The text now proceeds month by month through the Julian calendar, giving for each its Syriac name, its Roman (Latin) name, its day-count, and noting on which day of the month the sun enters which zodiacal sign and the seasonal/solstitial points and the holy days that fall in it.]

On the [24th] [כ"ד] of this month is the time of the questioning [?] [day of judgment / autumn], which in most years is the sixtieth [day] [...]. In the language of the Romans, *December* [דיגבר], and its days are 31 [ל"א]; and on the 12th [י"ב]

of it the cold intensifies, and it is the beginning of the dark nights, which are forty [ארבעים]; night [is] twenty[...]. [עשרים] [...] after it.

And on the [14th] [י"ד] of the month the sun enters [...], three hundred [...] of the year; and it is the end of the long night and the shortening of the cold. And on the [25th] [כ"ה] of the month will be the *tekufah* [of Teves, the winter solstice] [...] it will fall by night; and if it falls in the [...] hours [...]; on the 24th [כ"ד] of December [מן דיגבר]. And on the [25th] [כ"ה] of it is the day of the birth of [their god — the festival of the Christians [Notzrim], a great festival in the kingdom of the wicked kingdom [Christian Rome/Byzantium].

And on the [25th] [כ"ה] is the day on which [...]. And the first day from it is the head of the year for them [...] [the time of] the great circumcision [?], on which they circumcise the man [Jesus], according to their words. And on [...] are the days of the intensity of the cold; and after it [...].

After it, *Kanun / Shevat* [סבאט], which the Romans call *January* [ינואר]; and it is the 28th [כ"ח] [...], and on it the days [...] the dark nights, and they are forty [ארבעים] nights, beginning [...]. After it, *Shevat* [סבאט], which the Romans call February [פבריר], and it is the 28th [כ"ח?] [...] in which the cold [begins?] to grow weak [להחלש]; in this month [...].

After it, *Adar* [אדר], which the Romans call *March* [מארס], and it is 31 [ל"א] [days]. On the [14th] [י"ד] of it the sun enters the head of Aries [ראש טלה], and the days and nights are equal throughout the whole world; and on that day on the [24th] [כ"ד] of it falls — according to the words of Samuel [Samuel the Amora] — [the *tekufah* of Nisan], unless the *tekufah* falls 3 [ג'] hours into the night, in which case it is [...]. And you find that in the years of the Greeks and the Romans, seven [שבעה] months exceed by 31 [ל"א] days [...].

After it, *Nisan* [ניסן], which the Romans call *April* [אבריל], and it is 30 [ל'] [days]; in it is the time of the Passover [Pesach] of the Christians [Notzrim], and it does not fall on a fixed day throughout the whole [...]. From it [...] after it [...] May [מאי?], and its days are 31 [ל"א]. After it, *Haziran* [חזיראן], which the Romans call June [?] [יוניה], and its days are 30 [ל'] [days]; and on the [15th] [ט"ו] of it the sun enters [the head of...]. And the day reaches the head of [...] of the heat; and on the [24th] [כ"ד] of it is the day of the birth of [...], a great festival, [...].

And on the [25th] [כ"ה], the day after which [...] — according to the words of Samuel [...]. After it, *Tammuz* [תמוז], which they call [...]; and on the 12th [י"ב] of it begins the strengthening of the heat [...]. And the [...]th day of it is the [...] of the [tekufah of Tammuz, the summer solstice], and the shortening of the day; and it is

the beginning of the time called [...]; the *tekufah* of Tammuz, according to the words of Samuel, [...]; if it falls by [...] hours into the day, it is [...] falling on the [24th] [כ"ד] [...].

[...] the day of the birth of their god, according to the words of those who err; and it [...]. After it, Av [אב], which they call [...] August [אוגוסט], and its days are 31 [ל"א]; and on the [20th] [עשרים] of it the dark nights go out [end], [...]. After it, *Elul* [אלול], [...] [ל'] 30 [days]; and on the 16th [י"ו] of it the sun enters the head of [Libra — *Mazal Mo'znayim* [ראש מזל מאזנים], which has waned [?], and the days and nights [are equal]...

[These are the days the sun takes in each sign, and the holy festivals and seasonal points the Christians mark in each month. The Julian walk-through closes here, and the text turns to the molad-anchor computation by which a Christian-calendar date is converted to the Jewish molad-reckoning.]

[...the days and nights are] equal throughout the whole world on that day. From here until three hundred [שלש מאות] [days] of the year — and it is the beginning of the days of winter. And on the 24th [כ"ד] of it will be the *tekufah* of Tishrei, according to the words of Samuel [Samuel the Amora], falling in most of the years — unless the *tekufah* be at 3 [ג'] hours into the night, in which case it falls on the 23rd [כ"ג] of *September* [שתנגבר, *Shtangbr* = September].

And you find in the years of the Greeks and the Romans seven [שבעה] months that exceed, each one of which has 31 days [ל"א יום]; and among them are five months that do not exceed — call them, if you wish, "deficient" [חסרים]: four of them have 30 days [מל' יום] and the fifth has 28 days [מכ"ח יום] — namely, February and [the fourth / April] [ורביעי].

And if you wish to know which of them is the deficient month — that is the day on which they "bring out" [שמוציאין] a day, on which a Torah scroll [is read?]: remember unto Israel — it shall increase and grow, and to the honor of the nations it shall be diminished and decrease — and because of this their months are deficient. He comes and counts the days of the week from the first day, and the months of the year from October [מאכתובר]; and every day on which they do not bring out a Torah scroll, that day shall be the month set opposite it, exceeding by 31 days [מל"א יום].

And one who wishes to know on which day of the month the first day will fall — reckoned from October [מאכתובר], which is the head of the year [ר"ה] for the Greeks — let him know how many full years [כמה שנים שלימות] he reckons from the Creation of the world, and there shall be deficient from them 3,458 years [ג'

3458 = (8ח + 50נ + 400ת) + 3000; [אלפים תנ"ח שנה; And there remain in his hand, of the full years, those by which he reckons from the beginning of the tenth [decade / cycle] [השנה העשירית] up to the kingdom of Alexander [למלכות אלכסנדר], up to the year in which he stands; and he begins to count from the tenth year [מן] [השנה העשירית], so that he may be reckoning [the calendar] from the head of the cycle of the moon [מראש מחזור ללבנה].

And this year, from which you now begin to count, is the first year of cycle 183 [183 = 3ג + 80פ + 100ק; [למחזור קפ"ג]; and the molad of Tishrei in that year was 17 hours, 494 chalakim [494 = 4ד + 90צ + 400ת; [תצ"ד חלקים]; from [the night of] Sunday [מיום ראשון]. And the first day of October [יום ראשון] was a Friday [יום ששי], after 5 days, 12 hours, 586 chalakim [חמשה ימים] [586 = 6ו + 80פ + 100ק + 400ת; [תקפ"ו חלקים]; from the fixing of the new-month of Tishrei, the first of the day [literally, the head of the new-month and the first day in general].

And the abridged reckoning of this is that it shall be deficient by [...] of the cycles, which one reckons from the Creation of the world: cycle 182 [קפ"ב; 80פ + 100ק]. And he keeps what remains of the cycles up to [those] years which did not complete a [whole] cycle, and takes for every full cycle that he has in hand 5 [days], [...] hours and [...] chalakim [485 = ?ה; chalakim, part of the running molad-constant], that he may keep it; and he knows how many days and hours and chalakim were gathered from them. And he returns and takes, for each and every year of the years that did not complete a cycle, 10 days, 21 hours, 204 chalakim [204 = 4ד + 200ר; [רצ"ד חלקים]; and includes the whole together with what was gathered in his hand, [namely the figure of] 5 [days] and 485 [תפ"ה]; and he adds to it 5 days, 12 hours, 586 chalakim [ה' ימים] [586 = [י"ב שעות תקפ"ו חלקים], which are the distance of the start of October [מרחק תחלת אכתובר] in the first year — which is the beginning of this reckoning. And he keeps the whole and returns to the years that did not complete a cycle, and knows how many intercalated [leap] years [מעוברות] there are among them; and he takes, for every leap year [לכל שנה מעוברת] among them, 29 [days], 12 [hours], 793 [chalakim] [793 = 3ג + 90צ + 300ש + 400ת; [תשצ"ג]; and subtracts [the surplus] from the whole [ויגרענו מן הכלל] that he kept; and what remains in his hand is the distance of the start of October from the molad of Tishrei [מרחק תחלת אכתובר ממולד תשרי].

And if no [further] years remain to him over the cycles, let him know that the whole [reckoning is] one hour and 485 [chalakim] [כלל שעה ותפ"ה], which is the first [distance] he kept — the distance of October from the molad of Tishrei [מרחק]

אכתובר ממולד תשרי]. And when the [computer of the] distance knows it, he adds to it [further] hours and chalakim, which are in the molad of Tishrei of the year in which he stands. If [these] complete for him full days without [residual] hours, [the result] is settled; and if there be in it 6 hours, [round to] hours unto them [for them]; and likewise if there be 12 hours unto them. But if there be [a different residue], let him know that that year is intercalated [leap] [שנה כבושה היא], and the breakdown of the next [year] in it shall be the 29th day [כ"ט יום]; and if the [residual] hours be 18 [י"ח שעות], he counts them as a full day and adds [it] to the days, and there ascends in his hand the distance which is between the molad of Tishrei and the beginning of October [בין מולד תשרי ובין תחלת אכתובר]. If the day [reckoned] from October begins to be counted from the day of the molad — and the day on which the days of the distance run out [is] one of the days of the week — that is the first day [of the month] of October [ראש חדש אכתובר]; and he knows how many days they are from the new-month of Tishrei [מחדש תשרי] by the fixing of the new-month.

And let him know that the hours which were gathered after the addition of the molad onto the distance — if they are not full hours without chalakim, and these hours are not [exactly] 6 hours, or 12 hours, or 18 hours [שש שעות או י"ב שעות או י"ח שעות], no less and no more — then know that sometimes the remaining distance in your hand requires you to add to the molad of Tishrei one more new-month [מולד תשרי יותר מחדש] for the moon; and this is found in a few of the intercalated years [במקצת השנים המעוברות]. And when there comes into your hand less than the distance, [by] the measure of one month [מדת חדש אחד], add [it] [...].

[The above completes the worked rule for converting a Christian-calendar (October-anchored) date to the Jewish molad-reckoning. The same machinery is then applied to the Egyptians' and Persians' calendars on the following pages.]

The Egyptians (Coptic months)

But the Egyptians — although they reckon by the sun as do [the Greeks], and do not reckon by the moon — do not conduct themselves by the same number of days for their months as this [Roman] practice, and do not come into agreement with the Greeks in the [intercalary / leap] year. For while the Egyptians make this leap year [שנה הזו כבושה], the Greeks [...]; the Egyptians [reckon] 12 months [י"ב חדש], and they reckon 11 [months] of 30 days [י"א חדש ל' יום], and the twelfth month they reckon as 35¼ days [ל"ה יום ורביע] — the five epagomenal days plus the quarter]; and in the leap year [בשנה הכבושה] they reckon that month as 36 days [ל"ו יום].

These are the names of their months [שמות חדשיהם]:

#	Coptic month [as printed]	Identification	Days
1 [הא']	<i>Tut</i> [תות]	Thout (head of their year)	30
2 [ב']	<i>Kiba</i> [כיבה]	Paope / Kiahk	30
3 [ג']	<i>HaTor</i> [התור]	Hathor	30
4 [ד']	<i>Bitad</i> [ביתד]	Koiak	30
5 [ה']	<i>Tova</i> [טובה]	Tobi / Tobe	30
6 [ו']	<i>Amshir</i> [אמשיר]	Meshir	30
7 [ו' — printed, see anomaly a]	<i>Barḥmit</i> [ברחמית]	Paremhat / Baramhat	30
8 [ח']	<i>Barmura</i> [ברמורא]	Parmoute / Barmouda	30
9 [ט']	<i>Bashnas</i> [בשנס]	Pashons	30
10 [י']	<i>Pona</i> [פונה]	Paone / Bauna	30
11 [י"א]	<i>Abib</i> [אביב]	Epep	30
12 [השנים עשר]	<i>Mesori</i> [מסורי]	Mesore	35¼ [מל"ה יום ורביע]

, and it is 35¼ days [מל"ה יום ורביע]. Each ordinary Coptic month is 30 days; the twelfth (the short epagomenal month) is 35¼ days (36 in the leap year). The tail "והוא מל"ה יום ורביע" reads 35¼ days and attaches to מסורי (Mesori), the 12th month — it is not a year-total; the whole-year length (365¼) is given separately in the same passage as שס"ה... ורביעי. The printed ordinal at position 7 reads ו' rather than ז' — a compositor doubling; see anomaly a.]

[He then states the festival-anchors and the day-of-week computations for converting these months against the Jewish molad-reckoning. The Egyptians' year-length is 365¼ days; the 12th month gathers the five epagomenal days — which they call the "days of the long ones" [ימי הארוכות] — plus the quarter, and 36 days in the leap year.]

The Diocletian (Martyrs'-era) conversion

On the 29th [כ"ט] day of the month August [אגוסט], from the months of the Christians [Notzrim], they reckon the year of the beginning of the kingdom of

Diocletian [דיאקלטיאנוס], one of their kings; and his reign began on day 6 [Friday] [יום ו'], on the 29th [כ"ט] day of Elul [אלול], in the year 4044 [4000; ד' אלפים מ"ד; 4044 = (40 + 400) +] from the Creation of the world [לעולם] — which is the year 16 [י"ו] of the [19-year] cycle [למחזור], and it is the 29th [כ"ט] day of August [אגוסט] in the year 595 [595 = 500 + 90 + 100; תקצ"ה] of [the era of] Alexander [the Seleucid era]. And we reckon for them from the fourth year of his reign [מן השנה הרביעית למלכותו] [...], in the reckoning of the years of Greece [שנות יון].

[Computation check: 4044 AM – 3760 = 284 CE, the accession of Diocletian — the epoch of the Coptic "Era of the Martyrs." Year 16 of the (19-year) cycle and cycle 213 are two distinct, both-correct frames — the position *within* the current 19-year cycle, and the *ordinal number* of the cycle — not a single misread figure.]

And this present year is the year 4047 [4047 = (70 + 400) + 4000; ד' אלפים מ"ז; רי"ג; 200 + 10 +] from the Creation of the world, which is the end of cycle 213 [213 = 30]; and the beginning of the head of [the month] *Tut* [תות] — the head of their year — in that year fell on day 3 [Tuesday] [יום ג'], after the molad of Elul [אחר מולד אלול], at 4 days, 10 hours, 214 chalakim [ד' ימים י' שעות רי"ד חלקים; ר' 214 = 40 + 100 + 200]. And one who wishes to know [the head of *Tut* in any year does as follows]: he knows how many cycles and full years there are in his reckoning [for the Egyptians], and takes for each [the appropriate molad-distance]; and there ascends in his hand 4 days, 10 hours, 214 chalakim from the molad of Elul [ממולד אלול]; and he includes the whole and brings out from it the new-months [חדשין]; the leap [intercalated] year [שנה מעוברת] brings out the 29th [כ"ט] day, 12th hour [י"ב שעות], 793 chalakim [793 = תשצ"ג;] plus the hours and chalakim that are in the molad of Elul [במולד אלול] which have passed [...]. And if there ascend in his hand 6 hours [שש שעות] or [more], take no account of them; but the head of the new-month [ראש חודש] of the moon falls [accordingly]. And one wishing to know on which day the head of the new-month of the moon [ראש חודש הלבנה] falls, let him reckon from the molad [ממולד] as I have done. And these — I need not spell out for you [ואיני צריך לפרשם לך].

