The First References in Hebrew to al-Biá¹-rÅ«jÄ«’s On the Principles of Astronomy

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Published by Indiana University Press

DOI: 10.1353/ale.2003.0012

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The First References in Hebrew to al-Bitrūjī’s On the Principles of Astronomy

This brief notice identifies and presents an English translation of the first references in Hebrew to al-Bitrūjī’s On the Principles of Astronomy (Kitāb fi al-hay’ā). They appear in the three most important original works by Samuel Ibn Tibbon (ca.1165–1232): his Glossary of Technical

I wish to thank Gad Freudenthal, Angela Jaffray, J. L. Mancha, Bernard Septimus and the three anonymous readers for many helpful comments, corrections, and bibliographical references. For the Arabic text of al-Bitrūjī and the medieval Hebrew translation, together with an English translation and analysis of the astronomy and its historical significance, see Bernard R. Goldstein, ed. and trans., Al-Bitrūjī: On the Principles of Astronomy, 2 vols. (New Haven: Yale University Press, 1971). For general descriptions of the work and further discussion of specific points, see also Francis J. Carmody, Al-Bitrūjī: De motibus celorum (Berkeley: University of California Press, 1952), pp. 22–70; Julio Samsó, “Al-Bitrūjī al-Išbîlî, Abū Ishāq,” in Dictionary of Scientific Biography, vol. 15 (New York: Charles Scribner and Sons, 1978), pp. 33–36; idem, Las ciencias de los antiguos en al-Andalus (Mapfre, 1992), pp. 330–356. For the philosophical movement that led to al-Bitrūjī’s astronomy, a project that was initiated by Ibn Bājja and continued by Ibn Ṭufayl, Averroes, and to some extent also Mai-
Terms used in the Guide of the Perplexed (Perush ha-millot ha-zarot, completed 1213), his Commentary on Ecclesiastes (after 1213), and his last book, Ma'amar yiqqawu ha-mayim (1221 or 1231). These references, consisting of brief summaries of al-Bitrūjī's astronomy, were written not long after the original Arabic treatise was completed (between 1185 and 1192). The remarks found in the Glossary, (and perhaps those found in the Commentary on Ecclesiastes as well) predate the Latin translation made by Michael Scot in Toledo in 1217.

With these early references to al-Bitrūjī identified, and in light of other recent research, Bernard Goldstein's brief survey of his influence on Jewish literature can be expanded as follows. The original Arabic text was first referred to in Hebrew by Ibn Tibbon in his Glossary, Commentary on Ecclesiastes, and Ma'amar yiqqawu ha-mayim. It was cited in Arabic by Judah b. Solomon ha-Kohen in Toledo during the 1230s in his Midras ha-hokmah, an encyclopedia of science that he subsequently translated into Hebrew in Italy in 1247. The complete Arabic text, perhaps from the same manuscript used by Samuel Ibn Tibbon, was translated into Hebrew by Samuel's son Moses in 1259 in southern France. Samuel Ibn Tibbon's summary statement in Ma'amar yiqqawu ha-mayim was reproduced verbatim by Gershom b. Solomon in his popular Ša'ar ha-šamayim, written during the last quarter of the thirteenth century in southern France. Al-Bitrūjī's astronomical theory was briefly described and rejected by the southern French philosopher Levi b. Abraham b. Hayyim in his Liwyat ḥen (revised 1295 and 1299), a comprehensive encyclopedia of science and religion. Also in southern France, al-Bitrūjī's work had a strong impact on Gersonides, who criticized it in detail in Book Five, Part One, Chapters 40–44, of his Wars of the Lord, the magnum opus that he continued to revise almost until his death in 1344. Back in Spain, al-Bitrūjī's astronomical principles were summarized in 1310 and dismissed by Isaac Israeli of Toledo in his scientific work, Yesod ʿolam. They served as the inspiration for Joseph Ibn Naḥmias' fourteenth-

2 Bibliographical references for Ibn Tibbon's writing will be given below.

3 For the dating of al-Biṭrūjī's work, see Samsó, "On al-Biṭrūjī and the Hay'a Tradition," pp. 7-8. Al-Biṭrūjī refers to his deceased teacher Ibn Ṭufayl (d. 1185), whereas his ideas seem to have influenced an anonymous Arabic manuscript dated 1192.

