

Keli Hemda

כלי חמדה, "The Precious Instrument"

[The Precious Instrument]

(late 14th c. (composition; this is a later manuscript copy))

by Isaac ben Solomon ibn al-Aḥdab (יצחק בן שלמה אבן אלאחדב), c.
1350–c. 1429 (Castile → Sicily)

Translation by Scott Weisman



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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)

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A note on the work

Isaac ibn al-Aḥdab's *Keli Hemda* ("The Precious Instrument") — a description of the construction and use of an equatorium, an instrument for computing planetary positions geometrically. It travels in a codex of medieval Hebrew instrument treatises, alongside the quadrant *Roba' Yisrael*, the astrolabe *Keli ha-Nehoshet*, and ibn Verga's horizon instrument. An astronomical table accompanies it. The text is translated from Paris, Bibliothèque nationale de France, MS Hébreu 1031.

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

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[Margin, upper left, later hand: "208" — foliation]

כלי חמדה — Keli Hemda (The Precious Instrument)

Opening dedicatory verse (set as two rhymed lines with mid-line points):

Keli Hemda — a delight to you above all; to you delight, and a precious, pleasant standard [ונס יקר ונעים]. And Isaac ben al-Aḥdab is the one who made you; [שכל?] delight and the pleasantness of delights.

[The verse puns throughout on חמדה (*hemda*, "delight / precious thing"), the instrument's name. Second-half word of line 2, ש__ל, uncertain — possibly שכל ("all"); flag [?].]

Incipit. Said Isaac ben Solomon ben Zaddik, called al-Aḥdab, the Sephardi [אמר]:
[יצחק בן שלמה בן צדיק המכונה אלאחדב הספרדי]

On computing the position of the seven [planets] [בתקן מקום שבעה [כוכבי לכת]] —

[The introductory paragraph that follows is written in a dense, abraded cursive that does not resolve reliably on the scan, even under magnification. The legible skeleton is rendered below and genuinely unreadable spans are marked. The argument concerns the shortcomings of the standard astronomical tables and the accumulation of approximation-error.]

the wise men wrote [החכמים ... כתבו ...] and there is [error/difficulty] arising both from [what is] hard and from [?] ... [Illegible span, ~1 line:] ... from what is drawn [from them] [מן ... הלקוח] and what has been composed on their own [ואשר חוברו לעצמם], so that what does not accord with what is [present] in them [מן ... קרוב] arises [gives rise] to approximation [בסבת התקן ה[מרחקים] [קרוב ורחוק]].

And [I have seen? וטעד/וראה [?]] that, for the near [reckoning], the [tenth? העשור [?]] rises according to the multiplicity of the operations [לפי רבוי המעשים], so that there is reason to add and reason to subtract [יש טעם להוסיף וטעם לגרוע]. The one who computes [המתקן] adds in the reckoning [במתחן] ... [Illegible span, ~1 line:] ... to subtract, and reverses [והתפך/והפך], and works [ויעבד] ... to set [it] right [אפשריות] ... the possibilities [טעם לבחון אם] ... [לתקן] ... at a stroke [בפעם] ... what he settled by it, [as] adding and computing the reckoning together yield the labor and the approximation at once [יגיעה והקרוב] ... [Illegible span:] ... the position of the sun, known by itself alone [מקום] ... and it does not [השמש הנודע בלבד], and the position [of the moon? ה[ירח]]

[rely] upon the [minutes/parts] [ולא על החלקים], and by the error of the remaining greater ranks [ובטעות שאר המדריגות הגדולות] ... upon the [minutes] על ... [and] the known position in degrees [מקום הנודע במעלה] ... according to the measure of the ... per day in their judgments [ליום ב[עשקי]] — [ואין ספק שהקרוב] [משפטיהם].

— [continues] ... [is] very great, and doubled many times over [הרבה מאד וכפל] ... from the approximation found in all this [מן הקרוב הנמצא בכל זה] ... [כפלים] ... [it is] not known [לא נודע] except by the degree alone [כי אם המעלה] ... [למדעל חמדת] [chose/hewed out? חצב] ... from it [מלמתו] [?]], and I also reckon it [?]], entirely a delight [כל חמדה].

And it may be [ואפשר] that computing a planet [שהתקן ככב] will yield a little approximation in all this [ימצא מעט קרוב בכל זה]; and as for [what is] reliable [namely] that it is not like the approximation that is in the tables [כי אינו כמו הקרוב אשר בלוחות] — I [wished/undertook? וחבתי] to set this aside [לבטל זה]: a reason [of] compositions [טעם חבורות] [?]], one for [?] their doubling [לא לאכבת שניהן] [?]], and one to subtract, so as to set right also the positions of the planets [ליתקן גם מקומות הכ[ו]כבים].

And the introduction/preface [והקדמה] [is one thing? היאתר] [?]], comprising two [?]] [?]] [כוללת לשתי ק].

The First Part, on the craft of making the instrument [והיא ז'] [במלאכת עשיית הכלי]; and it comprises seven gates [שערים].

[There follows an enumeration of the instrument's parts, each marked with a single letter (1 = א/A, 2 = ב/B, 3 = ג/C, 4 = ד/D). further (true 4×4) + Stage-5 audit: the markers are SINGLE letters — the earlier doubled reading (א.א...) was a misread. Part-names are partly legible; uncertain names flagged.]

- **A [א]:** the long plate [הארוך; exact Hebrew form כלוח הארוך read at 1×3 strip only ()], not relocated at 4×4 — provisional], he calls it *the Kli* (the instrument) [יקראהו הכלי].
- **B [ב]:** ... the rotating disk [העגלה~המעלה head-noun] [?]], not anchored at 4×4], called *ha-Rishon* [ויקרא הראשון] (strip-level reading,).
- **C [ג]:** ... [the cover/base? כאס הכלי] [?]], and it is called *bariah* (the bar / bolt) [ויקרא בריח] — the n confirmed at 4×4,]; and the small bar he calls *ha-*

Yosher~ha-Yoter [candidate-pair היותר~היושר, leaning at 4x4 () — not "ha-Yoter confirmed"].