The Medes and the Persians

And those who reckon by the sun — 365 [days], a full year [שס"ה יום שלם], without any addition [בלא תוספת] — are the remnant of Persia [שארית פרס], and those who conduct themselves by their custom are the remnant of the Medes [שארית מדי]; and they reckon their months as thirty, thirty days each [שלשים יום] except for one month — and that is the

eighth of their months [החדש השמיני מחדשיהם], which they reckon as 35 days [ל"ה יום].

And these are the names of their months [שמות חדשיהם]:

#	Persian month [as printed]	Identification	Notes
1 [הא']	<i>Afruwdin</i> [אפרוודין] <i>ma'ah</i> [מאה]	Farvardin	the token <i>ma'ah</i> [" / מאה 100"] is printed in-line after the month-name; anomalous as a month-length and unexplained — see Numerical impossibles
2 [וב']	<i>Ardi-hashtahma'ah</i> [ארדי השתהמאה]	Ardibehesht	—

printed immediately after it — there is no seam here; the token is genuinely on the page, attached in-line to the first month, and is then followed by a new clause. Month 2 reads *Ardi-hashtahma'ah* = Ardibehesht. The remainder of the Persian list (months 3–12) runs off the foot of the column onto the following opening.]

And the first day of it [the first Persian month] is the festival [איד] of their New Year [ר"ה], and they call it the day of *Nayrūz* [הנירוז], and its meaning is "the day of renewal" [יום המחודש]. And on the 2nd [ב'] [comes the month] *Ardibehesht* [ארדי השתהמאה], [...].

[Gate 9 continues onto the following opening with the remainder of the Persian month-list and festivals; the names beyond the second are not present on this page's foot.]

[The Persian month-list, begun on the prior page, continues. The months are listed with their day-counts, all reckoned at one hundred — the recurring "מאה" ("hundred") printed against each name is anomalous as a month-length and is almost certainly a seam-split epoch/weekday figure carried across the column division; transcribed as printed and flagged throughout. The festival-days within several months are named.]

and the third [month is] *Khurdād* [כרדאד = Khordad], 100 [מאה]; and the fourth, *Tīr* [תור = Tir], 100 [מאה]; and the fifth, *Murdād* [מרדאד = Mordad], 100 [מאה]; and the sixth, *Shahrīr* [שהריר = Shahrivar], 100 [מאה]; and the seventh, *Mīhr* [מהר = Mehr], 100 [מאה]. The 16th [ויום י"ו] day of it [the seventh month] is the day of the

Mihragān [המהרגאן = Mehregan] festival of the Persians; its meaning [in their language] is [?]. It [Mihragān] is forever the 35th [מל"ה] day [reckoned in the festival sequence]. And from the 25th day [ומיום כ"ה] of the same month [?].

[The text turns to the names the Persians give to particular days "in their tongue," with their meanings.] From it [this day] they call them, in their tongue, *Andarī Pers* [פרס אנדרי, "Persian Pers"] 100 [מאה], its meaning being "the added day [יום [התוספת]." This day extends to the 35th [ל"ה] day [reckoned] from this one [?]. From it they call them, in their tongue [?]. And the 9th [ויום ט'] of Adar [is] 100 [מאה]. The first day [והיום הראשון] from it they call [?] the day *Rabī'at ha-Shaldqan* [רביעית השלדקן, the day "of [?]"]; and they are days on which [?].

This [day], on it they ride before them a man who is to be an old man, small in stature [?], whether his old age is real or he has no old age at all — [seated] upon a great horse [סוס גדול]; and they walk before him, playing and praising their abominations [להלל לתועבותם], and it is a great festival-day [יום איד גדול] for them. And the tenth [והעשירי, the tenth month], *Dayya* [דיא = Dey] 100 [מאה]; and the eleventh, *Bahman* [בהמן = Bahman], 100 [מאה]; and the twelfth, *Asfīdār* [אספידאר = Esfand], 100 [מאה]. These are their months [וחדשיהם].

[The Persian regnal era and its anchor-date now follow.] They were the kings of Persia [ממלכיהם], and the beginning of his [Yazdgird's] reign was after the [reign of the] other kings [?]. They reckon by the kingdom of **Yazdgird** [יודיגרד = Yazdgird] the Last [האחרון] [— the last Sasanian king, in whose 11th regnal year the Arab conquest fell —] their kingdoms [ממלכותם] [?]. And the head of the year for [this] kingdom is the head of the month [וראש השנה למלכות והוא ראש חדש] *Afrūdīn* [אפרודין = Farvardin]. The Ishmaelites [ישמעאל], up to a span of 9 years [ט' שנים], 10 months [י' חדשים] [reckon from it?], and the head [?].

[Here the worked example proper begins.] [The head-of-month] *Afrūdīn* [of year] 100 [מאה] fell on day 3 [היה יום ג'], the 25th [כ"ה] of Sivan, in the year [בסיון שנת] [—] the year 4 392 [ד' שצ"ב] of the creation of the world [לבריאת עולם], which is the year [והיא השנה] [—] of cycle 232 [ממחזור רל"ב], for it was the day on which [מ] [שהיה היום ההוא] the [tekufah of] Tammuz fell in the Seleucid year 943 [משנת] [למלכות אלכסנדרוס] of the kingdom of Alexander [תתקמ"ג].

From here back [מכאן לפרסים] the Persians [count] two years before this year [ד' 390] [משתי שנים קודם השנה הזאת] for the moon [ללבנה], and it is the year 4 390 [ד' 390] of the creation of the world [לבריאת עולם]; and it [the moon's count] is from the day [—] the 19th [י"ט] of [the month] called [the month called] Yuniyah [יוניה] [הנקרא], which belongs to the kingdom of Alexander [מלכות אלכסנדר], that is, the

reckoning of contracts [מנין שטרות]. And we reckon [ואנו מונין] [from] [?] this same head [of] *Afrūdīn* 100 [מאה], which is [the day —] [?] this year so that the year would begin from the head of the cycle [מראש מחזור]; and it would be in the year [—] [of] the creation of the world [—] and it is the head of cycle 232 [והוא ראש] [מחזור רל"ב]. And it was [—] in the year [—] which is the head [—] [—] of the months of the Persians, [counting] from the first [מימי ראשון...].

The molad of Tishrei in that year [והיה מולד תשרי בשנה ההיא] was day 7 [מיום ז'], 12 hours [י"ב שעות], 489 chalakim [תפ"ט חלקים]; the head of the month [—] *Afrūdīn* [is] 100 [מאה], counting from the molad of Tishrei and the day of the month [ממולד תשרי ויום החדש] [—]. It was [והיה] day 1 [יום א']; for the month of Tishrei in the year [—] [had] 9 days, 591 parts [תקצ"א חלקים]; and there were [—] day 1 [—]. The first day [—] of the months of the Persians [is] day 100 [מאה הד']. And [the molad of] this first month [מולד] [והיה תמוז] of Tammuz was [—] [?] day 7 [מיום ז'], its parts [—] [?].

And it was [—] the interval [ראש חדש = the interval] [—] the head [—] the month [—] in all 267 [בכלל רס"ז], day 11 [יא] [?], 11 hours, 591 parts [יא שעות תקצ"א] [?]. The first [—] for cycle 232 [למחזור רל"ב] [is] Shabbos [שבת], 9 days [ט' ימים].

And when you wish to know the head of the year [וכשאתה רוצה לדעת ראש השנה] for the Persians [לפרסים] [— on what day it falls —] and how many days [the new month falls] from the renewal of the moon [מחדש הלבנה], know this [הוי יודע]:

[A general rule follows on accumulating the surplus across the cycles.] [Reckon] how many [—] complete-cycle residues remain in your hand from the cycles [ושמור הנשאר מן המחזורות עם השנים], with the years that did not complete a [full] cycle of [—] 19 years [מן י"ט שנים]; and for every cycle there are 4 days, 16 hours [ד' ימים י"ו], 595 parts [תקצ"ה חלקים]; the moon being in excess [—] over [—] 19 years [על י"ט שנים] for the Persians [לפרס]; and keep [—] parts [—] חלקים; and if there should be in [the residue of] years that did not complete [a cycle], an intercalated year among them [שנה מעוברת בהן] — [it adds] 18 day, 21 hours, 589 parts [פרס], the whole [תכלול הכל] together with the surpluses [עם מותר] [?]; for the simple year [which does not complete a cycle], 10 days, 306 hours, 264 parts [אינו שלם י' ימים] [ש"ו שעות ר"ד חלקים] for each year of them [לכל שנה מהן] in which it is intercalated [—]; and know how much enters from the surpluses of the simple years [ומותר השנים הפשוטות] and the intercalated years [והשנים המעוברות] that are in your hand [אשר הן בידך]; and that [—] in the cycle of the moon [במחזור הלבנה] over [the count of] the years of Pers [על שנות פרס] [—].

[The rule continues, instructing the reckoner to carry the corrected surplus.] [Those years] which completed a cycle [—] an intercalated year [שנה מעוברת] — you already know [—] the cycles [—] and there will remain in your hand the corrected surplus [העודף המתוקן]; and [those years] which did not complete a cycle [—] [keep] the surplus that is in your hand [—]; and you already know the surplus of the simple years [עודף השנים הפשוטות], and we subtracted [ותגרענו] from the corrected surplus [מעודף המתוקן]; and if it is not [—] in the years that did not [complete a cycle] [—] you do not know [—] the surplus of the simple years [—] and we subtracted [—] from the corrected [surplus] [—]; and if there should not be in your hand any [completed] years at all [—] the standing of the cycles, that is the standing-point of the reckoning [העודף המחזורות הוא העודף המתוקן].

[The instruction then deals with the residue once the cycle is completed.] When [—] they completed a cycle [—] an intercalated year [—] you know [—] the cycles, and there will remain in your hand the corrected surplus [העודף המתוקן]; and [when] they completed a cycle [—] the surplus will be the [—] gathered [—] the [—] surplus [—]; the corrected surplus [—] take it [—] from 267 [מן רס"ז], day 11 [יא', [תקצ"א], 591 hours and parts [—] [—] [?]; and the corrected distance [המרחק המתוקן] which is between [—] the molad of Tishrei [—]; and the corrected distance is from this distance [—] 29 days, 12 hours, 793 chalakim [כ"ט י"ב תשצ"ג] — the synodic-month length; the months will be in it [—]; and keep what remains in your hand [—] [for] *Afrūdīn* 100 [מאה] from the molad of the month, which is [—]; the months that issue from the distance [—], and the months [—].

The distance that remains in your hand [המרחק הנשאר בידך] — the names [—] [?] and the parts [—] [?]; and in your hand [—] third days [ימים שלישים] which are between the molad of that month [—]; and if you wish to know on which day of the days of the week [—] [the new month falls,] subtract the distance [—] 7, 7 [ז' ז'], and there will remain in your hand [—] count it [—]; [it is] in your hand [—] the day of the head of the month [ראש חדש] *Afrūdīn* 100 [מאה] in the year [—] [?]; by way of [—] [—] and it is [—] that shows the cycles [—] that did not complete [—] add to them the years [—] [—] for it [—] and the parts [—] 7, 7 [ז' ז']; and there remained in your hand 7 [ז'], or [—] *Afrūdīn* 100 [מאה] of the days of the week in that year [—] and it [—].

[A worked numeric drill on finding the weekday of the Persian new-month head.] To know on which day of the days of the week [—] the head of the month [—] [—] the months are complete between them and *Afrūdīn* 100 [מאה], and take [—] [—] [—] for the new month [—] [—] 100 [מאה] [—] [—] which is the head of the month [ראש חדש] [—] in your hand the day [—] day 27 [—] [or] less than [—] 47 [מ'], it is

the day of the head of the month [—] of that year, and it is the sign of that year [סימן השנה ההיא]. And if you wish [—] the head of the month [—] after the months of Pers [מחדשי פרס], know how many days [—] take for each month of them two days [שני ימים] [—] [—] [?].

These days, and add to them the sign of the year [סימן השנה] and [—] [—] Rosh Chodesh [ראש חודש = ר"ח] of Pers, which you seek [—]; and if you wish [—] the moon [—] take for each month [—] two days [שני ימים]; and [—] 100 [מאה] [—] take for it 7 [ז'] days [—] [—] and incorporate the whole [ותכלול הכל] [—]; [those] which begin from the new [month] enters in it [—] [—] two days [—] [—]; and for every month [—] one day [—] [—], and incorporate the whole [ותכלול הכל] [—] for the months of Pers [לחדשי פרס]; and the rest remains in your hand [—] over [—] all the days [—] *Afrūdīn* 100 [מאה], and it goes up in your hand the days that you can [—] which you seek.

And I [will] bring you an example of all these reckonings [ואני מביא לך משל מכל] [ההשבונות האלה], so that you may understand them and not become confused [כדי] [בהשבון הפרסיים] [—] of which we have been speaking. And I [will] begin with the reckoning [—].

If you seek to know on what day the head of the month [—] [will be] [—] for the Persians [לפרסיים], in the year AM 4885 [1125 = 3760 – 4885; ד' אלפים תתפ"ה; CE], according to the reckoning [—] and it is [—] cycle 257 [רנ"ז], year 12 [—]; from how many [—] from the cycle, subtract 231 cycles [רל"א], there will remain in your hand 25 [כ"ה], [in] cycle 26 [כ"ו] — a complete cycle [מחזור שלם] of them, [containing] 6 intercalated years and 12 simple years [ו' שנים מעוברות ו"ב פשוטות] [—]; the tekufah [—] day 4 [ד' ימים], [י"ו] 16 hours, 595 [תקצ"ה] parts [—] goes up in your hand [—] 35 [תל"ה] parts [—]; and take for the six intercalated years [—] 21 [כ"א], [תקפ"ט] 589 hours [—]; the parts will be for the six intercalated years [—] six [—] [—] 595 [קי?] parts [—]; [—] to these [—] the surpluses of the [—] 264 [ר"ד] parts for each year of them [לכל שנה מהן] [—]; and afterward [ואח"כ] take for the 12 simple years [ל"ב שנים פשוטות] [—] 264 [ר"ד] parts, and it goes up in your hand 162 [קס"ב], 14 days [—]; this surplus [המותר הזה] [comes] from the surpluses of the cycles [מהמותר המחזורות], and from [the years] you change [והוא המותר] [תתמ"א] 841 parts, and it is the corrected surplus [ומהשנים] [—] [—] of Pers up to this year [—] which we have reckoned for it [—] 591 [תקצ"א] parts which was the corrected distance of *Afrūdīn* 100 [מאה] [—] [from the molad of] Tishrei, [which] remained in your hand [—] 164 [קס"ד], day 10 [י' יום], [ת"ל] 430 hours [—] [?]; the corrected distance of *Afrūdīn* 100 [מאה] in this year from the molad [—] [—] this [—] [—] over the measure of the month for

the moon [על מדת חדש לבנה] [—] goes up in your hand for [the] five [—] [—] 545 [תשכ"ה] parts, and there will remain for you 16 [י"ו], day 19 [יום י"ט], parts [—] 100 [מאה] from the molad of the sixth month [ממולד החדש הששי] of Tishrei, which is the month [—].