4 For the Latin translation, see Carmody, *Al-Biṭrūjī: De motibus celorum*.

century Light of the World, originally written in Judeo-Arabic but subsequently translated into Hebrew.13

Before we turn to the texts themselves, a few remarks about the provenance of Ibn Tibbon’s references and his method of citation are in order. Although Ibn Tibbon lived most of his life in southern France, it is more likely that he learned about al-Bītrūjī’s work not in Lunel, Arles, or Marseilles but in Toledo, which he visited at least once, sometime between 1204 and 1210.14 This venue for his first exposure to al-Bītrūjī suggests that he and Michael Scot may have known each other during their stays in this center of the Arabic-to-Latin translation movement.15 If corroborated, this thesis would reinforce the importance of Toledo as the principal point for the dissemination of al-Bītrūjī’s work.

Also noteworthy is the way in which Ibn Tibbon refers to al-Bītrūjī. Like Levi b. Abraham, Gersonides, and Isaac Israeli after him, Ibn Tibbon refers to al-Bītrūjī by a cognomen rather than naming him explicitly:16 Levi b. Abraham and Gersonides both write of the “master of a new astronomy” (ba’al tekunah hadasah); Israeli uses the phrase, “an individual who shook [the world]” (ʾiš ba-marʾiš, cf. Haggai 2:10); Ibn Tibbon uses the biblical locution (Gen. 41:38), “an individual possessed by the spirit of God” (ʾiš ʾašer ruah Elohim bo).17 But while all three of these later scholars rejected al-Bītrūjī’s novel theories, Ibn Tibbon’s expression seems to indicate approval of al-Bītrūjī and respect for the discipline in which he worked.18 This conclusion is borne out by a passage in the preface to the Commentary on Ecclesiastes in which Ibn Tibbon explains that he believes that the “work of the chariot” in Ezekiel, which Maimonides had identified with Aristotelian metaphysics,19 consists chiefly of astronomy; only the “man,” he explains, is part of metaphysics.20 In light of this, any new development in astronomy has great significance for understanding this most important prophecy of the Bible; furthermore, any astronomer or philosopher who contributes to a truer understanding of the celestial “chariot”
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7 The translation was edited by Goldstein, *Al-Bītrūjī: On the Principles of Astronomy*, with the Hebrew text facing a facsimile of the Arabic manuscript.

8 See James T. Robinson, “Gershom b. Solomon’s *Sha’ar ha-Shamayim*: Its Sources and Use of Sources,” p. 263 in *The Medieval Hebrew Encyclopedias of Science and Philosophy*.


ought to be considered an individual with prophetic insight. This significance is evident in the third text translated below, from *Ma'amaryiqqawu ha-mayim*.\(^{21}\)

The three passages from Ibn Tibbon’s writings translated here are the following:

(1) The complete text of one entry of the *Glossary*, namely, the definition of “daily motion” (*tenučah yomit*).

(2) The full explication of Eccl. 1:5, a verse that, according to Ibn Tibbon, is part of Solomon’s preface to his philosophical treatise. To prove that everything “under the sun” is subject to destruction (“vanity”) he must first establish continuity in the processes of the sublunar world, including the material cause—first matter—and the agent cause—the perpetual movement of the celestial bodies along the ecliptic. (The appendix presents a critical edition of this unpublished text.)

(3) A digression in *Ma'amaryiqqawu ha-mayim*, Chapter 10, which comes in the midst of an extended explication of Ezekiel, Chapter 1.

**Texts**


“Daily Motion” is a term that signifies the motion of the outermost orb, which revolves around the entire world in a single day, which consists of twenty-four hours.\(^{22}\) It is a volitional motion governed by desire.\(^{23}\) All of the orbs that are contained within [this outermost orb] move because of this motion; they are drawn after its motion in such a way that it is as if [this motion] for them is enforced, for this motion forces them to move in this way in opposition to their own volitional
Gersonideana,” in Studies on Gersonides, pp. 398–402; for those from 1992 to present, see the update of Kellner’s bibliography in the present volume.  