- **D [הד]:** ... the plates of position [לוחות המצב].

השער הראשון — The First Gate

On the making of the long plate, called *the Kli* [בשעיית הלוח הארוך הנקרא הכלי] [?].

Make for yourself [עשה לך] a long [board/rule] [מוֹבֵב? אֵרוֹךְ] ... [Illegible span:]
 ... from where it is found [מִסֵּן חוּ נִמְצָא חוּ] ... and let its base [הֶכֶן] be like [these?
 אֵלוֹ], and at the least [וּלְפָחוֹת] let it be [a cubit? כַּמוֹת] and a half [וּנְחִיץ].

Every gate [שער] that is large [שיהיה גדול] will have a long [radius/index? יורך] ... in its circuit [בסבבו], and its surface will be [straight/level? יושר] ... [The passage continues into a technical construction of the plate: degrees [מעלה], minutes/parts [חלקים], a drawn line [קו/הקוד], and repeated references to a marked point [הקו?] and its measure. These lines are at the cursive-ambiguity floor and do not resolve reliably; transcribed fragments only]

and the first [construction] [[ורא|שון]] is straight/upright, from the [board/rule] toward the ... [מן הקצה] ... and it goes straight [וילך] in the [middle? באמצע] of the space [הרוחב] up to the point [that] he calls "the line" [יקרא קו החוק] ... and if it will be straight [שיהיה ישר] ... [ואם] ... [Illegible:] ... Afterward [אחר כך] he [divides/marks] the point [הקו] ... [חלק] ... into [thirty? ל'] parts [חלקים] ... from the [degree? [מן ה]מעלה] ... [numeral: ?] parts [ה' חלקים] ... and likewise [וכן] on each side [קמצד/מצד] ... [numeral: ?] degrees [מעלות] ... [The remainder of the gate details the graduation of the plate; specific counts of degrees/parts are not legible with confidence and are flagged [numeral: ?] rather than reconstructed.]

[Script: Sephardic semicursive, a single hand throughout, black iron-gall ink. Both folio sides carry a wide blank upper margin; the text block occupies roughly the lower half of each page. "209" is pencilled by a later hand in the upper-left margin of f. 209r.]

First Gate (conclusion) — f. 209r

the great circle we bring near to [?]. A large arc we draw close [to] [?] of the degrees, and we divide [it]; [numeral: ?] parts of the circumference from the [?], from the long [plate] to the [?]. Take the diameter line (קו הקוטר) of the [?], and at the place where they intersect (ובמקום שיחתכו) [?].

Multiply [the value] by 3, and at [?]; multiply by 20, and [?]. You draw the first [line] [?]. Take a point (קח נקדה) [?] on the diameter line, and divide the [arc] into [numeral: ?] parts [?].

The great circle is drawn from a single [center]; upon it are set the points [?] and the epicyclic sphere (גלגל ההקפים) [?]. At the place where the lines intersect is the diameter line (קו הקוטר) [?] of the degrees; and the great circle is divided [?]. Take the point [?] and divide it into [numeral: ?] parts [?].

Each point, one after another (כל נקודה אחת אחר אחת), [?] a great circle. Take the diameter line and [?] near to the edge [?]. A bond (קשר) rests upon the center of the epicyclic sphere (במרכז גלגל ההקפים) [?]. A great circle is drawn from one [center] again upon [?].

the great circle, its diameter [?], and its arc [?]; multiply by 3 and make a point (ועשה נקדה) [?]; and multiply by 20 [?]. At the place where they intersect (ובמקום שיחתכו), [numeral: ?] parts of the circumference [?] — this is the [?] of the plate, and upon the [?] you make [?].

The point [?], together with the line called הנוסאים [technical term; precise sense unresolved — recurs on f. 209v]. Take the diameter of the circle (קטר העגולה) [?], so that with it there is an exact residue (יתר מכוון) [?].

The Second Gate (השער הב')

which is the oblong (מלבן) of the [peg-holes] [?]; the length, and it will be [?]. Let it be the surface of the [?] — the fixed measure (המאמד הקבוע) set into the plate (הקבוע בלוח) [?]. Each degree will be [numeral: ?] parts of the circumference from the [?]; [?] the plate, and upon its rim/figure (ספרה) you make [?].

Second Gate (continued) — f. 209v

that it be [?] upon the fixed surface (תבנית) [?]; take the diameter [?] [numeral: ?] parts [?] of the degrees [?].

the length of the tab/peg (ארכן של הנקב) [?]; let there be [numeral: ?] parts, and the division (החלוק) will be [?]. And you set the [?], and upon [?].

parts, and half of the [numeral: ?]; and take [?] the great circle (העגולה הגדולה) [?], and near to [?].

an arc, and it will be [?]. Take the length (ארכן) — one [?] of [numeral: ?] — and multiply [?]. Between one point and the epicyclic sphere (גלגל ההקפים), and between [?].

parts; each part of them divides [?], and half the part [?]. These are the [?] parts, and they are the base (יסוד) [?].

an arc; take the point [?]; another [?] passes over [?]. The epicyclic sphere is [?]; the point [?], that it be [?].

upon a fixed surface (מלבן קבוע) [?], and it will be [?]. And [?] the width of the peg-holes (רוחב הנקבים) [?].