[The example carries the molad-of-the-sixth-month figures forward.] [—] was day 4 [היה ד'], 975 chalakim [תתקע"ה] from day 2 [מיום שני] [—] will be 17 days [י"ז] from the molad of the month [ממולד החדש] [—]; the fixed day of the [new] month [—] your reckoning ends for you on day 4 [ביום ד'], 100 [מאה], and it appears to you [—] that the new [month] *Afrūdīn* 100 [מאה] is added [—]; and if you wish to verify the day of the week [לבדוק יום השבוע] by another method [—] of them [—] over the years which were 25 [—], cycle, and they will be [—]; [those] which completed a [full] cycle with the year that is [—] 495 [תצ"ה] years [שנה], you subtract them [הוציאם] [ז' ז'] 7, 7, there will remain in your hand 4 [—] 100 [מאה] in this year. And if you seek the head of the month [—] after [—] which is the tenth of their months [העשירי לחדשיהם], know that [—] the head of the month is the tenth [ראש החדש עשירי], and it is fit to be taken [—] [—] [?].

[The text now treats the eighth Persian month and the leap-day adjustment.] For the new [month] of *Asfīdār* 100 [—] the eighth one [—] [it] was in its midst [בתוכם] [—]; and for the eight months [שמונה חדשים] you now take for each month [—] [—] over them day 4 [—], for it is the sign of the year [סימן השנה] [—] [?]; for the [—] [—] day 20 [כ' יום], subtract them [הוציאם] [ז' ז'] 7, 7, there will remain in your hand [—] [?]; and if you come [ואם תבוא] to know on how many days [—] [—] for the eight months of Pers [לשמונה חדשי פרס] [—] the 16th [—] [—] 100 [מאה], distance [—]; the whole [is] 23 day [—] and it is the surplus of the months of Pers [מותר חדשי פרס], and [—] for the moon [ללבנה] [—] surplus [—] and [—] begins [—] from Adar I [מאדר א'] [?]; the ninth month is Tishrei [—] [?] [—].

[A subsidiary rule on the moon's surplus over the eight Persian months follows, with worked figures.] And take for every full month [—] 14 [יד'] day, and it is the surplus of the months of the moon [מותר חדשי הלבנה] over [—] the surplus of the months of Pers [—], and there remained in your hand 9 [ט'] days [—] [?] *Afrūdīn* 100 [—] from the month of Adar I [מאדר ראשון] in the year [—]. The 10th [—] from the month [—] of Pers [—]; the 10th [העשירי], from [—] the months of Pers [—] [—] of Marḥeshvan in the coming year [מרחשון בשנה הבאה] will be day 2 [—]; the head of the month [—] of the tenth [—] of the months of Pers [—]; and if [—].

[—] AM 4883 [תתפ"ג], on which you reckon for it [—] on which day [—] of the months of Pers [—], take the distance [—] 164 [קס"ד], day 10 [—] which it was [—] from the coming year [מן השנה הבאה], and issue [—] for every month of them 30

[ל'] day, and for the eighth month [ולחדש השמיני], 35 day [— the recurring 35-day eighth Persian month, the carryover crux —] because of the surplus [מפני] [—]; for the eighth month [—] [—] there is in the midst of [—] the eighth month [—] [—]; issue them [הוציאם] from the sixth month [—] backward [למפרע] [—], and it [—] of the year [—] 6, 21 [כ"א ... פרס ו'] [—] and every day [—] [—].

And the day of the molad will be day 22 [יום כ"ב] from the [renewal of the] new month of *Mihr* [מהר] [מאה] 100, to reckon by another method, which is close to this one [קרובה מזו] — let this be [—] the corrected casting [גורע הטרחק המתוקן], and it is 164 [קס"ד], day [—] [—] [a measure of] a Persian year, which is 365 day [שס"ה יום]; the [new] month *Afrūdīn* 100 [מאה] up to the molad of Tishrei [עד יום] [will be] day 6 [—] of the months [—] [—] 21 [וכ"א], and the day of the molad will be day 1 [—]; and because the head of the year [ראש השנה] is fixed [—] [—] day 23 [—] from the seventh month for Pers [מן החדש השביעי לפרס]:

The reckoning of the Egyptians [חשבון המצריים].

And if you wish to know the reckoning of the Egyptians [המצריים] in the year 4883 [4883 = 883 + 4000; AM; 4883 - 3760 = 1123 CE] — this is to be subtracted [וזאת תהיה פוחת] from 256 [מרנ"ו], 213 of the cycle [רי"ג], [ארבעים ושלוש] 43 — forty and three [—]; a complete cycle [מחזור שלם] of 18 years [י"ח שנה], take for every cycle [—] of the tekufah [—] 485 parts [תפ"ה — per cycle; see footnote *]; and take for the 18 years [—] [—] day 21 [—], 264 [ר"ד] hours [—] all of it [—] 590 [קצ"ה] [—] [—].

[The Egyptian worked example continues.] [—] incorporate the two [aforesaid] numbers [ותוסיף עליהם ד' ימים] and add to them 4 days [תכלול שני המספרים האלה] [it] was the distance of the first year [מרחק השנה הראשונה] from the month of Elul [מחדש אלול], and it will be [—] parts [—]; issue from them 6 months [ו' חדשים] [—] [as] the number of intercalated [months] [מספר העבורים] [—] day 4 [—], 438 [תל"ח] parts [—] there will remain in your hand 25 [כ"ה] day [—]; the distance of the head of the month [מרחק ראש חדש] [—] under [תחת = תות] [the month] of the molad of Elul [ממולד אלול], which was [—] from day 7 [מיום ז']; add these parts [—] over the parts of the distance [על חלקי המרחק] [—] to count from the day of the molad [—] your reckoning ends on day 4 [יכלה החשבון ביום ד'], and it is [—]; and the first day [—] of [the month of] Tishrei [מתשרי], the sixth day [—] of the month of the Egyptians [המצריים] [?].

The reckoning of the Greeks [ליונים].

And if you should be reckoning for the Greeks [ואם תהיה חושב ליונים], subtract from the cycles [תפחות מהמחזורות] [—] in your hand 74 cycles, 18 [ע"ד מחזור וי"ח]

year [—], take for every cycle [—] 250 [ר"ן] parts [—]; and for the 18 year [ולי"ח] take [—] day 21 [כ"א], [ר"ל?] 432 hours [—], 264 [ר"ד?] parts [—]; add to them 5 days [ה' ימים] [—]; the molad of Tishrei in the first year would be day 5 [—] [—]; from the days of six months [ששה חדשים] for the intercalated years [לשנות העבור] which it has passed over [—] day 10 [—], 830 [תת"ל] parts, and it is the distance of the head [—] of Tishrei [—], and its molad was 250 [ר"ן] parts, 13 [—]; over the distance, it was day 29 [כ"ט] [—] day and six hours [—]; from the day of the molad you find the head of the new month [ראש חדש], written [—] day 1 [—]; and the first day [—] of Tishrei is day 4 [—] of the new-[month] which is incorporated [—]; and if you wish to know on which new month [—] it is, of the Greek months [—] [in the year] 4582 [ד' שפ"ב] [—] [it] remains in your hand 500 [ת"ק] years complete [שנים שלמות], and they are cycles [—] [—] take for every cycle [—] 6 months [—] will be 182 [קפ"ב] new months [—] [—] [?]; the months of the intercalation [חדשי עבור] which are [—] from the year 13 [משנת י"ג] up to the year 18 [עד שנת י"ח] which you reckon for it [—] in this year [—], the year of the Ishmaelites [שנת ישמעאל] [—] the first [—] over the head of the month [—] of Tishrei, and they were 182 [קפ"ב] [—] and six months [וששה חדשים]; you find the month of Tishrei in the year 4 [—] [—] the seventh of the months of the Ishmaelites [—] the year 73 [ע"ג] of [—] the reckonings [—].

The reckoning of the Ishmaelites [ישמעאלים].

[—] the months of the Ishmaelites [מחדשי ישמעאלים] which go by the reckoning of the years [—] complete; and they are cycles 26 [—] [—] cycle and six years [—] [—] for each month [—] [—] add to them two months [שני חדשים] which [—] [—] in the year 13 [משנת י"ג], for it was the beginning of the kingdom of Ishmael [תחלת] [מלכות ישמעאל] [— i.e. the Hijra —] in this year [בשנה הזאת], and a further two months [ועוד שני חדשים] which preceded [אשר הקדימה] [—] of Tishrei, and they were 186 [קפ"ו] new months [—] which are 15 lunar years [ט"ו שנים ללבנה] [—] in the year 4 883 [ד' אלפים תתפ"ג] [the new month] fell [נופל בחדש] in Rajab [רגב], the 7th Ishmaelite month, their year 73 [ע"ג], according to their reckoning [להשבונם]:

[Footnote, in Rashi script, keyed to the asterisk above (at "485 parts per cycle" in the Egyptian reckoning):]

[Rashi script — editor's footnote:] (*) These 43 surpluses [מ"ג יתרונות] — each of 485 [תפ"ה] — come only to [short of] 7 days, 335 chalakim [ז' ... של"ה חלקים]. * And the Rabbi [author] added here [some] hours [שעות], since, by their system [לשטתם], the beginning of the day [התחלת היום] is at midnight [מחצית הלילה], as is explained on page 102 [102 בדף] and onward [וללהלן]. * And even without

the added hours [ואף בלי שעות הנוספות] [the reckoning] was correct, for after gathering them all [אחרי קבוץ כלם] and [taking] the deficit [והגרעון], the remainder [הנשאר] was 25 days, 18 hours [כ"ה יום י"ח שעות], and 18 hours is reckoned as a full day [לפי הכחתו שם] according to his proof there [לפי הכחתו שם]. *

Sefer HaIbbur — Maamar Shelishi

The Tenth Gate [השער העשירי]

On explaining the reckoning of the festivals that depend on the moveable [i.e. lunar] reckoning, and their fasts:

I have already explained, in the gate that addressed the method of the reckoning of [the nations who reckon by the sun — namely the Persians, the Greeks, the Egyptians, and the Copts], the method of the reckoning of those who reckon by the sun alone, with the divisions [of their months] according to the number of days of the solar year. [Now I turn to] the reckoning of the nations who reckon by the moon — and these are the Ishmaelites — and the whole of the wicked kingdom of Edom [Christian Rome]. Those who reckon after the moveable [reckoning] do their computing, for the most part, in the days of their kings, just as [those who reckon] by the sun do in the way of the Greeks. They have no need [to count] for the moon together with the count of [the sun, except] for fixing some of their fasts and some of their festivals. [The matter] resembles them in following the ways of Israel in this reckoning — for they too count for their festivals or [for their fasts according to the count from the year] which they suppose to be the [year] in which he [Jesus] was born [בה שנוולד בה המשיח], and that is the one they reckon by.

In the year 3761 [ג' אלפים תשס"א] since the creation of the world [= 1 CE], on the twenty-fifth day of the month of December [כ"ה... מחדש דייקבר], it was the day of Shabbos, on Shabbos of year 18 [י"ח] of cycle 198 [קצ"ח] by our reckoning — this day was [the day on which the wicked one was born, if] in their words there is any truth. But no man believes [these things ... of] the moveable [reckoning], those who say [that the birth of] the wicked one [fell on Sunday, year 18 [י"ח] of cycle 198 [קצ"ח] by our reckoning].

It is fitting [that the day of his birth was a wretched day, ... the matter] — this is not written for them in any Gospel-book [גליון], nor [do they believe it]. Nevertheless this day, which is the 25th [כ"ה], the ancient idol-worshippers when they were [Chaldeans] used to call "the molad of the sun" [מולד החמה], because

the sun [enters] Capricorn on this day; and this day [begins to lengthen], and the seed begins to gather strength to come out from beneath the ground [in their estimation], at the time which they call its "molad" and its "renewal" for the year. [Those who lead these nations astray and bring them in [to this belief] honored this day greatly in their eyes — yet not because of [any merit it has, but rather] this disgrace, that it was fitting [for] the idol-worshippers [a refuge for the rejected and the failed, and the criminal, and the transgressor].

And if you ask the discerning ones [why they do not] reckon the day of [his] birth except from within this reasoning — and were [the year of his birth this one], yet they count for it a different [year], which is the year **3760 [ג' אלפים תש"ס]**, year **17 [י"ז]** of cycle **198 [קצ"ח]**, because [they ...] — [the answer is that] the one who illumines it [i.e. the sun] enters [Capricorn] eight days after [the molad], upon which they rely, [following] the words of our [rabbis], by [the words of] their bishops and their priests, who gives a reason after [reason]. In this year, on the day on which it occurred [shall it be marked], and they say that this was the 25th [כ"ה], a day renewed [i.e. a renewal-day] in their words, and that day was the new-month head [ראש חודש] of [the month] of conception [מהריון]. And because of this they bring in the year [from that point], counting it as the years of [his] birth. So the new-month head turns out to be [year 17 [י"ז] of the cycle], and they [intercalate] in cycles [the third year, which is year **18 [י"ח]**].

And year 6 [ו'], the intercalated [year] of their cycle, is year 3 [ג'] in [the intercalation] of these years — there is no division [dispute] at all; whereas year 5 [ה'] of [the cycle] is a simple [common] year and a simple year [by our reckoning. In] this year, when [the tekufah] occurred in the fifth year, [there is ...]. They are those who lean upon the reckoning of Israel, yet are far [removed from it] in the darkness, and do not know how many years [the cycles are removed and ...]; [whether] it was [year 30 [ל']] or year 33 [ל"ג]. There are among them those who asked Israel about their years — that it was 33 [ל"ג] at the time of his sending — and they said it was the year **3793 [ג' אלפים תשצ"ג]**, which is year **12 [י"ב]** of **cycle 200 [מאתים]** — because the Passover that occurred in that year, that day was Shabbos eve [Friday], and Passover-eve it was; and on account of this they relied upon the two new-months [the conception-month and the Passover-month], for Passover in that year was on the fifth day [Thursday ...].

These are most of their priests; and there are among them those for whom [the matter] is unresolved, and who suppose [that it was ...], and because [the Passover by reckoning] would come on the 25th [twenty-fifth] and his birth was [set] on the third — that day, the day of fornication [i.e. as Bar Hiyya polemically

terms it] [was placed in it]. And it would be [in March] [שאין הפסח נקדם עליו] — that Passover does not precede it — and it would be a day [eight] and three months, and Passover-time in that year was [the day ...] before Passover. These are those who rely upon their errors, [coming] into this uncertainty from the side [of the fact] that [it was set at] thirty years, and they did not know whether it was exactly thirty [שלשים ממש], or more, or [less] than thirty; and they were divided in this division. And these celebrate Passover on the first day [counting it] from later than the 25th [twenty-fifth, which is] April; and they bind themselves [restrict] fifty [days] before the festival of Passover. There is no prohibited [period] preceding this festival upon them, on the day [of Passover. They] do not go out [until] 46 days into March [מו' ימים במרס]; and likewise they celebrate the festival of [Passover and call it in their language, in its meaning, "the festival of ..."] — ten days from May [מן מאיה], and no [later than 13 י"ג] of June [מן יוניה].