For the dating of Wars of the Lord, see especially J. L. Mancha, “Levi ben Gerson’s Astronomical Work: Chronology and Christian Context,” Science in Context 10 (1997): 471–93, where it is shown that, although Gersonides himself asserts that the astronomy section was completed November 24, 1328, he continued to revise it at least until 1340 and probably until 1344.


motion which, according to that which has been postulated in all previous astronomical models [ṭeḵunot], proceeds from west to east. But even if their motion proceeds from east to west, as has been stated by one of the modern scholars, an individual possessed by the spirit of God [see Gen. 41:38], this same motion of the first orb will cause [inferior orbs] to move more swiftly than [they would have moved] with their own [volitional] motion. This enforced or quasi-enforced motion that all the other orbs experience with the outermost orb is also called “daily,” for although it is enforced or quasi-enforced, this does not keep it from being referred to with the very same term.

(2) Samuel Ibn Tibbon, *Commentary on Ecclesiastes* 1:5 [see Appendix].

*The sun rises and the sun goes and glides back to its place, there it rises* [Eccl. 1:5].

Before beginning to interpret the present verse, I need to make known the following preliminary information, which is needed to interpret both this and the following verse. Namely, I need to make known that the sun has two motions. One is natural to it, that is, it is not consequent upon anything other than itself; whereas the other is enforced, that is, it is consequent upon the motion of something other than itself. The natural motion [of the sun] is from west to east, while its enforced motion is from east to west; [it is compelled in this way] by the motion of the outermost orb, the motion of which is from east to west. [The outermost orb] circles around the world with this motion in one day, on account of which it is called “daily motion.” With its [daily] motion, it is as if [the outermost orb] draws after it all the orbs contained within it, leading [these inferior orbs] to proceed also from east to west with the same rapid motion. The planets fixed in these orbs also move according to this motion, in the way that the part moves with the whole. But while the sun continues to move perpetually with this
That Ibn Tibbon and Michael Scot had some personal relationship was already postulated in the nineteenth century on the basis of the connection at Frederick's court in Sicily between Scot and Ibn Tibbon's son-in-law, Jacob Anatoli. On this relationship, see: M. L. Gordon, "The Rationalism of Jacob Anatoli" (Ph.D. Dissertation, Yeshiva University, 1974), pp. 234–242, with reference to earlier literature; Colette Sirat, "Les traducteurs juifs à la cour des rois de Sicile et de Naples," in Traduction et traducteurs au moyen âge, ed. G. Contamine (Paris, 1989), pp. 168–75, 181–90. But there is evidence, despite some chronological difficulties, that they had already been in contact earlier. I intend to examine the information relevant to this subject in a separate study.

For the cognomens used by Gersonides and Israeli, see Goldstein, Al-Bitrüji: On the Principles of Astronomy, pp. 40–43. For Levi b. Abraham, see, e.g., Vatican MS 383 (IMHM 484), 6a–7b. I thank Gad Freudenthal for focusing my attention on this phenomenon.

In the biblical context alluded to, Pharaoh praises Joseph with this expression after Joseph had explained his dreams. Note that the biblical phrase seems to reflect al-Bitrüji's opinion of himself. See, e.g., Goldstein, Al-Bitrüji: On the Principles of Astronomy, par. 16: "I remained perplexed and confused for some time and stopped studying (the rest of) the book to meditate and (overcome my) confusion. Finally, I was inspired by (God) and awakened from my stupor and confusion. Thereupon an idea arose in my mind which had not occurred to anyone—but it did not come from human speculation, for God wished to show His wondrous things and to reveal the secret of the heavens." See also par. 96: "We have discussed the model for the motion of the starry sphere, one which we discovered with the help of God." It seems that these remarks, moreover, and Ibn Tibbon's representation of them, are what Judah ha-Kohen has in mind in his own assessment of al-Bitrüji. See the text translated by Langermann, "Some Remarks," p. 386: "Know that a great secret was revealed to [al-Bitrüji]. Had he been a Jew, he would have been worthy of the divine wisdom."

There is no reason to suspect that Ibn Tibbon had an interest in suppressing the name of an Islamic philosopher; elsewhere in his work he cites by name and makes clear reference to al-Fārābī, Avicenna, and Averroes. Moreover, the only other scholar to
enforced motion, it also moves in its own orb from west to east according to its natural motion. With this [natural] motion it completes [a cycle of] its orb in $365\frac{1}{4}$ days.