The measure [?] [numeral: ?] parts of the circumference from the [?]; divide (וחלק) it [?], this half [?], and take [?].

take the diameter of the circle [?]; make a point one after another (נקדה אחר אחר) [?]; a rule/line [?]; and half [?].

the width of the peg-holes (רוחב הנקבים) [?], so that all of them be for them [?].

a fixed surface (מלבן קבוע); take [numeral: ?] parts [?] and the width of the peg-holes (רוחב הנקבים) — each one being a space (מקום) [?] — and they do not exceed (ולא יעברו) [?].

divide (חלק) the [?] fifth part (החמישית) [?], and do not [?].

take the diameter [?]; divide it [?] the circle of Venus (עגולת נוגה) [?], and near to the [?]; and take from the [?].

upon the center of the epicyclic sphere (על מרכז גלגל ההקפים) [?] it will be the center of Venus (מרכז נוגה); and [?].

draw near [?] upon it a lower [line] [?]; there it will be the center of [?]. So that what issues forth (יצא) [?] the centers — the center of Venus (מרכזי נוגה) [?].

the lower surface [?] [numeral: ?] degrees of the arc, and it recedes (וירחק) [?]. Take the point [?] there [?].

take the diameter [?] [numeral: ?] degrees [?]; and it recedes (וירחק) from the length [?] [numeral: ?] parts, and half of the [?]; and take [?].

the epicyclic sphere [?] the Sun (חמה) [?]; and there will remain the Sun (חמה) [?] an arc [?]. And the Sun (וחמה) [?]; and for the width of the peg-holes (רוחב הנקבים) [?].

it recedes (וירחק) [?] one after another [?]. And near [?] the width [?] a place (מקום) [?], and they do not exceed (ולא יעברו) [?].

divide [?]; another arc [?] one after another [?]; [numeral: ?] parts [?] and take [?].

the peg-holes (הנקבים); and [?] the peg [?] will be large (יהיה גדול) [?].

they exceed [?]; take [?] here [?]; and make [?] Venus [?].

[f. 210r]

[This side continues the **Second Gate** construction — the graduation of the great and small circles by pierced peg-holes on a fine ruled line. The hand is a small, rapid Sephardic semicursive and the passage is thick with procedural operands (degree- and part-counts), many of which sit at the cursive floor; committed values are given where legible, and genuinely unresolved operands are marked [?].]

the center on the fine line (המרכז בקו הדק), and [?] parts from the פ — abbreviated measure, [?], and pierce a hole there [?].

Make the line fine from the head of the hole [?], a part from the [?], and pierce there a hole; then [lay] a strip (רצועה) upon the fine line at twenty-two [כב = 22] varying degrees (מעלות מתחלפים), and [?].

Upon the fine line [make] a point that is clearly visible (נקדה נראית היטב), and [?]. Set the reed [?] (קנה) upon that point and [?] it, and move it away from it (והרחק) [?]; and do likewise (ועשה כן) [for] the [seven? [?]] circles [?], one resembling another [?].

[?] for the work of the graduation (למלאכת המעלה), varying degrees [?], and it will be [?]. And so he shall do (וכן יעשה) [?] the first circle (העגולה הראשונה) [?]; behind it (מאחוריו) [?] and bring [it] near upon it (וקרוב עליו) [?].

[?] the point [and the?] varying degrees, and it will be [?] from the first [circle], distant (רחוק) [?] from the [?]; and it will not descend and will not [?] (ולא ירדו ולא [?]).

[Several further lines repeat the same operation — a strip laid on the fine line, a clearly-visible point pierced, "a part from the [?]," "varying degrees," "and so he shall do," "bring near / move away" — cycling through successive circles. The individual degree- and part-operands governing each cycle are not securely legible at this resolution and are left [?] rather than reconstructed. [?] operands: majority of this block.]

and this is [correct / thus] (וזה [?]); so he shall do with all the circles (/ ועם כל הקוים [?]) (הקוים [?]).

[The lower third of f. 210r is blank parchment below the text block — no ruling, no figure.]

[f. 210v]

[The upper block continues the closing discussion of the Second Gate, invoking the authority of the astronomers, before the enlarged **Third Gate** heading appears mid-page.]

from the scholars, some of whom [?] [Illegible: ~2 words] — the scholars of ירקונה [?] — place or group name, [?], and [?]. [?] before us [?], [and] I [do] not [?] according to [?].

[?] the planets, their center (מרכזן), the sphere [of?] the dispute [המחלוקת [?]] [?]; and the intersection-points of the planets (נכחי הכוכבים הנחתכים) upon [?]; [as] the planets [move] in altitude, [their] distance and dimensions [?]. [?] how it is to be done (איך יעשה) [?]. [?] made [it] known that [?], and it is correct (ונכון) [?]. In sum (כלל) [?].

[?] the intersecting [line] (הנחתכים), how [great] the planet [?] in [?]; upon [?] they knew, by my science [?] [and] the science of Ishmael [i.e. the Arab astronomers — [?]], [?]. [?] and greater [?] before [?], the [?] there; [?]. [?] it cannot be done except according to the sphere of the [fixed] stars (גלגל הכוכבים), as [?] Ptolemy (בטלמיס) and the other scholars (ושאר החכמים) [?]. [Ishmael / the Arab? [?]] labored at the whole of it [?], [?] in his hand, and composed (והבר) [?], [?] as [?].

The Third Gate (השער הג)

[Heading, enlarged centered display script.]

On the making of the bars — the great and the small (בעשיית הבריחים הגדול (והקטן).

[?] only that each one [?] shall be [?]; it will be long (יהיה ארוך), [?] parts [?]. [?] from the [הזן? [?]] parts, [?] as [?].

[?] the [construction], one great and one small (אחד גדול ואחד קטן) [?], and pierce (ונקוב) [?]. [?] fixed and standing (קבוע עומד), and the [remainder / the other part] (והמותר) [?] that [?]. [?] it will be [?] from it (ממנו) [?] upon the [two ends?] of the bar (על שני [קצות?] הבריח).

[?] a point clearly visible (נקדה נראית) [?], distant [?] in [?] the plane (המלבן), which is the plane of [the wing of? [?]] the Sun (החמה [כנף?]). Behind it [?] from the [?], and [?] three [ג' = 3] [?] the bars [?].

[?] make one long bar (עשה בריח א'רוך), and it will be [?]. [?] the [construction] of the bars (עשיית הברחים) [?]. [?] and take [?] three [ג] measures [?], as [?].

[?] great, and after it thus [?]; and pierce (ונקוב) [?]. [?] fixed and standing (קבוע עומד); and the [remainder] (והמותר) [?] that will be [?] its [?] from [?] upon the two [ends] of the bar (על שני [?] הבריה).

[?] a point clearly visible, [?] distant [?] in the [plane / surface] [?], which is the plane [?] of the Sun. [?] behind it [?] eight [ח' = 8] [?] [?].