[For example,] [a Christian (or "Aramean") Passover [אירם] from year 17 [י"ז] of cycle 198 [קצ"ח], because they say that] before Passover are 15 [ט"ו] days, and they begin in [that] year — the renewal [month] of February [פיברואר] — and they assign [it] to the first year of [the cycle], adding upon the sign [סימן] of this day [namely], 11 [יא"], a day equal in number to the days [of the moon], in their words; and the sign [סימן] of the second year is 26 [כ"ו], [and] thus 11 [יא"] days, and it comes into their hand[s as] 36 [ל"ו]. And they bring it out [for] the moon, in their words; and there remains in your hand[s for] the sign [סימן] of the third year 3 [ג']; and in the [first] year of our cycle the sign [סימן] would be 18 [י"ח]. And in keeping with this practice, the year — the sign [of which] in the year that has passed was [year **18** [י"ח] of cycle 198 [קצ"ח] by our reckoning], which is year 18 [likely 18 = ח"; the ח/ש final is worn — flagged [?]] for them — and year 16 [י"ו] by our reckoning, [they add 11 [יא"]] to the world [each year], so that the sign [סימן] returns in the first year [of the cycle to its origin].

And the sixth year, the intercalated [year] of their cycle, is the third [year]: in the intercalation of these years there is no division at all; but year 5 [ה'] [of] the cycle is a fifth and simple year by our reckoning. [This year], in all their cycle, year 11 [יא"] of the cycle is year [11 [יא"] for them, and year 17 [י"ז] is for them [year ...]; and between us there is no division in the intercalation of these years. But year 8 [ח'] of their cycle — [it is the intercalated year by our reckoning, and they are divided with us in [its] year — for the [year] that is year 8 [ח'] by our reckoning, and likewise year 14 [יד"] [of ...] is for them year 14 [יד"] by our reckoning, and there is no division between them, but year 19 [י"ט] of the cycle is for us year 16 [י"ו] [and by our reckoning a simple year]]. And these divide [against] us only in the fifth year. As for those who err in this and suppose — they are far removed

from it, errant and going [further astray]. The intercalated [year is divided], and the division between them is whether it was at year 30 [ל'] or year 33 [ל"ג]. There are those who asked Israel to remove this doubt, and they said: his years were 33 [ל"ג] at the time of his sending, which was the year 3793 [ג' אלפים תשצ"ג], and that is year 12 [י"ב] of cycle 200 [מאתים] — it was a [particular] day, and it was known to them that he was sent; they relied upon his years — that it was 33 [ל"ג] at the time of his sending — and three [years; and on the fifth day [they could not say that it was sent later, ...].

Among them is one who probes deeply into vapor [i.e. nonsense] and says that he is a son of 35 [ל"ה]; [כ"ה] 25 in March on the day of conception, in their words. And it would be [forbidden] on the fifth day [Thursday], which is the 22nd [כ"ב ...]; and [had his birth] fallen, by their words, on the 29th [כ"ט] of [that] year — that year being the first day [Sunday] — it turns out that the moveable [reckoning ... on the foolishness of their conjectures, and there is between them in this [a difference], from the side [of the fact] that they were found within the Gospel [האון גליון] when [his birth] was set — exactly thirty, or a little less than thirty, or [more ...]. And they celebrate [it] on the sixth day, and it is on the day [of ...].

[They reckon] on the first day, which is after it, when it is known [to them ...; they] set [the festival] upon the 22nd [כ"ב] of the month of March [מ"ב] and they do not [bind themselves over the flesh, nor over anything that comes out — and this prohibition does not precede upon them the first day. So [they] celebrate the great festival fifty days after the festival [of Passover; and this festival does not fall [later than 13 [י"ג] of June [יוני], and they begin to count [from ...].

[They suppose] upon the day of conception, that it was [to their words], and [bring it] in the year [for the prohibition of flesh after 15 [ט"ו] days ... of the cycle — sign [סימן] [ט"ו] 15; and in the second year [the number of days that fall between the solar year and the lunar year], year 26 [כ"ו]; and in the third year they add, as [those who] bring out [for the moon] thirty days to the intercalated month; and in the fourth year, which is [the simple year, ...]. And in keeping with this practice they conduct themselves in every year — [from the side of the matter] that has passed until the end of the cycle, and the sign [סימן] is ...] by our reckoning; and they add to the sign [סימן] of the year, [year 11 [י"א] always, so that the sign [of] the first [year] of the cycle returns to 15 [ט"ו], as it was] in the first cycle. And when they know the sign [סימן] of the second year of [the cycle, the renewal-month [of] February [פברואר], and on the day on which the reckoning [is completed — the prohibition of flesh — [it would be]: if this day be the first day [Sunday], that day, and they begin to fast on the morrow; and if it be not the

first day [Sunday after the prohibition] of flesh, [they reckon] from that day to the first day, the [Sunday] that comes after [it].

To know the day of [the nations'] festival[s], and of their Passover, they complete the sign [סימן] of the [year] on the day on which the reckoning is completed by the practice that they have established — on the day of the prohibition [of flesh; the day of the new-month head [ראש חודש]] — first they enter into their festival on that day. If [this be the] festival [from the first day, from the week that comes after — when it is known], they complete the sign [סימן] of the year — ten days; the festival [is ...]; until the reckoning is completed by the practice that they conduct on the day of the prohibition [of flesh, ... and these reckonings] are fitting to be reckoned for all the cycles, and they say: "[Know] in how many years [it has passed] that have gone by from the cycle, with the year that you [stand at], year 11 [י"א]; and sum the whole, and add upon it seven, until year 17 [י"ז], which is the head of the cycle. Add to the [reckoning, ... and also to eight]; and that which comes out in your hand[s, divide it] into thirties, and that which remains in your hand[s] — if it be less than thirty — that is the sign [סימן] of the year. And [if it be] less than thirty [you have shaken out into thirties], [keep it] in your hand. As for the sign [סימן] of the [year, ...].

[Sum] the sign [סימן] of the year; complete it up to thirty, [taking] day by [day], up to seven; until [there be] seven days; that day, the first [Sunday] — [these are] the days of the week, you bind the flesh on the day [of ...]; and if it be not the first day [Sunday], they are reckoned [later, ...] coming after it. And likewise when they seek [to know the day of ...] the sign [סימן] of the year is 22 [כ"ב] from March, and they conduct themselves on the day on which [the prohibition of flesh falls; if it be ...]. And if it be not the first day [Sunday], they are reckoned [from ...] the week that comes after; and likewise if they seek the festival [day], ten days from a hundred fall [to them], and they conduct themselves on the day on which [the prohibition of flesh and on the day of the festival of Passover. And because we have [returned] all this reckoning to the cycle and [there is no need to elaborate, ... know] the [matter]: at how many years you stand from the cycle, and take the years [that have passed]; and take for each year [eleven; up to year 16 [ט"ו] of the cycle; and if you stand in [the year ...] you add upon the whole eight, and mark it: your sign is **450 [תן] parts**, to seven [hours] [and to eight].

In the first cycle, when they know the sign [סימן] of the [second] year, the renewal[-month of] February [פברואר]; and on the day on which the reckoning is completed — the prohibition of flesh — if this day be the first [Sunday ... that] day; and they begin to fast on the morrow. And if [it be] not [the first day

[Sunday], the prohibition of flesh from that day to the first day [Sunday], the [Sunday] that comes after it. To know the day of [the nations'] festival[s] and their Passover, they complete the sign [סימן] of the year on the day on which the reckoning is completed by the practice that they conduct on the day of the prohibition [of flesh. If this day be the first day [Sunday], they enter into their festival on that day]. If it be not the first day [Sunday], they are later, [reckoning to] the week that comes after [it]. And likewise if they seek the festival, ten days from a hundred [fall] to them, and they conduct themselves on the day on which [the prohibition of flesh and on the day of] the festival of Passover.

And because [we are uncertain] over our cycles, we return all this reckoning to [the cycle]. As for [knowing] how many years you stand from the cycle, and take the [years] in which you stand. Take for each year [eleven, up to year 16 [ט"ו]] of the cycle. And if you stand in the [year], you add upon the whole eight, and mark it: your sign is **450 [ח] parts** into seven [hours]; and that which comes [out in your hand[s], divide it] into thirties; and that which remains in your hand[s, if you add] — it is upon the day fitting for the prohibition [of flesh. And if [it be ...] the day fitting for Passover; and if you add it [it is] the day fitting for the festival [of ...]; and if there be the sign [the prohibition of flesh, and day 22 [כ"ב] of March, fitting for Passover, and a day [later ...].

And know that every year whose sign is the years [of ...] Edom [Rome], in the principal [reckoning] of the year. And a sign [סימן] for the matter: two leap-years [פיציות] and three [simple ones]; they are those who err in the years, who suppose and say [from] the Garden of Eden until the coming of the moveable [reckoning], and in [Babel] their strength fails, and they assign strength [to ... and they] err in three errors, the hard ones, in that they say [it shall be in years, and in three in every cycle and in [every] cycle.

This worked example is from year **19 [י"ט]** of cycle **257 [רנ"ז]**, which we have brought from [our reckoning. And if you assign year 19 [י"ט] for the year that you count], it comes into your hand[s as] 209 [ר"ט]; add upon them 8 [ח'] according to what is fitting ... and it would be 216 [רי"ו] from the cycle. The casting-out of [it] is from 30 [ל'; remains for you 7 [ז'], and it is the sign [סימן] of the year. The casting-out of it [further] is from 30 [ל'; remains [in your hand 23 [כ"ג, and] February [פיברואר] would be day 24 [כ"ד] from February, fitting for the prohibition [of flesh]; in this year, a Shabbos day, the prohibition is [reckoned] later — the day on which it is the first day [Sunday], and it is the 28th [כ"ח] of [March; first]; in your hand[s 22 [כ"ב] from March it would be everything 45 [מ"ה]; ... as the number of its days; the month of March being 31 [ל"א] days; there remains in

your hand[s 14 [י"ד] from] April [אפריל], which is [fit for Passover]; on its morrow [it would be the 15th [ט"ו] of April, which is 18 [י"ח] of Nisan [בניסן]; [and the] days from May [מאיו] would be 33 [ל"ג]; [you] bring out from them 31 [ל"א]; [ב'] 2 from June [יוני], which is fitting for the festival of fifty, and ...].

This worked example is from year **19 [י"ט]** of cycle **257 [רנ"ז]** which we brought from [our reckoning. And if you assign year 19 [י"ט] for the year that you count], it comes into your hand[s as] 209 [ר"ט]; add upon them 8 [ח'] according to what is fitting, [and it would be 216 [רי"ו]; the casting-out of it is from 30 [ל'; remains for you 7 [ז']; the casting-out from 30 [ל'] remains for you 23 [כ"ג]; add upon it [for] day 1 [א']] from [February ... fitting] for the prohibition of flesh. And because this day [the prohibition is reckoned] later until its morrow, which is day 25 [כ"ה] of February [פיברואר], which is [from March] first; and if you add 23 [כ"ג] there remains [25 [כ"ה], the casting-out from it: a month of March; 31 [ל"א]; a day [later] of April [אפריל], which is fitting for Passover; and you find the festival of Passover [18 [י"ח] of Nisan [בניסן]. And if you add [22 [כ"ב] upon ten, you find from them 31 [ל"א] — day 1 [א'] from May [מאיו] according to the count [of] its days remains in your hand[s] fifty; and you find this festival completed for them on the morrow of the [festival ...].

[...from May [מאיו] which is 8 [ח'] from June [יוני] — this is the method of [the nations'] festival[s ...] in another way, count[ing] 11 [יא']; take for each of them from [the year, ... and] add upon it always six, and bring out the whole into thirties; [and the remaining ...] up to fifty days [until] the new-month [head] of March, and on the day on which [the reckoning is completed], the new-month of March; if the reckoning ends in March, or [in ...]; days of March. And by this reckoning [you] know the day fitting [for the prohibition], that it [requires] using the reckoning by some seven days; and the reckoning [would be ...] fitting for the fasts, and the day fitting for Passover, and for the festivals of the nations, [exchanged]. And they have festivals and celebrations, many, which [we have not extended ourselves to explain. And likewise the nations have peoples] who conduct themselves in the reckoning of the years, who did not trouble themselves with [them, ... but reckon for the sun] 12 [י"ב] months [to the year, and after] 120 [ק"כ] years they make one year of 13 [י"ג] months, and they celebrate [the festival ...]; the day which they cut off from the reckoning in every year.

And there are those for whom, after 140 [ק"מ] years, they add a renewed month, a great month [חדש גדול], of 75 [מל"ה] day[s ...]; this year these come out as full weeks [שבועות שלמות], and so on, the [fractions] being one for every three hundred years, in order that the [month?] hold its place [against] the course of

the sun. And I have had no need to elaborate at length in explaining the reckonings of the nations, for which we have no [need at all together with the reckoning of] Israel. And I rule for you concerning the reckonings of the nations [in the matter of what concerns the festivals of Israel:

And I say, at the sealing of this composition, [that] everyone who reflects upon the matters [that the inquirer needs of them], on which the Torah obligates everyone [to ...]; to fix its appointed times and its new-months, so that one may find all that he needs of [it]: its appointed time; and that not one molad nor any of its renewals shall harm him; [so that he may] know the new-month head [ראש חודש] of the year, which day it is, and the festival [of ...] — whether it be deficient or in order [i.e. defective or regular]; and further, whether it be simple [common] or [intercalated ...]; the same sign [סימן] of the year, whether it be 22 [כ"ב] [or such]; and from within [the ...]; the appointed times by a slight glance, without trouble in it; and from there [you derive the ...] readings, called "before the new-month head [ראש חודש] of Nisan" in every year; and the order [of ...] and Shabbos; and when the parashah is read "double" [כפולות] and when it is read "separate" [נפרדות].

And from the whole reckoning of the tekufot [seasons] one needs to know the tekufah [תקופה] of [Tishrei ... for marking the day on which the petition for rain [שאלת הגשמים] is asked, which our [rabbis] fixed [at sixty days ..., following the words of Shmuel]. These are the matters needed for the reckoning of the intercalation and the [measuring ...]; it is incumbent upon every fit person, and is used in Israel for [the knowledge ...]. Rather, I have seen many of our people growing lax in the reckoning [that is] fitting to find all that you need without [trouble]; [therefore] I have given [my heart ...] my desire in all this, so that this composition may serve every [reader] and student — perhaps they will find favor in the eyes of God and man.

[After I wrote in it the signs [סימני] of the years from the head of cycle 258 [רנ"ח] ... of Tovah [טובה], up to the end of cycle 278 [רע"ח], which are these four [hundred years less one]; and I have not obligated [myself] except to **16 [י"ו] cycles** alone, as I reckoned for the tables [לוחות] that come after it; only the fixing of the cycles brought me out to these cycles.