This is all according to what previous astronomers have proposed; all of this can be found in their books. But now there is an individual possessed by the spirit of God [see Gen. 41:38] who has discovered an astronomical model [tekunah] that does not suppose two motions contrary to each other; nor does it [postulate] an orb that does not revolve around the center of the world or an epicycle. As for the apparent motion of the planets from west to east, he says that they do not really experience this motion. Instead, what happens is that they fall short of completing in one day the full circle that is completed by the orb specific to the circle of daily motion. [This recent astronomer] also placed in their nature a westward motion specific to [each of] them through which they make up some of the lag [hissaron], for they are not able to complete it [all]. Rather, each one [of the orbs] has a daily lag, some more and some less, depending upon its relative position: the closer any individual orb is to the outermost orb, which is specific to the daily motion, the smaller its lag; the farther it is, the greater its lag. This is all according to what can be found in the book that this sage has composed according to this astronomical model. Aristotle had already alluded to an astronomy like this, for he saw that all of the other models were impossible according to the physical principles that he had postulated in natural science.

Returning now to our subject of enquiry, we say that the circle that the sun makes according to its specific natural motion, which accounts for its lag, is called the “orb of the zodiac.” It is given the name of the corresponding circle in the orb of the fixed stars. The twelve constellations, which are called the twelve “signs” of the zodiac, were contained in [this circle] at the time when they were given this name. The circle called “orb of the zodiac” is a “great circle,” which divides and cuts the circle called the “celestial equator” into two equal parts.
whom Ibn Tibbon refers by an honorific is Maimonides, whom Ibn Tibbon esteems above all others; he calls him the "True Sage."

For Maimonides' definition of the "work of the chariot," see Steven Harvey, "Maimonides in the Sultan's Palace," in Perspectives on Maimonides, pp. 47-76, where relevant passages in Maimonides are identified and previous studies referred to.

See Robinson, "Samuel Ibn Tibbon's Commentary on Ecclesiastes," pp. 228-29, par. 19: "As for the prophet Ezekiel, he wrote at length about the 'chariot' using the method of 'chapter headings.' Since then, divine science—or say: astronomy with divine science—has been called the 'work of the chariot.' This is because most of what is alluded to therein is done so by means of certain wondrous secrets represented figuratively as four Ḥayyot [see Ezek. 1:5]. The chariot itself is the four beasts, as has been explained by the True Sage in his Noble Treatise, namely, in Chapter Seventy of Part I. It seems, as we have said, that the 'work of the chariot' includes both astronomy and divine science. The latter is the science through which one knows that which is beyond nature, that is, everything that has no natural capacity for motion, rest, or anything else circumscribed by the term 'nature.' The statement made by the Master, in several places, that the 'work of the chariot' is identical to divine science is quite surprising. For he did not make any mention of astronomy, and yet I see that [the 'work of the chariot'] is comprised more than anything of astronomy. Only the 'man' [see Ezek. 1:26] is a part of divine science." See the similar remark in Ma'amor yiqqawu ha-mayim, ed. M. Bisliches (Pressburg, 1837), p. 55. It should be noted, however, that whereas Ibn Tibbon seems to recognize the importance of astronomy in Aristotle's Metaphysics, he differentiates the discipline—metaphysics or divine science—from the contents of the book. Moreover, what he understands as astronomy (Hebrew hokmat ha-tekwunah; Arabic ilm al-hay'ah) is not mathematical astronomy but astronomy and celestial physics; his "work of the chariot" is really a Jewish cosmology that corresponds very closely to the Arabic hay'ah tradition, about which see the sources referred to in note 1.