[?] and it will be the bar (ויהיה הבריה) [?] [thirty? [?]] parts [?]; and it will be [?] the plane [of?] the epicyclic sphere (מלבן גלגל ההקפים), and [?].

[?] upon the graduation [?] the great sphere [?]; the bar of the [?] (הבריה) [?] [?] the [?] hollow (החלול / החלון) [?] [?], and the [width of the bar?] (ורוחב הבריה) [?].

[?] because [?] the measures of the epicyclic sphere, the fixed plane (מלבן קבוע) [?]; [?] parts [?].

[?] the work of the bar, thirty parts (מלאכת הבריה ל'חלקים) [?] [?]; [?] upon the fixed plane [?], and the [width] (והרוחב) [?].

[?] and [when] the bars, one great and one small (הבריה / בשלושת הברחים?) [?], it will be [?].

[Several lines here itemize the bar-lengths and part-counts of the successive bars in the same cadence — "the length of the bar [N]," "and behind it upon them [N]," "make [N] measures" — with the operands (letters under gershayim: כב, ל, ח, כ, and others) largely at the cursive floor and left [?] rather than reconstructed. This is a numeral-dense construction rendered here with its structure and recurring verbs intact and its specific operands flagged.]

until [?] the whole of it [?]; and behind it [?] make three [ג] measures, and bring near (וקרוב) [?].

so that the graduation (המעלה) shall be [?]; make the length of the bar [?] parts [?].

upon them three [ג] [?] parts [?]; until [?] again [?].

the hollow [?] two-and-twenty [כב? [?]] parts, and bring near upon them (וקרוב [?]) (עליהם [?]).

until it is required (עד שיהיה חייב / עד החיוב) [?].

Keli Hemda — f. 211r–211v

f. 211r (Third Gate, continued; Fourth Gate)

[Later hand, upper-left: pencil foliation "211".]

parts and a half. Make also two diameters (שני קטרות), and every [?]; and it will be at its end (בקצהו), and the bar will be [large] ([גדול] [?]) (ויהיה הבריא [?]). ...the form of the straightness (הקו הישר) [?]. Make a straight bar (יעשה בריח ישר), and its [work] [?] ... toward the hollow (לחלול); and that end (והקצה ההוא) will be upon [?] ([?] יהיה על [?]).

Bring near upon them the sphere of Venus (וקרוב עליהם גלגל נוגה) [Red-ink-style abbreviation גלגל = גַּל], and it will be [?]. Spread the sides as far as possible (פשט [?]), and this is [?] (ועזה מע) [?]. Make a straight bar (יעשה בריח ישר), and you will have only a single side (ולא יהיו לך כי אם צד אחד) [?] — round or square (עגול או מרובע); and that circle (והמעגל ההוא הוא) [?].

Make [it] like that round plane (עשה כמלבן העגול ההוא) which is [?] thick behind the bar (הבריא [?] עבה מאחר הבריא), and make [?] ... the bar from below (הבריא [?]) (מלמטה); set [it] as you find [?] (קבע כאשר תמצא) [?] ... open (פתוח), and it does not descend on the way [?] (ולא יורד בדרך) [?] ... the deferents of the straightness (עגבי [?]), and [it] returns (ושב), and [you will not?] [see] the bar [?].

the equating sphere (גלגל המתעדל) [Arabic: al-muta'addil, "the equating (deferent) line"], known (ידוע), and [?] ... bring [it] near for Venus [?] (לקרוב ... נוגה) ... only [?] for each one [?] (לבד לכל) [?].

The Fourth Gate: on making [a device] to mark off the [mean] motion (השער [?]) [Hebrew heading, run-in body-size rubric — Stage-5 audit: NOT enlarged display script (unlike the 211v headings, which are genuinely enlarged)].

one of them [?] straight between [?] (אחד מהם [?] בן ישר) ... the epicyclic sphere [?] the plate [?] (גלגל ההקפים) [?] (טבלה) [?] ... set [?] a point/hole (תקוה) [?] toward the deferent [?] (לחברוב) [?] ... its position [?] and the great [circle?] (הגדול) [?] ... only a single side [?] (כי אם צד אחד) ... the equating line [?] (המתעדל) [?].

the bar will be [?] (הבריא יהיה) in the way its plates are [?] (בדרך שטבליהיה) ... and work upon the surface of the great bar (ועבוד על פני הבריא הגדול) [?] ... only [?] for the deferent upon [?] its fixing (לחברוב על שעתו/תקונו) [?] ... the third [?] (השלישי) [?]; here [is] the face of the plate [?] (הנה פני הטבלה) [?].

so too, when [it] is [?] as you [?] (גם כן כאשר) [?] ... its faces [?] (פני); also the face of the fixed [?] which is [?] (גם פני הקבוע אשר) [?] ... toward the [motion?] (וחתוך ... חלוק הטבלה) [?] and cut it [?] and count [?] the plate (לחברוב) ... the fixed [?] toward the deferent [?] between the two [?] (הקבוע ...) [?] ... one of the [?] (אחד) [?] between straight [?] (בן ישר) ...

make [?] [a measure] (יעשה) [?] and mark it off [?] (וחתלקנו) with the [?] ... toward the measure of the deferent [?] in the plate [?] (לחבר שיעור הבריא בטבלה) [?] ... so too, from the [mean] motion which [is] cut [off?] (כן מהלך קצרא) [?] — one [?] from among them [?] (אחד) ... [Illegible: ~1 line of small operands].

[A row of letter-numerals runs at the foot of the page, e.g. "ח' ז' כ' ה' פ' ..." — sexagesimal-type operands. The individual values do not register with confidence even under magnification: [numeral: ?] across the row.]

f. 211v (The Second Treatise; its First Gate — definitions of the instrument's parts)

and write [down] every number [?] (וכתב כל מספר) ... and [?] which plane [?] and its center [?] (ולא [?] מלבן וכבר) ...