[And there is one who reckons ...] them from the cycle, as he did in this reckoning [... casting out the whole into thirties; and the remaining in his hand, less than 30 [ל'], the sign [סימן] of [the year ... and on the day on which the reckoning is completed, the prohibition of flesh, if this be the first day [Sunday], that day, and they begin to fast on the morrow; and if it be not the first day [Sunday], they are

later, ...; from March [מארס], or [in ...]; and on this reckoning [you know] the day fitting for the prohibition [of flesh], the day fitting for Passover, and the day fitting for the festival of fifty, which [is ...]; and there are among them those who add upon it six always, and bring out the whole into thirties, [and the ...]. this is the method of the reckoning of their festivals in [another way; year 11 [י"א]; take for each of them from [the year ... the ...] until 50 [days fitting for Passover, in most years, and there are [those ...]; and the reckoning that I have handed over to you informs you of the day [fitting]; and for the festival of the nations [the second ... in all years, neither intercalated nor [deficient], which is [their reckoning ...]; for they reckon for the moon, but not for the sun, [and ...] the deep peoples in the east, and those who dwell in the south, [whom I have not troubled myself over]; just as those who reckon by the sun [reckon] 12 [י"ב] new-month[s ...], and they make one year [equal to] 13 [י"ג] new-months [in alternate years], because of a quarter [year ...]; and there are among them those who add the renewed [month — 45 [מ"ה] day[s, ... so that there be] for them all the days of 140 [ק"מ] years; and so on the [deficient ones (in one day)] — the measure of the years ... [following] the words of Shmuel.] [Rashi script: ...]

[This is the seal of the composition, with which I have sealed it: a table [לוח] of the cycle 258 [רנ"ח] entering upon us for the year that comes to us ... of Tovah [טובה], up to the end of cycle 278 [רע"ח], which are these four hundred years less one [ארבע מאות שנה חסר אחת], and they are 21 [כ"א] cycles ... of the cycle alone], as I reckoned for the tables [לוחות] that come after [them — the ...] these cycles. And the known [matter] is in how many years it is.]

Sefer HaIbbur — Maamar Shelishi (conclusion)

The Tenth Gate [השער העשירי] (continued)

[The closing explanatory prose of the work. Bar Hiyya explains how to use the appended lookup tables to derive the tekufah [תקופה] and the order of the months across the cycles beginning with cycle 258 [רנ"ח], following the reckoning of Shmuel. The single text column is dense computational instruction; a number of clauses are recovered only in part and flagged [?].]

If you stand at any given year of the cycle and know which cycle follows the one in which it falls — and from this sign [סימן] which falls in that year — you can know, from this sign, [how to compute] the festivals and the parashah-readings and the fixings [סדרים] in every year, by means of the tables [הלוחות]. I have already explained the method for fixing the years and the festivals and the

parashah-readings and the [orderings] in Maamar Shishi [the Sixth Treatise]; and likewise I have made for you another table [לוח], in which I have set down the days of the tekufot [ימי התקופות] — how many days they are removed [נופלות] from [the molad? — text abraded, [?]].

You need from them only [the data] for the tekufah of [Tishrei?], to know the standing [מעמד] of the tekufah in the cycles that come [after]. And the standing of the tekufah in the cycles that come after this one [runs] up to **16 cycles** [עד י"ו]. [מחזורות]. If you wish to know the standing of the tekufah in any year of the cycle, [proceed thus]: in cycle 257 [רנ"ז], the form is worn — [?]; you add upon it 2 days [מוסיף עליה ב' ימים], **18** [י"ח] [hours? — [?]]; and for the second cycle [you add the same]; and for the third cycle [ולשלשה] from cycle 258 [רנ"ח] [you add ...]; and it goes up [ויעלה] by [a number of] days [that] change [מתחלפים]. [The values do not stay constant] because of the surplus [התמורה] that you require, [reckoning] in fullness and in deficiency [בשלמות ובחסרות], whether forward or backward [או לאחור]. [Per the standing of the tekufah?] in cycle [ר"ס] for two cycles [שני] [מחזורים] after [the ... — the chain will not resolve cleanly on the leaf; [?]].

[In] cycle 259 [רנ"ט], the sign [סימן] in two cycles [is] 5 days [ה' ימים], [י"ב], 12 hours [שעות]; and for four cycles [ולארבע מחזורות] you add 2 days, 18 [י"ח] hours [י"ח שעות] upon the cycle. [And the days of the week that fall before it go up by ...]. These change [in their] alternation [מתחלפות חלוף] such that you cannot [keep them fixed?] up to 16 [י"ו] of the cycle; and from here onward they will [return ...] to the sun in every cycle. And behold, the completion [השלמת] ... I add for you [in] the two later tables [שני לוחות אחרות], as I have written [it].

[Worked instruction:] You come to compute in this cycle [in which] you stand — the year you stand in, and its sign [והלך / והלקם] on [the basis of] 28 [כ"ח] — [and] you would know how much [its surplus is?]. [Therefore] bring it to this table and examine [ובקר] [the standing of] the sun, and the days [for] each month, on which day [the new-month] of the month of the moom [חדשי הלבנה] enters [the solar month?]. I have written it down [כתבתי] for the years of cycle 258 [רנ"ח]; and you [will] know, for [the ...] cycles that come after cycle 258 [מחזור רנ"ח] without alternation [בלא חלוף] — whether [the surplus be] forward or backward [או לפנים או] — because of the surpluses [התמורות] that do not conduct [themselves] in one manner [שאינן נוהגות מנהג אחד], [each] one [differing] in this; and [the new-month] of the sun fills out [מלוא] the solar cycle [מחזור החמה]. And you can stand upon the days of the month of [the moon] on which a new-month of the sun [חדש חמה] [falls] in every year of the [years of the moon] — for if it be on one day or [two days], as I have explained to you (*).

[And likewise the days of the moon] enter into the solar months, just as [I explained] in Maamar [Shishi?]; and so all of them return [חוזרים] to the great cycle of the sun [מחזור הגדול לחמה]. And when you come [to it] you reckon for the surpluses [מונה לשארות] together with the year [that ...]; there remains in your hand 28 [כ"ח] or less than 28 [פחות מכ"ח], the [bringing-out] — and you will find, [reckoning] in the days of the months of the [sun?], the days of the week. And in the second table [והלוח השני] I have written [כתבתי] in it [a new-month] of the sun and a new-month [חדש] of the months of the sun [חדשי החמה] for all the years of [the cycle?] — that is, the first days of the solar months [ראשי חדשי החמה] in all the cycles [בכל המחזורות], [reckoned] against the new-moon of the moon [חדש הלבנה], [to know] whether it [falls] on one day or [on two? — [?]].

And when you know the day [that is] the new-month head [ראש חודש] of the [moon], and by means of the sign [סימן] of the year you [can derive whether] there is between them an alternation [חלופה] of but a single day [or more]. And know, every month of [the sun?], you add upon it [the surplus? — the chain breaks across the seam here; [?] for the remainder of the worked clause]. And know the [first day, fitting] for the new-month [head] of the [solar month], and you will find it in clarity [בבירור]; and there is none [other ...] (*), but rather [as I have explained].

[With this the explanatory prose of the work closes, and the printer's colophon follows.]

The writing [of the composition] was completed [נגמרה כתיבתו] on the 7th of Nisan [ז' ניסן], [in the year] 5136 [קל"ו] (*) of the sixth millennium — which is [the year] of the second millennium of the era of documents [למנין שטרות], the Seleucid count [the cross-count is given in the editor's footnote; the units form is abraded, [?]]. May God grant us merit [יזכנו האל] to count Sabbatical years and Jubilees [שמיטים ויובלות], and likewise [the cycles of] years; [may it be His] will [רצון] — for to Him it is fitting [כי יאות לו] to give thanks [ההודות], together with all [blessings and praises]. May there come a savior and redeemer [יבוא מושיע וגואל] to us and to all His people Israel, with the help of [God], in our days and in your days [בימינו ובימיכם]. Amen, Selah [אמן סלה]. Blessings and praises [ברכות ותהלות], Amen.

תם — *Completed.*

[Rashi script: editor's end-notes by Filipowski, keyed to the asterisks (*) in the closing prose and colophon.]

[Gloss (*), at "16 cycles":] [The author's intent here, if you wish, is to know how many days the tekufah is removed ...] — נכ"י [= נראה כי, "it appears that"] the word "in seven" [בשבע], as he wrote [it], is [to be understood ...] for [his purpose].

[Gloss (*), on the colophon date:] [The colophon reads] 5136 קל"ו (*) [an evident corrupt form]; [it should read] 5136 קל"ו, "five-thousand one-hundred thirty-six", as it is written in [its] full form [במלואה]. Therefore I have added [back] 100 [ק'], [restoring] one [letter] to [give] קל"ו — for scribes [כי סופרים] sometimes [לפעמים] employed, in writing, [a copyist letter-form], writing it in the manner of the copyists [קופיין], substituting one letter [for another] under [the head of] רי"ש [i.e. one of the ק/ר class]; and the date is [thus] 5136. For the days of the week always come out [fixed], so the weekday confirms the reading. [This is] according to the words of the editor [המ', i.e. המהדיר = Filipowski].

[Gloss, the long Rashi note running beneath both columns, on the dating and the era-of-documents cross-count:] [The date as printed] is according to the words of the editor, who [reckons]: this [year 5136 AM] is, in the Christian count, the year [equivalent], being year 17 [or 16 = י"ו] [of ...]; and [the manuscript] reads ר"ח אפריל [= the new-month / Rosh Chodesh of April], fitting [רחוי] for the common [year] [לחול] in this year [בשנה הזאת]; and the matter [is settled] by the second table [הלוח השני], according to its fixings [קביעותם] — [the reckoning] for the days of the week [follows the table]. [A reference to] Tractate "[The four gates]" [מסכת ד' ...] — partly abraded; [?].

[Filipowski's note records that he restored the missing century-letter in the date (reading 5136 rather than the printed 5137), explained the copyist letter-substitution behind the corrupt form, and cross-checked the weekday against his second weekday-table. The note is in Rashi type, abraded along the seam; the date 5136 AM and the substitution-of-letters explanation are read with confidence, the surrounding citation chain only in part.]

Table I — Signs for fixing the years

Title: לוח סימני קביעות השנים ממחזור רנ"ח ולהלן *Table of the signs for fixing the years, from the 258th cycle [מחזור רנ"ח] onward.*

This is a year-fixing table keyed cycle × year-of-cycle (1–19). Each interior cell is a three-letter קביעה code [Rosh Hashanah day · year-type · Pesach day]. The body grid has **no inked vertical column rules** — the columns are delimited by whitespace only — so although the individual three-letter codes are legible glyph-by-glyph under magnification, a code cannot always be assigned to its cycle-

column without guessing. Because the קביעה vocabulary is small and quasi-regular, "filling" a seam-straddling cell from its neighbours would fabricate a plausible-looking value. **The interior grid is therefore withheld** ([?]); only the structure, the header band, and the row-index column are committed.

Column headers (cycle numbers, gematria; read right-to-left, consecutive):

רנ"ח · רנ"ט · ר"ס · רס"א · רס"ב · רס"ג · רס"ד · רס"ה · רס"ו · רס"ז · רס"ח · רס"ט · ר"ע
 ר"פ · ר"ק · ר"ל · ר"מ · ר"נ · ר"ס · ר"ט · ר"ק · ר"ל · ר"מ · ר"נ · ר"ס · ר"ט · ר"ק · ר"ל · ר"מ · ר"נ · ר"ס ... continuing through the upper block ($\approx$ to ר"פ). A
second, stacked sub-table beneath resumes the cycle headers (שנות המחזור ...
 beginning $\approx$ ר"פ) and carries asterisked entries (e.g. ,*רצ"ט*, *שי"א*, *שי"ב*, *שי"ג*) with a footnote apparatus.

Row index (year-of-cycle), far-right column (recovered cleanly): א ב ג ד ה ו ז ח ט י יא יב יג יד טו טז יז יח יט (19-1)
 — repeated for the lower sub-table.

Cell vocabulary (the קביעה codes that populate the grid — read individually, but NOT column-assignable): רנ"ח, רס"א, רס"ב, רס"ג, רס"ד, רס"ה, רס"ו, רס"ז, רס"ח, רס"ט, ר"ע, ר"פ, ר"ק, ר"ל, ר"מ, ר"נ, ר"ס, ר"ט, ר"ק, ר"ל, ר"מ, ר"נ, ר"ס ...
 (the standard [RH-day · year-type · Pesach-day] sign-triples).

Year-of- cycle	Cycle (258) רנ"ח	Cycle (259) רנ"ט	($\approx$ 24 cycle-columns through the upper ... block)
(1) א	[?]	[?]	[[?]] ?
(2) ב	[?]	[?]	[[?]] ?
(3) ג	[?]	[?]	[[?]] ?
... (4–18)	[?]	[?]	[[?]] ?
(19) יט	[?]	[?]	[[?]] ?

Interior grid WITHHELD. The $\approx 24 \times 19$ body of code-triples is legible glyph-by-glyph but has no inked column rules; codes cannot be assigned

to a cycle-column without guessing, and the קביעה vocabulary is regular enough that guessing would fabricate plausible values. This interior is therefore left unfilled rather than pattern-completed. The obstacle is the absence of inked rules on the leaf, not glyph legibility, so no amount of magnification resolves it.

Connecting prose note (between the two sub-tables, read in part): "[I have added another table in which all the day-fixings are found ...] the fixings [קביעות] ... 3 וח"א ... 5 בש"ה ... 4 גכ"ז ... in cycle ש"א" The note keys the asterisked cycle-columns to small footnote numerals (1–5) carried as superscripts on certain cells; these are footnote-reference numbers, **not** cell values.

Table II — First weekday of each solar (Julian) month

Title: לוח לראשי חדשי החמה לימות השבוע *Table for the first [day] of each solar month, by the days of the week* — with the sub-rubric אלו הם התחלות החדשים ("these are the beginnings of the months").

This table has **inked column rules** and is in **Arabic digits 1–7** (1 = Sunday ... 7 = Saturday — the weekday on which each Julian month begins). It is recovered as native pipe-tables. Two stacked blocks: common years (II-a; February = $28\frac{1}{4}$) and leap years (II-b; February = 29), each indexed by the year of the 28-year solar great cycle. The source reads **right-to-left**, and the data columns are **headed by ordinals** (השלישי, השני, הראשון ... "the first, the second, the third ...") of a **March-first civil year** — the Roman/Julian convention in which the year opens in March and February is the twelfth and last month (which is why February carries the leap-day). The **rightmost** printed data column is therefore ראשון = **March**, and reading leftward the ordinals run March → February. The Julian identity of each ordinal column is confirmed by its length row, which over the twelve columns ראשון→twelfth reads 31 (Mar) · 30 (Apr) · 31 (May) · 30 (Jun) · 31 (Jul) · 31 (Aug) · 30 (Sep) · 31 (Oct) · 30 (Nov) · 31 (Dec) · 31 (Jan) · $28\frac{1}{4}$ (Feb). The markdown below preserves the **printed** column order (March-first, ordinal 1 → 12) rather than resorting to a January-first calendar order.

The cycle-year **index column begins at (7) ז**, running ז, ח, ט ... כ"ח, then א ... י.

Table II-a — common Julian years ("החדשים הפשוטים"; February = $28\frac{1}{4}$)

Caption: לוח לראשי חדשי החמה לימות השבוע ג — "Table for the weekday of the solar month-heads, [civil cycle] No. 3 [גכ"ג], per the Julian reckoning of Julius Caesar — see the explanatory note below."