It should be emphasized that the philosophical commentaries on Isaiah 6 and Ezekiel 1, 10, many of which remain in manuscript, as well as the commentaries on Maimonides' interpretation of these visions in Guide 1:69-70 and 3:1-7, constitute a still unexplored source for the history of astronomy and celestial physics. Many follow
The celestial equator is an imaginary circle in the orb of the fixed stars. These circles [namely, the equator and zodiac] are two of the great circles drawn from east to west. Because this is so, and [because] each one divides the other in the middle, and the equator is in the middle of the world, from east to west, the circle corresponding with the orb of the zodiac divides [the equator] as follows: half of [the circle of the zodiac] is in the north and half of it is in the south, in accordance with the distance between it and the equator. For [the equator and circle of the zodiac] have only two points of intersection or conjunction. When the sun is in some part of the orb that inclines toward the north, one says that it is in the northern direction and “goes” [see Eccl. 1:6] in the north. This continues of necessity for half a year. When it is in the half that inclines toward the south, one says that it is in the southern direction and “goes” in the south. This continues for the other half year.

After having given this preliminary statement, in summary fashion, I say that in the previous verse [namely, Eccl. 1:4] he introduced [the notion] that a “generation” goes and a “generation” comes and that this process continues perpetually. The same meaning is implied when he says: “and the earth abides forever.” That is, he explained the unity of the material cause. He comes now to indicate the unity of the agent causes, one of which—indeed, one of the greatest—is the rising and setting of the sun, which occurs as the result of [the sun’s] enforced daily motion. This motion is the cause of day and night, for the period of time in which the sun can be seen is called “day,” in whatever place it can be seen, whereas the [period of] time in which the sun is concealed is called “night”; and both [day and night] are causes of generation and corruption. What he says here is that they, that is, rising and setting, continue perpetually without change. This he indicates with the phrase “it glides back to its place, there it rises.” That is, [the sun] continues perpetually to rise every day at the same place, or close to the same place, where it had risen the previous day. This perpetual continuity is

22 I translate galgal as “orb” rather than “sphere” throughout the following texts, following the distinction discussed by Grant, Planets, Stars, Orbs, p. 115, n. 137.


24 On the meaning of tekunah, which translates the Arabic hay’a, see the literature cited above (n. 1).

25 See, e.g., Ptolemy, Almagest 1:8.

26 New JPS translation; cf. RSV: “The sun rises and the sun goes down, and hastens to the place where it rises.”

27 Reading ha-tenu‘ah ha-hi’ ha-memaheret as an accusative. Or: with an increasingly rapid motion.

28 See Aristotle, De caelo 1:3, 270a2ff.

29 Literally: “This is all according to what astronomers have proposed according to what can be found in their books from then.” See, e.g., Ptolemy, Almagest, 1:8, 3:1.

30 See, e.g., Goldstein, Al-Bitrūjī: On the Principles of Astronomy, par. 33.

31 He seems to mean that there are no eccentrics, i.e., orbs that revolve around a center slightly removed from the center of the world. The expression used here, galgal mitnoceca lo’ saviv merkaz ha-coUm, however, differs from the term used for eccentric in the Glossary, namely, galgal ha-yose’ hu% U-merkaz, which translates literally the Arabic term khārij ʿan al-markaz.

32 See, e.g., Goldstein, Al-Bitrūjī: On the Principles of Astronomy, par. 54.

33 See, e.g., ibid., par. 56, 104ff. The source of motion is the outermost orb, which distributes a power to the lower orbs, each having less power the farther it is from the outermost orb. On desire and impetus see Samsó, “On al-Bitrūjī and the Hay’a Tradition in al-Andalus,” pp. 9-13.
the cause of generation and corruption. This is agreed upon by all sages.47

(3) Samuel Ibn Tibbon, Ma’amar yiqqawu ha-mayim, ed. M. Bisliches (Pressburg, 1837), pp. 46–47.

As for the sphericity of the Hayyot [see Ezek. 1:5], this was alluded to with the phrase “[and the soles of their feet] are like the [spherical] soles of a calf [‘egel]” [Ezek. 1:7].48 As for the soul and intellect [of the Hayyot], this was alluded to when he hinted that all of them possess the face of a man, all of the faces “are faces of man” [see Ezek. 1:10], even though some of them tend toward the other forms that he had mentioned.49 As for the desire [of the Hayyot],50 we say that he alluded to this with [the phrase] “in whatever direction the spirit would go [they went, they turned not when they went]” [Ezek. 1:12]. As for the existence of the two actions [alluded to here], finally, this is something known through sense perception, insofar as all of the Hayyot revolve with one motion from east to west, on several axes, but they also have an additional motion; namely, each Hayyah has a motion specific to it, which appears to proceed from west to east and which turns on several axes other than that of the “firmament” which is “over the heads of the Hayyot” [see Ezek. 1:22] and around a center different from that around which the “firmament” moves.51