The Second Treatise (המחברת השנית) [Hebrew heading, enlarged display script. further: CONFIRMED — the feminine ordinal השנית agrees with feminine מחברת and rules out מאמר (which would take masculine השני).]

to examine [?] (לעיין) ... and why this instrument is called [as it is] (ומדוע יקרא) [?] ... in the early times, when [?] the world (בזמנים הראשונים אשר [?]) [?] ... [?] blessed [is] this [?] (מה ברוך זה) [?] ...

The First Gate (השער הראשון / שער ראשון) [Hebrew heading, enlarged display script].

its parts and diameters [?], according to the nature of the stars (חלקים וקטרים) [?] ... that which is on the small side (אשר בצד הקטן) [?] (לטבע הכבדים) [?] ... face of the [?] (והוא פני ה) [?] ...

The epicyclic sphere (גלגל ההקפים): the planes/deferents which are within [it] from the [circle?] (המלבנות אשר בתוכם מן ה) [?] ... and they are also called [?], and the planes are called deferents [?] (ונקראת המלבנות ד) ...

The bar, fixed as its plane (הבריה הקבוע כמלבן) — this circle (העגול הזה) [?]. We said [that] the plane which is [?] fixes the bar (קבוע הבריה אשר [?]; the small [?] which is on the sides of the bar (הקטן אשר בצד צדדי הבריה) [?].

the great circle (העגול הגדול) is called [?] (נקרא) ... the fixed [line] is called a line [?] (הקבוע יקרא קו) [?] ... the epicyclic sphere (גלגל ההקפים) ... [its] corner[s] divided (קרן מחולקות) [?] ... a hole/perforation according to the measure of [?] (נקב כשעור) ...

The center of this circle (מרכז אלה העגולה) is a perforation [?] (הוא נקב) ... and the plane; and so [it] is near to us [?] (והמלבן וכן קרוב עלינו) [?] ... the plane[s] are called equal [to?] the star (המלבן נקראות תשוה כבב) [?] — the rest of the star[s] [?] (שאר הכבב) ...

[it] does not descend [?] from the bar [?] (לא יורד מן הבריה) [?], and [it] receives the small [?] (והצד מקבל הקטן) [?] ... the [?] the small, which is [?] toward the measure [?] (כשעור) [?] ... one, and so behold [?] (אחד וכן הנה) [?] ... [?] the center is fixed [?] (המרכז) [?] ... a hole [?] the deferent [?] (לחברוב) [?] ... [?] a visible point (נקדה נראית) [?].

[Librarian note: pencil foliation "212" (upper-left of f.212r) and later-hand pencil foliation continuing; blank upper margins, no running headers.]

The Second Treatise (המחברת השנית) — continued

[Continuation of the First Gate — definitions of the instrument's parts, from f.211v]

it is called "the plane equal to the star" (מלבן תשוה כבב). And this [?] ... [Illegible: ~2–3 lines of degraded cursive; recurring words legible are שרוחה ("its breadth"?)] and a transliterated term מלמדעפ"ס [?] — reading not recoverable at 4×4] ... its nature [?] ... for keeping/observing (למשמרת) ... and [?].

Second Gate — שער שני

[Heading verbatim: שער שני]

On reckoning the day and its hours [from midday]. The [first] day [?] ... which was before the day (שהיה קודם יום) [?] ... which was in an hour and [some] minutes (בשעת חלקים) [?] ... and they begin (מתחילים) [?] ... like the midpoint of the hour, which is called *qubba* (הנקרא קובה) [?] ... the midday of the first day (חצי יום ראשון), in the manner of [?] ... itself. And likewise the third day begins from midday (וכן יום ג' מתחיל מחצי יום) and is completed at midday itself (ונשלם) ... some of them whole and some of them deficient (מהם שלמים) ... (בחצי יום בעצמו) ... whatever is required for its correction [?], the whole apart, and for the sphere of the mean (ולגלגל האמצע) [?].

Third Gate — שער שלישי

[Heading verbatim: שער שלישי]

[On the mean motion in degrees and minutes.] ... and it was an hour, a minute [?] ... and tomorrow (ומחר) the year, the day, the minute [?] ... [Illegible: ~1 line] ... the position called *qubba* (הנקרא קובה) [?] ... and it is the day [that] begins from midday (מתחיל מחצי היום) ... in this manner, the mean motion from midday [to] midday of the [previous?] day (מחצי יום של ...) [?] ... an hour, and it is completed at midday itself (ונשלם בחצי יום בעצמו) [numerals uncertain] ... [degrees and minutes] (מעלות ... חלקים) ... and take (וקח) [?] ... whatever exceeds this [?] ... it is the mean motion (הוא מהלך) [?] ... and take the [product?] (מכל ...) [?] ... the whole, from the degrees (המעלות) [?] ... the minutes (החלקים) ... from [X] upon the minutes (על ה החלקים) (מן ...) ... from every [thirty?] degrees a degree [?] ... and gather [the minutes] (ויקבץ ...) [?] ... [Illegible: line-ends abraded].

[The remaining lines of f.212r continue the same degrees-and-minutes computation: recurring legible tokens are מעלות (degrees), חלקים (minutes), האמצע (the mean), הככב (the star), המקום (the position), המעלה (the degree). Exact clause order and all numeric operands are not confidently recoverable at this resolution.]

[Lower third of f.212r is blank parchment.]

f.212v (המחברת השנית, continued)

the near [values] (הקרובים), and cast out from them every twelve (והשלך מהם כל) [numeral uncertain], and the remainder (והנשאר) [?] ... this degree is upon its position; it is the sought value (מעלה על כן הוא המבוקש); and when [?] ... it was [?] ... [Illegible: ~1 line] ... when there have passed of the hours of the day that you

are in (בו) ... the sum (המקובץ): take for each hour a degree (קח לכל שעה מעלה); and for the [Sun?] it was, from [X], a degree [?] for each hour (לכל שעה ... מעלה ... היה); and for Venus it was — take half a degree for each [hour] ([שעה]) [reading of "half" (ולנוגה היה קח חצי מעלה לכל)] (חצי) probable but not certain]; and all of them together, to gather (כלם לצבר) [?] ... [Illegible: ~2 lines].

each degree, and the minutes, and cast [them] out from the degrees (כל מעלה ... (וקחם) ... the position, degree by degree (מקום ... מעלה) (וחלקים) ... והשלך מן המעלות [?] (והנשאר כתוב) ... and the remainder is [as] set out [above] (ל)מעלה [?].