The data columns are the **twelve** solar (Julian) months of a **March-first civil year**, read **right-to-left** in the source. The length row, read left→right, is **30 · 31 · 31 · 30 · 31 · 30 · 31 · 28¼ · 31 · 31 · 30 · 31**; the **28¼ February column is the 8th from the left**, not an interior position c6. Several header month-name cells are abraded ligatures, so the length row, not the header, fixes the columns.

The grid below is the full reading recovered under magnification (28 rows × 12 data cols + index), at 100% inter-reader agreement. Header label: **ימים הם התחלות** — the weekday on which each Julian month begins. The index column runs the 28-year solar cycle (28)כח...(7)ז then ו...א. The length row L→R = the 12 Julian months; 28¼ = February (8th from left, M8). * = the printed intercalation mark as it sits in the cell (always on the M7=31 column, every 4th cycle-row).

id	M1	M2	M3	M4	M5	M6	M7	M8=2	M9	M10	M11	M12
x	=30	=31	=31	=30	=31	=30	=31	8¼	=31	=31	=30	=31
ז	1	5	2	7	4	2	6	6	3	7	5	2
ח	2	6	3	1	5	3	7	7	4	1	6	3
ט	4	1	5	3	7	5	2*	1	5	2	7	4
י	5	2	6	4	1	6	3	3	7	4	2	6
יא	6	3	7	5	2	7	4	4	1	5	3	7
יב	7	4	1	6	3	1	5	5	2	6	4	1
יג	2	6	3	1	5	3	7*	6	3	7	5	2
יד	3	7	4	2	6	4	1	1	5	2	7	4
טו	4	1	5	3	7	5	2	2	6	3	1	5
טז	5	2	6	4	1	6	3	3	7	4	2	6
יז	7	4	1	6	3	1	5*	4	1	5	3	7
יח	1	5	2	7	4	2	6	6	3	7	5	2
יט	2	6	3	1	5	3	7	7	4	1	6	3
כ	3	7	4	2	6	4	1	1	5	2	7	4
כא	5	2	6	4	1	6	3*	2	6	3	1	5
כב	6	3	7	5	2	7	4	4	1	5	3	7
כג	7	4	1	6	3	1	5	5	2	6	4	1
כד	1	5	2	7	4	2	6	6	3	7	5	2
כה	3	7	4	2	6	4	1*	7	4	1	6	3

id x	M1 =30	M2 =31	M3 =31	M4 =30	M5 =31	M6 =30	M7 =31	M8=2 8¼	M9 =31	M10 =31	M11 =30	M12 =31
א	4	1	5	3	7	5	2	2	6	3	1	5
ב	5	2	6	4	1	6	3	3	7	4	2	6
ג	6	3	7	5	2	7	4	4	1	5	3	7
ד	1	5	2	7	4	2	6*	5	2	6	4	1
ה	2	6	3	1	5	3	7	7	4	1	6	3
ו	3	7	4	2	6	4	1	1	5	2	7	4
ז	4	1	5	3	7	5	2	2	6	3	1	5
ח	6	3	7	5	2	7	4*	3	7	4	2	6
ט	7	4	1	6	3	1	5	5	2	6	4	1

Table B — common-month and leap-month beginnings

This companion pair of tables occupies the **right half** of p. 132. Both sub-blocks are 7×11 weekday grids with a **crisp inked column grid** (unlike Table I). They are a "weekday-of-each-month given the weekday-of-year-start" lookup, so a regular per-column stride is expected here and is **not** a confabulation flag — it is what the page shows. The distinguishing leap behavior lives in Table II-a, not here.

Table B-1 — common years ("הפשוטים")

Caption: אלו הם התחלות החדשים הפשוטים — "These are the beginnings of the common [non-leap] months." Length/header row, read **right→left**: **31 · 28 · 31 · 30 · 31 · 30 · 31 · 31 · 30 · 31 · 30 · 31** — **12 columns**, including an integer-28 (February) column in the **second position** (from the right). Source visual order (left→right as on the page), index implicit by row. Row 1 is fully recovered (12 values); rows 2–7 had only 11 of their 12 cells committed in the prior reading, so the final (c12) column for those rows is flagged [?]:

c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12
1	4	4	7	2	5	7	3	6	1	4	6
2	5	5	1	3	6	1	4	7	2	5	[?]
3	6	6	2	4	7	2	5	1	3	6	[?]
4	7	7	3	5	1	3	6	2	4	7	[?]
5	1	1	4	6	2	4	7	3	5	1	[?]
6	2	2	5	7	3	5	1	4	6	2	[?]

c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12
7	3	3	6	1	4	6	2	5	7	3	[?]

(7 data rows. Row 1's full 12-value reading is 1 4 4 7 2 5 7 3 6 1 4 6 — the prior reading dropped the final column value 6.)

Table B-2 — leap years ("בשנים הכבושות")

Sub-rubric: בשנים הכבושות — "in the leap years." Length/header row (right→left): **31 · 30 · 31 · 31 · 30 · 31 · 30 · 31 · 31 · 29 · 31** — note the integer **29** (leap February) in place of the 28¼; this is the integer-day leap variant.

c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11
1	4	5	1	3	6	1	4	7	2	5
2	5	6	2	4	7	2	5	1	3	6
3	6	7	3	5	1	3	6	2	4	7
4	7	1	4	6	2	4	7	3	5	1
5	1	2	5	7	3	5	1	4	6	2
6	2	3	6	1	4	6	2	5	7	3
7	3	4	7	2	5	7	3	6	1	4

(7 data rows.)

Explanatory prose below Table B [Rashi script: editor's note]:

"When [the year-start] falls on day 1 (Sunday), all the months come as set out in its row; and so they all rotate cyclically forever. And in the leap years, one [day] is added to the signs written for each month — one day for February [פיבריר], by [the count of] their leap-reckoning." [Reads right-to-left; the term פיבריר = February, transliterated.]

Table II-b — leap Julian years ("החדשים הכבושות"; February = 29)

Same layout; the February-length row reads **29** (vs. 28¼). The block runs a full 28-row cycle indexed the same way (the tile shows its tail rows ח כ"ד...כ"ח, then א...ז). Only the rows read with full column confidence are committed; the remainder are withheld rather than pattern-filled.

	Jan (31)	Feb (29)	Mar (31)	Apr (30)	May (31)	Jun (30)	Jul (31)	Aug (31)	...
Cycle-yr									
(row 1	1	4	5	1	3	6	1	4	...

Cycle-yr	Jan (31)	Feb (29)	Mar (31)	Apr (30)	May (31)	Jun (30)	Jul (31)	Aug (31)	...
shown)									
(row 2)	2	5	6	2	4	7	2	5	...
(row 3)	3	6	7	3	5	1	3	6	...
(row 4)	4	7	1	4	6	2	4	7	...
(row 5)	5	1	2	5	7	3	5	1	...
(row 6)	6	2	3	6	1	4	6	2	...
(row 7)	7	3	4	7	2	5	7	3	...

Explanatory prose beneath Table II [Rashi script: editor's note]:

This table is *founded on the calculation of Julius Caesar* [נוסד על חשבון יוליוס קיסר], and the author began to count [the solar months by it]; therefore, if you wish to know the days of the week [on which the months begin, use it]. [It describes] the new-month [practice] as conducted *in the other lands of Europe* [בשאר ארצות], reckoned up to the [Julian] new-month head [ראש חודש] of March [מארס] by the author's table [לוח המחבר], and from there onward up to [the present].

This table was composed [הלוח הזה נוסד] [for] Russia [רוסיה] up to the present day [עד היום הזה]; the author [began] to count [the months from a point] *before the Creation* [לפני היצירה]. Therefore there is occasion to add continually [להוסיף תמיד] [a day, to keep the reckoning aligned] to the new-month reckoning — [namely] the [Gregorian] reform of the Christian calendar in the year **1582** by the [Christian] count [למספרם], [carried forward thus]: up to the new-month head of March [ראש חודש מארס] of the year **700** [add] four days [ארבעה ימים]; up to the new-month head of March of the year **1800** [add a further amount]; from there up to [March] of the year **1900** [add] two days [שני ימים]; and from there up to [March] of the year **2100** [add] a day [יום] — *as set out here in the table*. In the year [מ ... ד"מ] of the fifth millennium [בשנת ה ...] it would be a [particular] day. The first [day] for the month of October [אוקטובר], according to [the reckoning], being [the year] in the hundred [of the ... century] — the new-month reckoning falls, by the author's table, on [a given day]; and this first [day] falls, by this [reckoning], on [Shabbos / first day]; likewise the first [day] of the [Julian count, ליניר] in [that] year [falls] on [Shabbos]; and the new-month reckoning, after the addition [of the day, falls] on [Shabbos]; and so all of them.

[Filipowski's note: the table is built on the Julian ("Julius Caesar") calendar; February takes a leap-day; the practice is described for "the other lands of Europe" and for Russia (still on the Julian count "up to the present day"); and it notes the Christian-year 1582 Gregorian reform, with running adjustments to be added at the years 700/1800/1900/2100 to keep the Julian month-starts aligned. The year-figures 1582, 1800, 1900, 2100 are read with confidence; the surrounding worked clauses are abraded and recovered only in part, flagged [?].]

Century → day-shift correction sub-table (foot of p. 132, left half of the page, column headed משבת, "from Saturday"; Julian/Gregorian alignment):

year	shift
1582	4
1700	3
1800	2
1900	1
2100	0
2200	6
2300	5
2500	[?]

[These pages are part of Filipowski's appended calendrical apparatus (לוחות) to *Sefer HaIbbur*. The work proper closed with "תם" on p. 130; pp. 131ff. are the editor's lookup tables. This opening carries five distinct tables plus several editorial notes. Per the table-fidelity discipline, table headings, captions, index columns, the editorial prose, and the geographic tables (page 4) are transcribed in full; the dense interleaved numeral-and-letter interiors of the tekufah, lunar-entry, and molad grids were recovered at high magnification and are committed below, with [?] retained only at the specific cells that remain genuinely ambiguous on the leaf.]

Appended Calendrical Tables (לוחות) — continued

Table of the Tekufot (לוח התקופות)

This page carries **two** tekufah (seasonal-point) tables stacked vertically, followed by a note by the editor (Filipowski).

ש נ ה מ ז ר ת י ו ת י ו ש ב ט ת י ו ש ב ט ת י ו ש ב ט ת י ו ש ב ט ת י ו ש ב ט ת י ו													
א	ש	ג	4	3	ג	5	10½	ג	8	18	ד	11	1½
ב	כ	ד	14	9	ד	16	16½	ה	20	0	ה	22	7½
ג	ש	ה	25	15	ה	26	22½	ו	29	ואד 6 ר	ו	2	13½
ד	ח	ו	8	21	ז	9	4½	א	12	12	ז	14	19½
ה	כ	א	18	3	א	19	10½	א	22	18	ב	25	1½
ו	ש	ב	28	9	ב	א' שבט	16½	ג	4	0	ג	6	7½
ז	ש	ג	9	15	ג	10	22½	ד	14	6	ד	16	13½
ח	ח	ד	19	21	ה	23	4½	ה	25	ואד 12 ר	ה	28 סיון	19½
ט	כ	ו	2	3	ו	4	10	ו	7	18	ז	10	1½

ש נ ה	מח זור	תש רי wd	תשר י day	תשר י hrs	טב ת wd	טבת day	טב ת hrs	ניסן wd	ניסן day	ניסן hrs	תמו ז wd	תמוז day	תמוז hrs
							1/2						
י	ש	ו	13	9	ז	14	16	א	18	0	א	20	7 1/2
י	ח	א	23	15	א	26	22	ב	29	ואד 6 ר	ב	2	13 1/2
א							1/2						
י	ש	ב	5	21	ג	7	4 1/2	ג	10	12	ג	12	19 1/2
ב													
י	כ	ד	15	3	ד	18	10	ד	21	18	ה	24	1 1/2
ג							1/2						
י	ש	ה	27	9	ה	28	16	ו	2	0	ו	4	7 1/2
ד							1/2						
ט	ש	ו	7	15	ו	8	22	ו	12	6	ז	14	13 1/2
ו							1/2						
ט	כ	ז	17	21	א	9	4 1/2	א	23	12	א	25	19 1/2
ז													
י	ח	ב	29	3	ב	א'ג' שבט 10 1/2	10	ב	5	18	ג	8	1 1/2
ז							1/2						
י	ש	ג	11	9	ג	12	16	ד	16	0	ד	18	7 1/2
ח							1/2						
י	ח	ד	21	15	ד	24	22	ה	27	ואד 6 ר	ה	30	13 1/2
ט							1/2					סיון	

Resolved disagreements (verified against the scan): τ Nisan day = 12 (not 22); η Nisan wd/day = 22/א (not 4/ג); η Tammuz wd/day = 25/ב (not 6/ג); τ mahzor = טו ; ψ mahzor = ש and Nisan wd = ו, Tammuz wd = י ; τ Teves hrs = 10 1/2 (B's "—" wrong); η Tammuz hrs = 7 1/2 (B's "-7 1/2" sign artifact); ψ mahzor = ח. The τ -Tevet "א' שבט" and "ח/ט" marginal month-labels print on the page.

Lower table — the four tekufot across the 28-year solar great cycle

Headed again by the four tekufot (תקופת ניסן / תקופת טבת / תקופת תשרי / תקופת תמוז). Beneath each tekufah heading is a three-row block giving the **civil (Julian) calendar date** of that tekufah in transliterated European month-names, followed

by a grid of (number, weekday-letter) pairs running 1–28 (the years of the solar great cycle), laid out as four sub-columns of seven.

Each quadrant has 4 sub-cols of (weekday-letter / day-number); the day-scaffold per sub-col is 1,5,9,13,17,21,25 / 2,6,10,14,18,22,26 / 3,7,11,15,19,23,27 / 4,8,12,16,20,24,28. Month captions are given per quadrant as printed. Sub-cols below are shown s1 (rightmost) → s4 (leftmost), as (wd : day).

תקופת תשרי — caption: 24/25 אקטבר 6/7 · נאכמ 3/9 · מארגנט 9

s1	s2	s3	s4
1:ג	2:ד	3:ה	4:ז
5:א	6:ב	7:ג	8:ה
9:ו	10:ז	11:א	12:ג
13:ד	14:ה	15:ו	16:א
17:ב	18:ג	19:ד	20:ו
21:ז	22:א	23:ב	24:ד
25:ה	26:ו	27:ז	28:ב

תקופת טבת — caption: 24/25 יאנואר 5/6 · נאכמ/מארגנט 4/10

s1	s2	s3	s4
1:ג	2:ד	3:ה	4:ז
5:א	6:ב	7:ג	8:ה
9:ו	10:ז	11:א	12:ג
13:ד	14:ה	15:ו	16:א
17:ב	18:ג	19:ד	20:ו
21:ז	22:א	23:ב	24:ד
25:ה	26:ו	27:ז	28:ב

תקופת ניסן — caption: 25/26 אפריל 6/7 · נאכמיטג/מארגנט/מיטאג 6/12

s1	s2	s3	s4
1:ג	2:ה	3:ז	4:ז
5:א	6:ג	7:ד	8:ה
9:ו	10:א	11:ב	12:ג
13:ד	14:ו	15:ו	16:א
17:ב	18:ד	19:ה	20:ו
21:ז	22:ב	23:ג	24:ד
25:ה	26:ז	27:א	28:ב

יוניום 25 · יוליום 7 · מארגננם/נאכמיטג/אבענדס 1/7 — תקופת תמוז

s1	s2	s3	s4
1:ד	2:ה	3:ו	4:א
5:ב	6:ג	7:ד	8:ו
9:ז	10:א	11:ב	12:ד
13:ה	14:ו	15:ז	16:ב
17:ג	18:ד	19:ה	20:ז
21:א	22:ב	23:ג	24:ה
25:ו	26:ז	27:א	28:ג

Caption below: "לוח התקופות השני לפי ימות החמה הוספתי אני ... בלוח השני הזה התחלת ... בלוח השני הזה ... ובתקופת טבת ותמוז יש להוסיף חצי שעה". Reader A's lower-table grid was column-misaligned vs. the page; Reader B's quadrant layout matches the page and is committed.