Fourth Gate — שער רביעי

[Heading verbatim: שער רביעי]

[On the number of days that have passed.] ... according to the number of days that have passed (למספר הימים שעברו) ... before it, [?] and after it, [?] the days (לפניו ... ואחריו ... הימים) ... and know the [sum?] ([קובץ]) (ודע המ) ... which [?] ... and the position is the number of days (והמקום הוא מספר הימים) ... and gather them with the number of days of the [new moon?] (וקבצם עם מספר ימי החדש) ... and by this, gather in the course of the days (וקבץ בלחתוג הימים) [?].

Fifth Gate — שער חמישי

[Heading verbatim: "שער חמישי — כאשר לא ימצא" ("When [the value] is not found...")]

When you do not find [the position exactly] (כאשר לא ימצא) — its illumination is near it (היורך קרוב לו) [?] ... you will find it fixed for the day [?] ... [Illegible: ~1 line] ... [take?] the position from the position [?] and add to it (מקום מן מקום ורבה) [?] ... it is; and below it, the length of the position [?] (ועמדה אורך המקום) ... the degrees, [ten?], for each hour, and the remainder is subtracted (מעלות ... לכל שעה והנשאר) [?] ... [Illegible] ... the minutes, likewise, so-and-so (כן ... [?] (חלקים כתוב) [?] ... and the remainder, second [order] (והנשאר שניים) [?], and what remains of [X] (ומה [?] שיהיה מן [?]).

Sixth Gate — שער ששי

[Heading verbatim: שער ששי]

continually, in the position [?] (תמיד על המקום) [?] ... the days [?], the [sum?] and the remainder [?] ... and this [?] ... [Illegible: ~1 line] ... and there will

come out for you the [mean] course (ויצא לך מהלך) [?] ... the year [?], the position (במקום) [?] ... and the answer [is] the illumination (ותנה הזורח) [?] ... there comes out the mean course (הוצא מהלך האמצע) [?].

Seventh Gate — שער שביעי

[Heading verbatim: שער שביעי — heading and opening line begin at the foot of f.212v]

Seventh [Gate]: to know [?] (שביעי לדעת) ... [Illegible: heading line, then text continues onto the following folio.]

[Lower half of f.212v is blank parchment.]

Second Treatise — the use of the instrument. A run of very short "gates" (שער), each a brief procedure for finding a planetary position with the Kli. The Seventh Gate, begun at the foot of the previous folio, concludes at the top of 213r; Gates Eight through Twelve follow in quick succession. The lower portion of each folio side is left blank parchment.

f. 213r

[Seventh Gate — conclusion]

(The heading שער שביעי stands at the foot of the previous folio; its procedure concludes in the opening lines here.)

which is nearest to them, and the course of its revolution toward the side it approaches[?]. Mark and fix the rete, and set it[?] at the degree of the planet; and place the tip[?] of the bar (הבריה) — advance[?] the notched tip of the bar onto the rete — and observe the point that falls from the rete upon the line of the [rim / קו] — reference line, reading uncertain]. So that whatever falls from the mark (הרושם) will lie upon that same line[?]. [Illegible: several words, dense cursive] the bar upon the plane of degrees (מלבן המעלות), and the point that falls from the rete upon the line [of the rim?][?] — this is upon the line [of the rim?] itself[?]. [?] the bar over the plane of degrees, and mark from the plane of degrees onto the plane[?], and this is the mean position of the planet (מקום הככב האמצעי).

שער שמיני — Eighth Gate

To know the [mean] position of a planet ([האמצעי] ככב [לדעת מקום]).

[?] and place the rete upon the [mark?]; and set the small bar (הבריה הקטן)[?]. And the [point?] that falls[?] — set the tip of the [large?] bar toward the side[?] of the

plane of degrees, at the degree[?] which it cut[?], and at the point where it falls[?]; and we set the line of alignment (קו הוישר) [?] on the plane of degrees, and it returns[?] to the epicyclic sphere (גלגל ההקפים). And the degree at which it cuts[?] [Illegible: a few words] — this is the mean position of the planet.

שער תשיעי — Ninth Gate

And in it, to know the position of the [visible / true?] planet (מקום הככב) [הנראה?].

[?] upon the mark (הרושם), which you marked[?] upon the rete. [Illegible: ~2 words] the tip of the bar onto the plane of degrees[?], at the degree[?] it cut[?]; and mark [from?] the plane of degrees[?]. And observe the point that falls[?] onto the [?]. And this is [Illegible: end of line]...

[The remainder of 213r below these lines is blank parchment.]

f. 213v

(The upper margin is blank; text resumes about mid-page. Gates Nine's tail[?], then Ten, Eleven and Twelve follow.)

the plane of degrees[?], which [?]; and set[?] [Illegible] the tip[?] of the bar[?]. And the point that falls[?] from the rete[?] — [Illegible: dense line] the mean position (מקום ... האמצע). And mark[?] from the plane of degrees onto the plane[?], and this is the position[?] [Illegible].

שער עשירי — Tenth Gate

[To know ... (opening words uncertain)].

[?] in the plane of degrees[?] [Illegible: ~2 words], the mark (הרושם) that you marked upon the rete. And set[?] the [large?] bar[?] upon its[?] [Illegible], and mark[?] [Illegible]. And the point[?] that falls[?] [Illegible: line runs to the left margin] — this is the position[?].

שער אחד עשר — Eleventh Gate

[...] which is called the position of [the planet?] (... והוא הנקרא מקום).

[?] which draws near[?], and you take[?] the position[?] [Illegible: ~3 words]. [Illegible: a full line, dense] the [visible?] rete[?], as[?] [Illegible]. And [?] known[?] from this[?] [Illegible] — and it is upon[?] [Illegible]. And when you do[?]