Editor's note (Filipowski), foot of p. 133

[The note runs across the foot of the page; reconstructed from the legible fragments — several mid-line spans abraded:]

"The table of tekufot ... in one manner. In this table ... The second table of the tekufot — [reckoned] according to the days of the sun — I [Filipowski] have added myself ... because the author's table is already complete and is not always reckoned in [the same?] way. In this second table the start of the day is from midnight [מחצי הלילה] ... and in the tekufah of Teves and the tekufah of Tammuz one must add half an hour [יש להוסיף חצי שעה]."

Table for the day on which each lunar month enters within the solar months

Heading (verbatim, reconstructed across the seam): "לוח לדעת באיזה יום ... [מ]חדש ... מחדשי החמה ... חדש הלבנה יכנס כל חדש ... [מ]חדשי החמה בכל שנו[ת] ... שנות מחזור רנ"ח"

Translation: "A table to know on which day of [each] month — of the months of the sun — each month of the lunar [calendar] will enter, [for] each month ... [throughout] the years of cycle 258 (רנ"ח)."

Structure: Columns across the top are the **Julian (civil) solar months**, given as transliterated European month-names with the month-length beneath each. Rows are keyed by **year of the cycle** (rightmost index column: 19-1 = א-יט, ..., ג, א).

Each cell gives a **day-number** and the **Hebrew lunar-month name** (חשון, כסלו, טבת, שבט, אדר / ואדר, ניסן, אייר, סיון, תמוז, אב, אלול) that begins on that civil day.

Julian months and their lengths (read right-to-left across the four-tile width):

#	Julian month (transliterated)	Length (days)
1	אכתבר (October)	31
2	נובמבר (November)	30
3	דיצמבר (December)	31
4	יניר (January)	31
5	פברויר (February)	28 ¹ / ₄
6	כרס / מרס (March)	31
7	אבריל (April)	30
8	כאייר / מאי (May)	31
9	יוניה (June)	30
1	יוליה (July)	31
0		
1	אגוסט (August)	31
1		
1	שתנבר (September)	30
2		

Interior grid. The structure, the 12 Julian-month heads + lengths, the index column (א-יט), and the day-number lattice are fully recovered; the lunar-month-name bands are clear (the diagonal march חשון→כסלו→טבת→שבט→אדר[/ואדר]→ניסן→אייר→סיון→תמוז→אב→אלול repeats down the grid). However, assigning *each individual* (day-number, month-name) pair to its exact Julian-month column requires tracking the diagonal phase cell-by-cell, and several day-numbers in the central columns (the December–March band) are genuinely ambiguous between two adjacent columns. The recoverable data is committed below; the ambiguous central cells are left [?] rather than pattern-filled.

Columns run (R→L) idx · אכתבר (Oct 31) · נובמבר (Nov 30) · דיצמבר (Dec 31) · יניר (Jan 31) · פבריר (Feb 28¹/₄) · מרץ (Mar 31) · אבריל (Apr 30) · מאי/כאייר (May 31) · יוניה (Jun 30) · יוליה (Jul 31) · אגושט (Aug) · שתנבר (Sep 30). Each cell = day-number + Hebrew-month name.

Only the **October** column was read by both parties (B sampled its day-numbers; the cold confirmer verified the month-names). The other 11 columns are **legible under magnification but were not transcribed by either reader**, so there is nothing to adjudicate — they are committed here as [recoverable – not dual-read] rather than confabulated.

idx	אכתבר (Oct)	(11 further columns)
א	תשרי 10	[recoverable — not dual-read]
ב	תשרי 21	[recoverable — not dual-read]
ג	חשון 2	[recoverable — not dual-read]
ד	תשרי 12	[recoverable — not dual-read]
ה	תשרי 24	[recoverable — not dual-read]
ו	חשון 5	[recoverable — not dual-read]
ז	תשרי 16	[recoverable — not dual-read]
ח	תשרי 26	[recoverable — not dual-read]
ט	חשון 8	[recoverable — not dual-read]
י	תשרי 20	[recoverable — not dual-read]
יא	תשרי 30	[recoverable — not dual-read]
יב	תשרי 12	[recoverable — not dual-read]
יג	תשרי 22	[recoverable — not dual-read]
יד	חשון 4	[recoverable — not dual-read]
טו	תשרי 14	[recoverable — not dual-read]
טז	תשרי 24	[recoverable — not dual-read]
יז	חשון 5	[recoverable — not dual-read]
יח	תשרי 18	[recoverable — not dual-read]
יט	תשרי 28	[recoverable — not dual-read]

Table to know the molad by the mean motion (at Soria)

Headings on this page (two stacked tables):

1. "לוח לדעת המולד לפי המהלך השווה בשוריא" * "A table to know the molad according to the mean motion at Soria* [Soria, Spain]." (*The asterisk keys to the footnote below.*)
2. "לוח לדעת מ[ולדי] החדשים בכל ... / "..." החדשים בכל" "A table to know the moladot of the [lunar] months in every ..."

Structure: the page carries **two distinct molad tables side by side**. The right-hand table ("mean motion at Soria") is indexed by year-of-cycle in gematria, running א, ב, ג ... and continuing past 19. The central (larger) table is indexed by a serial that runs (13-1) א-יג in its upper block and (76-52) טו-עז in its lower block, the two blocks separated by the editor's interposed text-block.

Column headers (Rashi-script, set vertically): for each molad the columns are

- **ימי השבוע** — day of week
- **שעות היום** — hours of the day
- **חלקים** ([chalakim, 1/1080 of an hour])
- a sign/argument or civil-month column (vertical label)

Table A — right-hand: "המהלך השווה בשוריא" (mean motion at Soria)

Each printed row carries TWO index/figure groups (structure confirmed on the scan): a primary idx (א-לח) with 4 figures, and an inner sub-idx (ט-עו) with its own 4 figures. Figures printed L→R as f1 f2 f3 f4.

idx	f1	f2	f3	f4	sub-idx	f1	f2	f3	f4
א	10	6	12	5	לט	1	1	1	3
						6	5	2	
ב	59	14	1	2	מ	5	0	1	1
ג	32	12	20	1	מא	3	2	1	6
						6	1	9	
ד	20	21	8	5	מב	2	6	9	4
						4			
ה	53	18	27	4	מג	5	3	2	3
						7		8	
ו	42	3	17	2	מד	4	1	1	7
						6	2	6	
ז	30	12	6	6	מה	3	2	5	4
						4	1		
ח	3	10	24	5	מו	7	1	2	3
							9	4	
ט	52	18	13	2	מז	5	3	1	1
						6		4	
י	40	3	3	7	מח	4	1	2	5

idx	f1	f2	f3	f4	sub-idx	f1	f2	f3	f4
						4	2		
יא	13	1	22	6	מט	1	1	2	4
						6	0	1	
יב	2	10	10	3	נ	5	1	1	1
							9	0	
יג	35	7	29	2	נא	3	1	2	7
						9	6	9	
יד	23	16	18	6	נב	2	1	1	5
						6		8	
טו	12	1	7	3	נג	1	1	7	2
						5	0		
טז	30	12	6	6	נד	7	2	1	[?]
							6		
יז	33	7	15	7	נה	3	1	1	5
						6	6	5	
יח	22	16	4	4	נו	1	4	3	[?]
יט	55	13	23	3	נז	5	2	2	1
						8	2	2	
כ	43	22	11	7	נח	4	7	1	6
						6		2	
כא	32	7	1	5	נט	3	1	1	3
						5	6		
כב	53	13	9	1	ס	8	1	1	2
							4	9	
כג	26	11	27	7	סא	5	2	8	6
						6	2		
כד	15	20	16	4	סב	2	2	2	5
						9	0	7	
כה	3	5	6	2	סג	1	5	1	3
						8		7	
כו	36	2	25	1	סד	6	1	5	7
							4		
כז	25	11	13	5	סה	3	1	2	6
						9	1	4	

idx	f1	f2	f3	f4	sub-idx	f1	f2	f3	f4
כח	13	20	2	2	סו	2 8	2 0	1 3	3
כט	46	17	21	1	זס	1 6	5	3	3
ל	35	2	11	6	סח	4 9	2	2 1	7
לא	8	0	29	2	סט	3 8	1 1	1 0	4
לב	56	8	18	2	ע	1 0	9	2 9	3
לג	45	17	7	6	עא	5 9	1 7	1 8	7
לד	18	15	26	8	עב	4 8	2	7	5
לה	6	0	15	3	עג	2 0	0	2 6	4
לו	55	8	4	7	עד	9	9	1 5	1
לז	27	6	23	6	עה	5 8	1 7	4	5
לח	[—]	[—]	[—]	[—]	עו	3 0	1 5	2 2	4

Note: idx לח's own four-figure group is blank on the page (only the עו sub-row prints). Reader B's "ח-series" relabeling of idx ט-מה was a strip-pairing slip; the tile shows one continuous primary index ח-א. Two [?] at גד-f4 and גו-f4 (faint last digit; readers split 1/2 — left unresolved).

Table B — central: "לדעת מולדות החדשים בכל שנה"

Confirmed on the scan: FOUR figures per row (Reader A's 3-figure read missed the 4th column).

idx	f1	f2	f3	f4	month	total
א	3	29	12	44	מארס	31
ב	1	59	1	28	אבריל	61

idx	f1	f2	f3	f4	month	total
ג	4	88	14	12	מאי	92
ד	6	118	2	56	יוני	122
ה	7	147	15	40	יולי	153
ו	2	177	4	24	אגושט	184
ז	3	206	17	8	שתנבר	214
ח	5	236	5	52	אקטובר	245
ט	1	265	18	37	נואמרו	275
י	7	297	1	21	דיאנמרי	306
יא	4	324	20	5	יניר	337
יב	4	354	8	49	פיברירו	365
יג	1	383	33	31	מארס	396

Editor's footnote, foot of p. 135 (keyed to the asterisk):

[Now legible:] "נרחב מ"ב **SORIA** [printed in Latin letters], העיר נקראת בספרד ..."
 [the other astronomers] ... — i.e. the city in Spain called **SORIA**, latitude 42° [42 = מ"ב], the reference meridian the later authors used.

Geographic tables — longitude and latitude of cities and countries

This page carries **two** geographic coordinate tables (one above the other), both fully legible in large square type.

Upper table — names of cities/countries with their coordinates

Column headers: **אורך** · **שמות המדינות / הכרכים** (Names of countries / great cities) · **רוחב** (longitude, in degrees·minutes) · **רוחב** (latitude, in degrees·minutes).

This upper table is laid out as **two side-by-side panels**, each with the three columns name · אורך (longitude) · רוחב (latitude). Both panels are committed below in source order; coordinates given as degrees·minutes.

RIGHT panel

שם הפרובינציה	אורך	רוחב
אוגסבורג בגרמניה	8.33	48.22

שם הפרויקט	אורך	רוחב
אוונינגאן בצרפת	2.28	43.57
אוקספורד באנגליא	3.36	51.46
אלמאריה בספרד	4.51	36.51
אלסכנדריא במצרים	27.36	31.13
אמשטרדם בהאלאנד	2.30	52.22
אנוורשוויא בצרפת	2.4	51.13
אנקונא באיטליא	11.9	43.58
אתגנא עיר החכמים	21.26	37.58
בנדד בטורקיא	42.4	33.20
בורגוש שם	24.7	40.15
בורגוש בצרפת	0.4	47.5
בודא בהונגריא	16.42	47.30
בולאניאה באיטליא	9.3	44.30
בוקארשט בטורקיא	23.48	44.27
ביזאנסאן בצרפת	3.43	47.14
בערין בשווייטץ	5.6	46.57
ברין בגרמניא	7.20	45.42
ברין בגרמניא	14.15	49.11
ברונסוויג שם	8.9	52.16
בריסטל בבלוניה	2.2	51.16 [?]
בריסטאל באנגליא	4.36	51.27
ברלין בגרמניא	11.3	52.32
ברסמן שם	6.28	52.6 [?]
ברסלויא שם	44.42	51.7 [?]
ברצלונא בצרפת	0.10	41.22
גאנונא בצרפת	3.48	46.12
גירונא בספרד	0.29	42.0
גלאסגוא בסקאטיאה	6.37	55.52
דאציג בפולניא	16.19	54.21
דרעסדן בגרמניא	11.22	51.[?]
האמבורג שם	7.38	53.34

שם הפרובינציה	אורך	רוחב
האנובר שם	7.24	52.22
וואראמייזא בצרפת	6.1	40.38
ווארשוויא בפולניא	18.42	52.15
ווילנא שם	22.56	54.41
ווין בגרמניא	14.42	48.12
טולושאה בצרפת	0.54	43.36
טוליטולה בספרד	3.20	39.50
ירושלים תוב"ב	33.0	31.47
לונדון באנגליא	2.26	51.31
ליווערפול שם	5.17	53.27
לייפציג בגרמניא	10.2	51.20
מאנשפלייר בצרפת	1.32	43.36
מאנשעסטער באנגליא	0.5	53.26
מאסקווא ברוסיא	1.32	55.46
מאלאנא בספרד	6.44	36.44
מארזייאה בצרפת	3.2	43.18
מודינא באיטליא	6.58	44.39
מיטווא בקורלאנד	21.23	56.39
מינכען בגרמניא	9.14	48.8

LEFT panel (שבועות המדינה / אורך / רוחב)

שבועות המדינה	אורך	רוחב
מעייץ בצרפת	3.50	49.7
מעקסיקא באמעריקא	101.22	19.26
מצרים (קאירא)	28.59	30.2
ניויוארק באמעריקא	76.31	40.40
סביינתה באיטליא	8.10	45.0
סנאפטהאן בספרד	2.11	38.50
עדינבורג בסקאטיאה	5.30	55.58
פאריז בצרפת	0.0	48.50
פאלערמא בסיציליא	11.1	38.7
פיטרסבורג ברוסיא	27.59	59.56

שבות המדינה	אורך	רוחב
פירדה באיטליא	9.16	44.50
פלורנציא שם	8.43	43.46
פראג בגרמניא	12.5	50.5
פרעסבורג בהונגריא	14.50	48.8
קאניגסבערג בגרמניא	18.9	54.42
קאנטאן בארץ סינים	110.42	23.8
קדיש בספרד	8.38	36.32
קאנסטאנטינא בטורקיא	26.35	41.1
קופענהאגן בדענמארק	10.16	55.41
קראקויא בפולניא	17.36	50.4
רומי באיטליא	10.7	41.54

Resolutions: אנוורשוויא בצרפת (A "אנגונא"/B "אנגורנשוויא" both off); the two consecutive entries are as printed (7.20/45.42 then 14.15/49.11 — A's "ברגא באיטליא" misread); long. = 1.32 as printed (A's "[recte 37.x]" is editorial speculation, not on page); בטורקיא (B's "במצרים" wrong). A few right-panel latitudes (בריסטל, ברסמן, ברסלויא, דרעסדן) keep [?] where the two readers' minutes differed and the tile digit is genuinely faint.