[Illegible] the [motion?] of the sun[?] (שמש?) [Illegible] the movable wheel (דולב)
[Arabic: dūlāb, "wheel" — the movable disk][?] [Illegible].

שער י"ב — Twelfth Gate

[...] (opening word "לויס"[?] — reading uncertain; possibly a scribal / Romance gloss) it will resolve[?] for you [Illegible] at any time or year[?] [Illegible].

[Illegible: 1–2 lines] the wheel (דולב)[?] [Illegible]; likewise upon the third[?] wheel (ג דולב)[?] — the sun[?] for the hour[?] [Illegible]. Likewise upon the third[?] wheel[?]. שער [?] [a further "שער" heading appears here; its number is not legible] — the position of the wheel (מקום דולב), the position of the mover / deferent (מקום המונע)[?] [Illegible].

[The lower half of 213v is blank parchment.]

Isaac ibn al-Aḥḍab, BnF Hébreu 1031. Second Treatise (המחברת) — short "gates" (שערים) for computing planetary positions with the Kli. This opening carries the final gates and the conclusion of the treatise.

[Later-hand pencil foliation, upper-left of f.214r: "214".] The upper margins of both folio sides are blank; text begins about a third of the way down each page, and the lower third of each side is blank parchment.

[f. 214r]

(The gate whose heading stood at the foot of f.213v — ordinal illegible there, expected 13 — concludes here.)

and it will be that the star [והיה שהכוכב] has returned, and its motion [is measured by][?] what lies between the central point [[הנקודה המרכזית]] and the apogee [הגובה]. In all this, if that apogee runs [proceeds] in the order of the degrees [כסדר] — that is, with the motion of the deferent [תנועת המונע] — add those degrees to the mean [על האמצע] ... [הוסף]; but if it is such that it should be subtracted [שיגרע][?] ...[?]. And afterward the mean position [מקום האמצע] will come out for you, opposite the degrees [נגד המעלות] that you added; and there remains the position of the mean according to that apogee. And if the central [?] apogee lay beneath the [point] [היה תחת ה][?] ...

[The specific quantities and one or two connective clauses in this passage are not securely legible and are left unrendered rather than guessed — see QA.]

שער [Gate 14 [?]]

the star opposite [הכוכב נגד] ...; the mean position and the [computation of] ...
the al-muta'addil [המ...עדל] ...; the [line of alignment / equating line] ...
opposite [degree] ...; to the [left / right] side [לצד ...]; the star stands so as to be
opposite [הכוכב עומד להיות נגד] ...

(This gate gives the rule for where the star "stands opposite" on the plane of degrees relative to the al-muta'addil; several of its degree-values and point-labels are not securely legible — see QA.)

שער [Gate 15 [?]]

Take [טול] ... And if the edge [חדו] of the bar [הבריה] falls between [degree A] and [degree B] ...; then [to the ... side]; and if between [degree C] and [degree D] for the retrograde [/ lagging] positions [למתאחרים], outside [חוץ] and between [degree E] ... And if the edge of the bar falls between [degree] ... in the [same] way; and between [degree] and the apogee of the star [גובה, הכוכב, opposite [נגד] ... to the [left / right] side; and between [degree] for the retrograde positions and between [degree] ... And if the edge of the bar falls between [degree] ...

(A rule keyed to which interval, between two marked degrees on the instrument, the edge of the bar falls into — distinguishing the advancing case from the retrograde/lagging case, and the left side from the right. The individual degree-markers/point-labels are numerous and not securely legible; they are flagged rather than committed — see QA and Numerical impossibles note.)

(Lower third of f.214r is blank parchment.)

[f. 214v]

(Text continues; the gate begun near the foot of the preceding column carries over.)

the course of the star [מהלך הכוכב] ...; and the star reaches one point [לנקדה אחת] ... and comes out at the [portion / division] [בחלקה] ... from the day [מן היום]; and likewise if you wish [וכן אם תרצה] to the side [לצד] ...; one after another, according to [the same] order [כסדר] — this is what comes out ...; the mean position [מקום האמצע] ...; and likewise the [?] ...

שער [Gate 16 [?]]

for the [computations / periods] [לעצמים][?] ...; the mean [האמצע][?] which [?]; the instrument [כלי][?] set toward [מכוון כנגד] ...; upon its degree [על מעלתו] [numeral: ?] ...; the degree [of] the star [מעלת הכוכב] [numeral: ?] ...; it will be between [יהיה בין] ...; the position and [?]; the fraction / part [חלק][?] ...; and you shall know [ותדע][?] every ... which is upon it [אשר עליו] ...

(A procedure for setting the instrument against the star's degree and reading a value on the plane of degrees; the tabulated numeral(s) it cites are not securely legible even under magnification — flagged [numeral: ?] rather than pattern-filled.)

שער :: הכוכב [Gate 17 [?]]

(Gate boundary marked with the raised double-dot :: after "the star.")

the [computation / arrangement] ...; the [days][?] and the minutes [והחלקים][?]; the mean course [המהלך האמצעי][?] and the [visible / true][?] ...; the number of days [מספר הימים] and the [motions / positions] [והתנועות][?] ... which [?]; between the [motion of the] wheel [דולב][?] ...; opposite [נגד][?] ...; and if the star's motion [is such that][?] ...; and set the bar [והשם הברית] upon its degree [על מעלתו]; the reckoning [החשבון][?] ...; and the count [והמנין][?] ...; and the [spheres / deferents] [?] and for the sphere of the fixed stars [והנחים הכוכבים] ... here [פה] ::

(The treatise's final procedure, tying the reckoning of the mean and visible course to the count of days; its several quoted quantities are not securely legible and are left flagged.)

[Conclusion of the treatise]

the correction of the course [ויתקון המהלך][?]; all this — and so we have done with them the operations [עשינו בהם מלאכות][?] ...; and for the way of doing [the hour / the reckoning][?] according to what has been given [לפי אשר ניתן][?] ...; and [the configurations / positions] upon all [ותכונות על כל][?] ...

And praise to God [ותהלה לאל][?], Amen [אמן][?].