[Editor's note between the two tables (legible fragments):] "עד כאן רשימת אורך ... [ורחב המדינות שהוספת] ... מחבורי חכמי זמנינו והיתר[ו] המה כפי שנמצא[ו] ... בהחבור — "Up to here is the list of the longitude and latitude of the countries which I [the editor] added ... from the works of the scholars of our time, and the rest are as found ... in the [main] composition."

Lower table — longitude of countries from the start of habitation, and latitude from the equator

Heading (verbatim): "לוח אורך המדינות מתחלת הישוב ורחבן מקו השווה" **Translation:** "Table of the longitude of the countries from the start of the inhabited world [the Fortunate Isles / start of habitation], and their latitude from the equator [קו השווה, the line of equality]."

Column headers (right-to-left): **אקלים** · שמות המדינות (names of countries) · **רחב** (longitude: degrees + minutes) · **אורך המדינות** (climate-zone number, 1-digit) · **המדינה** (latitude: degrees + minutes).

This "bottom-left small table" — "לוח אורך המדינות מתחלת הישוב ורוחב מקו השוה" — has five numeric columns as printed, R→L: (deg אורך / min-block ...) — committed in Reader B's 5-column alignment, which matches the column rules on the page (Reader A's 2-field grouping was a misparse).

place	c1	c2	c3	c4	c5
שוריא	5	28	13	41	38
שנטמאהן	5	23	40	40	15
נוביא	4	24	10	32	15
פאם	4	25	0	33	0
סבתא	5	25	40	35	20
סביליא	5½	25	40	37	15
מאלאקא	5	26	22	37	0
קורטובה	5	27	0	38	30
נראנדה	5	27	30	37	30
אלמאריאה	5	28	0	36	30
טוליטולה	5	28	15	39	52
מורסיאה	5	29	30	37	30
בלונסיאה	4	30	20	36	25
ביורקא	4	37	0	39	0
ברצלונא	5	33	0	41	10
סקיליאה	5	65	20	31	0
אלסכנדריאה	4	63	0	31	0
מצרים	3	64	3	29	55
נירונא	5	30	0	41	30
מנפשטלר פרפיניאן	4	32	30	43	0
טילושאה	5	20	0	42	45
ירושלים	4	69	30	32	0
ביכה	2	79	0	21	40

[Table frame / rule closes the page.]

[Editor's closing note — Filipowski]

[The top of the page concludes a remark of the editor (Filipowski). The text is set in square type as continuous prose.]

so as to keep alive the spirit of the Sages, I decided to add here one further chapter, a discourse on [?] computation of the motions, by the great sage Don [?] [the surrounding words are damaged] — to the great sage **Don Profiat Duran** [דון פרופיית דוראן = Profiat Duran (the *Efodi*)], the renowned **Efodi**, who is the commentator on the *Moreh* [Maimonides' *Guide of the Perplexed*]; as [?] I found it in the treasury of the books of Paris (**B. 234**) [the manuscript shelf-mark in the Paris library].

On the Reckoning of the Shemittot and the Dating of Certain Eras

[חשבון השמיטין ונהוועת קצת תאריכים] — "Reckoning of the Shemittot and the Dating of Certain Eras." Heading set off by a rule. This is an editorial essay by Filipowski; the prose is dense with Anno Mundi dates given in gematria, and several readings are uncertain.]

The beginning of the knowledge of the reckoning of the jubilees and the shemittot is the knowledge of [?] the year... by this one's knowledge is made light, [knowing] in which portion of the time — from that [given] year up to the present time — [a given event falls]. If you wish to know exactly [?] how much remains of a jubilee, then according to the opinion of the one who says that the count of fifty [years] ascends [i.e., is reckoned] here and there — to subtract for the reckoning of the shemittot, from every hundred [?] years that have passed two years [the two intercalary jubilee-years], and to cast off the remainder by sevens. And if a remainder is left [?], behold, the year [?]...

[The argument continues, weighing two opinions on whether the fifty-year jubilee count is reckoned continuously or is subsumed. It runs through a sequence of Anno Mundi dates. The gematria letterforms in this stretch are small and several are abraded; the values below are transcribed as read, with [?] on the uncertain ones.]

The first [year of the] count was the year **ב' אלפים** [2,000 AM] [?], of which seven [?] portions [?] are [502 =] **תק"ב** [?]; and in [503] **תק"ג** [?] they began to count [?] [509] **תק"ט** [?]; and the first jubilee was the year [552] **תקנ"ב** [?]. And the

reckoning continued in this way up to [?] the year **ג' אלפים ל"ז** [3,037 AM] [?] of the Creation. And from there onward the jubilees were annulled [בטלו יובלות] [?]...

by Resh-Lamed [רש"ל = R. Shelomo Luria(?)] [?] — at the time when all dwelt upon it [the land], year [?] **ג' [50]** [?]; for then, according to his words, the whole [count] ascends [?]. For after the exile of the [tribe of] **Reuben** and the **Gad[ite]**, and also during the period of the Second Temple [בבית שני], since the count [of jubilees] [?] [continued] here and there, according to the opinion of [some of] the Sages — as is implied [?] by the words of **Resh** [Rashi(?)] [?] regarding the matter of the jubilees that were annulled. And so the count continued up to the destruction [of the Temple] [חרבן]... and the First Temple stood for the building of the Second Temple [?] year **ג' אלפים ת"ח** [3,408 AM] [?]. And they began to count the shemittin [שמטין] from the matter of the shemittah alone [?], independent of the matter of [the jubilee], which does not depend on [the dwelling in] the land — just as they said: "the going-forth of the sabbatical [year]" — and from where do you know [?] the year of the shemittah? ...up to [?] **ד' אלפים** [4,000 AM] and it was **ג' אלפים תכ"ח** [3,428 AM] [?]...

[The discussion turns to the destruction of the Second Temple and the divergence between two opinions (associated with Rashi and Maimonides) on which year of the shemittah-cycle it fell in. The text cites **Tractate Avodah Zarah 9b** (מסכת ע"ז) and the **Rambam** (Maimonides).]

according to [(?)372 =] **שקע"ב** [?] years passed after the destruction [?]. However, a dispute has fallen here as to whether the year of the destruction is [counted] in the general reckoning [?]: for in **Tractate Avodah Zarah** [מסכת ע"ז] [it says] that the year of the destruction was of the general reckoning **התכ"ז** [?] — and according to its issuing-forth [?], the year of the destruction is not of the general reckoning, since it was completed at the building of the Second Temple [?]...

[The editor adduces the conflicting figures (172) **קע"ב** [?] and the alternatives raised by "others," and resolves with reference to **Rashi z"l** (year **ה' אלפים** [5,000 AM] [?] for the shemittah by one reckoning) and the **Ramban** (Nachmanides) [רמב"ן], reading **ג"ב** [?]. He notes that what Rashi z"l wrote is what he himself wrote in the Tractate regarding the year **הכ"א** [?] — relying on what is written in Tractate **Arakhin 12b** [מסכת ערכין] [?]. He concludes:] And this is sufficient for the knowledge of the reckoning. And all the dating-figures [תאריכין] written in this chapter are explained in the *Seder Olam* — from there is their knowledge. This [is according to] the opinion of the author of the *Seder Olam*.

On the Knowledge of the Eras [Chronological Dates]

[A new subsection. The editor gives a list of foundational chronological epochs, each with its Anno Mundi date. The gematria figures here are likewise small and several letters are worn; values are transcribed as read with [?] on the doubtful ones.]

The beginning of the knowledge of the year is to know with which [date] each era [תאריך] begins. And from their knowledge [comes] this — that the sages of computation built [their reckonings] upon them. There is no profit [?] in copying out [all of] them; I will bring [only] a few of them:

- The **Flood** [המבול] was [in the year] **אלף ותר"נו** [1,656 AM].
- The **First Temple** [בית ראשון] was built [in] **ב' אלפים תתק"כח** [2,928 AM].
- ...[a worn line] **ת"ח** [?]....
- The **Exodus from Egypt** [יציאת מצרים] [in] **ב' אלפים תמ"ח** [2,448 AM] and [?]....
- The **kingdom of Alexander** [מלכות אלכסנדר] began — and that is the reckoning of contracts [the **Seleucid era** / minyan shtarot] — [year] **ג' אלפים ת"ן** [3,450 AM], day 2 [Monday], the **26th of Tishrei** [כ"ו תשרי].
- The **Christian** [Jesus] was born [in] **ג' אלפים תשמ"א** [3,741 AM], the 9th of **Teves** [ט' טבת], [year] **18** of cycle **198** [י"ח למחזור קצ"ח], on the **25th** day of the month of **December** [דיצימיר"] — and that is the Roman date.
- The reckoning of the **Ishmaelites** [the Muslim Hijri era] began on day 5 [Thursday], the **2nd of Av** [ב' אב], **ד' אלפים שמ"ב** [4,342 AM].

[The editor explains:] The sages of computation mention, in the years of the computation, the secret of the intercalation [סוד העיבור], which is founded upon the molad... The Ishmaelite [Hijri] reckoning is founded upon the course of the moon alone, and they make [their years] simple [common], whereas the reckonings mentioned above [for our calendar] they make [intercalated], just as [explained] above...

- The beginning of the **Persian reckoning**: the day **ג'** [Tuesday], the **22nd of Nisan** [כ"ב ניסן], [year] **ד' אלפים של"ב** [4,332 AM].

[and it explains] whether this [present] year is one [counted] after another [a full year] according to the dating-figures, so that there is no need to [recompute]; and so all the [intercalated] years [are reckoned] threes — three years [each] being [either] complete [full], regular, or deficient [שלמות כסדרן וחסרות] — and so on.

And after this knowledge it will be easy for you to know the year that [is in question] [?] — and there is no need to be lengthy about this. [:]

[End of the chronological essay.]

Table of Contents [תכונת העינים]

Front matter and body (right column)

Entry	Page
הקדמת המבקר — The editor's [critic's] introduction	v
תולדות המחבר — Life of the author	vii
באור מאמר קשה — Elucidation of a difficult discourse	xix
הקדמת המחבר — The author's introduction	3
המאמר הראשון — The First Treatise	5
השער הראשון — Gate 1	6
השער השני — Gate 2	9
השער השלישי — Gate 3	10
השער הרביעי — Gate 4	13
השער החמישי — Gate 5	14
השער השישי — Gate 6	16
השער השביעי — Gate 7	19
השער השמיני — Gate 8	21
השער התשיעי — Gate 9	23
השער העשירי — Gate 10	26
המאמר השני — The Second Treatise	31
השער הראשון — Gate 1	32
השער השני — Gate 2	35
השער השלישי — Gate 3	36
השער הרביעי — Gate 4	39
השער החמישי — Gate 5	41
השער השישי — Gate 6	45
השער השביעי — Gate 7	53
השער השמיני — Gate 8	57
השער התשיעי — Gate 9	62

Entry	Page
Gate 10 — השער העשירי	69
The Third Treatise — המאמר השלישי	73
Gate 1 — השער הראשון	74
Gate 2 — השער השני	78
Gate 3 — השער השלישי	81
Gate 4 — השער הרביעי	87
Gate 5 — השער החמישי	91
Gate 6 — השער הששי	95
Gate 7 — השער השביעי	96
Gate 8 — השער השמיני	99
Gate 9 — השער התשיעי	100
Gate 10 — השער העשירי	109

Appended tables [luchot] (left column)

Entry	Page
Table of the moladot [conjunctions] — לוח המולדות	51
Table of the signs of the years of the cycle — לוח סימני שנות המחזור	71
Table for the fixing of the new months [Rosh Chodesh] — לוח תקון ראשי חדשים	72
Table for the fixing of the orders [year-types] — לוח תקון הסדרים	72
Table of the accumulation [of] hours and 485 [?] chalakim — לוח הנקבץ משעה ותפ"ה חלקים	86
Table of the surpluses [remainders] of the four tekufot according to [the reckoning of] Shmuel — לוח מותר ד' התקופות לשמואל	87
Table of the tekufot of R. Adda — לוח תקופות ר' אדא	90
Table of the signs of the fixings of the years — לוח סימני קביעות השנים	115
Table of the [solar] new-month in the days of the week — לוח ר"ח החמה בימי השבוע	116
Table of the tekufot of Shmuel — לוח תקופות שמואל	117
Table of the solar months with the lunar months — לוח חדשי חמה עם חדשי לבנה	118
Table of the moladot in the solar months — לוח המולדות בחדשי חמה	119

Entry	Page
לוח המולדות על מהלך השווה בשוריא — Table of the moladot upon the mean motion [equal course] in Soria [?]	119
לוח רוחב ואורך המדינות — Table of the latitude and longitude of the cities	120
פרק אחד מספר חשב האפוד — One chapter from the <i>Sefer Cheshev ha-Efod</i> [of Profiat Duran]	121

Errata [טעות הדפוס]

[The closing rubric of the volume. Set off by a rule. Each entry gives the page (דף) and line (שורה), then the printed reading and its correction (or, where bracketed, the variant of the Oxford manuscript, (נוסח אוקספורד). The page/line numbers are printed in Arabic numerals at the right of each line; reproduced in logical order below.]

Page (דף)	Line (שורה)	Correction
3	5	תלה כל אשבל ("...all Eshbol") → כאשכל הילד ("like the cluster, the child"), per the Oxford manuscript [נוסח אוקספורד].
6	2	כנורת צנורת ("kinoret tzinoret") [correction implied]
8	14	יצורת וצורת ("yetzuret v'tzuret") [correction implied]
9	11	מלמטה: ושנ ושני ("below: and-shen → and-sheni")
12	14 / 23 [?]	מלמטה: ההמה החמה ("below: ha-hemah → ha-chamah," 'the sun')
20	10 / 17 [?]	לבד לבר ("levad → levar")
35	12	מם מפני ("mem → mip'nei," 'because of')
36	26	After the word מותרי [?], the words אלו הדברים ("these matters") were dropped [נשמטו]. — To the months [לששה חדשים] there are given 2

Page (דף)	Line (שורה)	Correction
		yetiv [?] and 12 [?] hours, [making] 42 hours per day; "לב" [?] months are given 4 days and 24 [?] hours [per the Oxford manuscript]. [This errata entry is a longer note inserted into the text; the small figures within it are uncertain — flag.]
48	42 [?]	מול מול ("mul → molad")
62	20 / 21 [?]	בעושרין בפושרין ("be-oshrin → be-foshrin") [?]
63	6	נולד: לא נולד ("nolad → lo nolad," 'was not born')
63	32	ני וי ("ni → vi") [single-letter correction]
65	17	תרצ"ה תרצ"ד ("694 → 695")
105	28	After the word מותר ("surpluses"), there were dropped [נשמטו] [the words] בכ"י [?] [in the manuscript] "the cycles," and so on [המחזורות] [ואל...].

[End of the errata, and end of the volume. Page 3 of this opening is a blank leaf.]