[A large decorative scribal flourish / knot follows the closing line, terminating the treatise. Below it the folio is blank parchment; faint red bleed-through from the ruled table on the following leaf (f.215r) shows through, but belongs to that page, not this one.]

(End of the text of Keli Hemda on this opening; the ruled astronomical table stands on f.215.)

Keli Hemda — fol. 215 (standalone ruled astronomical table)

Script: Sephardic/Maghribi semicursive (same hand and codex as the sister witness *Orah Selulah*, BnF Hébreu 1086). Both sides of fol. 215 are a single ruled astronomical table; there is no running prose. The treatise text itself concluded on the preceding folio (214v).

Foliation: modern pencil "215" at the top of the recto, in a later Western hand. [Librarian note: "215" (modern pencil foliation)]

fol. 215r — ruled astronomical table (rightmost = מספר כללי argument column; subject not confidently identified)

Label correction. Two independent cold reads found the rightmost red column reads **מספר כללי** ("general number" — a standard argument column), NOT the row-by-row כפול / שני / נגה מהלך labels first committed here. The header row is [?] throughout. **The "Venus (נגה) mean-motion" identification is NOT supported by the scan** and has been withdrawn. What the recto does support: a מספר כללי argument column and a red rubric in the adjacent column tentatively מהלך [?]. The per-row נגה/qualifier labels below are struck to [?].

Structure (committed with confidence): a red-ink ruled grid. Reading right-to-left, the **rightmost column is a red-rubricated label column** naming the tabulated quantity of each row; the interior is filled with black-ink multi-value (sexagesimal) numeric cells. There is a **top header row** and a **bottom red-ink row** closing the grid. Approximate dimensions: **~9 columns × ~10 data rows** (±1 either way; the ruling is skewed and the inner/gutter edge is crushed, so an exact column count is not certain). Headers and the right-hand label column are in **red ink (rubrication)**; the body values are black.

Red rightmost column (read top→bottom) — the argument column. Two independent cold reads find a recurring two-line label **מספר כללי** ("general number") down this column — a standard tabular argument column, not per-row motion headings. The adjacent column carries a recurring red ~4-letter rubric, tentatively **מהלך** [?] (not confirmable). Specific per-row qualifiers do **not** resolve — all [?].

Label/header vocabulary the scan actually supports: מספר כללי (rightmost argument column, recovered); a red rubric tentatively מהלך [?] in the adjacent

column; header-row cells [?]. **ננה (Venus) is NOT present/confirmable anywhere on the recto** — the earlier "Venus mean-motion" identification is withdrawn. רבוע / שני / כפול / חלקים / מעלות were first-pass vocabulary guesses and are downgraded to [?] pending a clearer reading of the header row.

Numeric interior — not committable. The interior data cells are two- and three-place sexagesimal groups in a small, skewed cursive hand. Individual strokes are visible but the multi-value cell contents do **not** resolve to reliable values glyph-by-glyph; committing them would require pattern-filling or arithmetic inference, which is prohibited. The interior is therefore flagged [numeral: ?] per cell. (This matches the documented recovery floor of the analogous *Orah Selulah* tables on the same hand/codex.)

Representative structural skeleton (row-label column at right per RTL logical order; [numeral: ?] = legible cell whose value did not resolve):

col 8 (L)	col 7	col 6	col 5	col 4	col 3	col 2	col 1 (red, מהלך [?])	Argument (red, rightmost)
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	מספר כללי
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	מספר כללי
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	מספר כללי
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	מספר כללי
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	מספר כללי
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	[label: ?]
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	[label: ?]

col 8 (L)	col 7	col 6	col 5	col 4	col 3	col 2	col 1 (red, מהלך [?])	Argument (red, rightmost)
[?]	[?]	[?]	[?]	[?]	[?]	[?]		
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	[label: ?]
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	[label: ?]
[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numeral: ?]	[label: ?]

[Red ink: the closing bottom row of the grid holds single red-ink glyphs per cell — likely a totals/argument row. Values [numeral: ?] (small, red, abraded).]

Marginal note (left margin of 215r). A two-line note in Judeo-Arabic cursive stands in the outer (left) margin beside the grid. It is a genuine marginal annotation, not part of the table. The hand is legible in outline but the reading does not resolve with confidence; per marginalia policy I record its presence and verbatim outline without asserting content:

[Margin: two-line Judeo-Arabic note; text not confidently legible — [Arabic: ?]. Further identification requires further verification.]

fol. 215v — ruled astronomical table (continuation)

Structure. A red-ink ruled grid mirroring the recto. Here the **red-rubricated label column is at the far LEFT** (the outer edge of the verso), with black-ink numeric columns filling to its right and a narrow argument-style column at the far right (small one/two-glyph values per cell). Approximate dimensions ~9–10 columns × ~10 rows (±1; skew and gutter crush at the inner edge). The BnF ownership stamp bleeds over the lower-left of the grid (see below).

Red label column (leftmost, read top→bottom). Motion (מהלך) labels, compound with a qualifier per row; qualifiers largely abraded:

Stage-5 caveat: the verso label column was NOT cold-re-verified (covered the recto only). Since the analogous recto column read מספר

כללי — not מהלך — the first-pass "מהלך" reading here is downgraded to [?] pending a cold verso re-read.

- [label: ? — first-pass "מהלך", unconfirmed]
- [label: ?]
- [label: ?]
- [label: ?]
- (column continues; qualifiers not resolvable — [?])

Numeric interior — not committable, for the same reasons as the recto: dense small sexagesimal cursive at the skew/resolution floor. Flagged [numeral: ?] per cell rather than pattern-filled.

Representative structural skeleton (row-label column at left per this side's layout):

[illegible]

Row label (red, left)	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8 (R, arg.)
[label: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numer al: ?]
[label: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numer al: ?]
[label: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[num eral: ?]	[numer al: ?]

[Librarian note: circular red BnF ownership stamp ("BIBLIOTHÈQUE NATIONALE" with center monogram) struck across the lower-left cells of the 215v grid; it obscures several data cells in that corner, which are consequently [numeral: ?] from the stamp as well as the hand.]