However, just recently one of the sages of this science in this generation, an individual possessed by the spirit of God [Gen. 41:38], discovered an astronomical model according to which the motion specific to each Hayyah also proceeds from east to west, like the motion of [the outermost orb] which contains [them]. All of the [inferior orbs] that are drawn after [this encompassing orb] follow the motion of the outermost “firmament,” revolving around its center but on different axes.52 [According to this model, furthermore,] the backwards motion that exists with respect to the planets is not the result of their possessing
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34 See, e.g., Goldstein, Al-Bīṭrūjī: On the Principles of Astronomy, par. 65, 67, 86, 104ff. Each body has its own motion, a "motion of completion," through which it attempts to compensate for the lag. In this way it tries to imitate the motion of the outermost orb.

35 Literally: "everything according to the order of some from some." He refers to the relative speed of the orbs, as is explained in the following sentence.

36 That is, contrary to Ptolemy's model, in which motion accelerates from top to bottom, al-Bīṭrūjī's system decelerates from top to bottom. The farther away an orb is from the first cause and the closer it is to the moon, the slower is its motion; the outermost orb is the only source of power, and power determines speed. See, e.g., Goldstein, Al-Bīṭrūjī: On the Principles of Astronomy, par. 22, 57.

37 Al-Bīṭrūjī himself makes this claim; see, e.g., ibid., par. 9-10, 17, 32; see the studies of the Andalusian "revolt against Ptolemy" referred to in n. 1. For Aristotle, the source of power and principle of motion come from the outside, from the prime mover. There is uniform motion, in one direction; contrary motions from a single mover are unacceptable. One substance (the fifth substance) should have no opposition. Moreover, there can be no vacuum, which eccentrics and epicycles would create.

38 Literally: "completes its lags."

39 That is, the ecliptic.

40 He is referring to the precession of the equinoxes; the signs are no longer aligned with their so-called fixed positions, in which 0 Aries is the vernal equinox.

41 I.e., it revolves around the center of the world; it is not a small circle or epicycle.

42 Literally: "the straight line that goes through the middle of the world." See Glossary, s.v. qaw ha-šawweh.

43 Namely, it does not represent a physical reality but is rather a mathematical device used for calculation and celestial orientation, mapping the apparent motions of the celestial bodies.

44 Literally: "the circle that divides it will have half..."

45 That is, they are divided such that each part rises further away from the intersection, either to the north or to the south; i.e., the northern section is defined from the equinox to the summer solstice or Tropic of Cancer and the southern section from the equinox to the winter solstice or Tropic of Capricorn.
a [specific volitional] motion from west to east in opposition to the westward motion [of the "firmament"]; on the contrary, it [the motion of the planets] is also from east to west. But this motion, according to which they are drawn after the westward daily motion of the outermost orb, does not include the whole completed circle of the outermost orb, for the velocity of that which is drawn is not as swift as the velocity of that which draws it. Rather, there remains a considerable portion of this [circular motion of the outermost orb] which [the inferior orbs] do not complete and they remain because of this significantly behind. With the motion specific to each of them they make up some but not all of the lag. But regarding the lag that exists with respect to each of the planets, the moon completes a full circle in one month, the sun in one year, and similarly all other [planets] according to a fixed period. All of this can be found, with strong proofs and demonstrations—with respect to whatever can possibly be demonstrated—in the book that this sage set forth concerning this new astronomy.


The text presented here is based on my edition of the complete Commentary on Ecclesiastes, included in my unpublished doctoral dissertation. That edition draws on three manuscripts, which are described there in detail: I=Biblioteca Medicea Laurenziana (Florence), Plut. II.51 (Institute for Microfilmed Hebrew Manuscripts 17811); F=Biblioteca Medicea Laurenziana (Florence), Plut. I.5 (IMHM 17633); R=Biblioteca Nazionale Centrale Vittorio Emanuele (Rome) II, 7 (IMHM 402). The apparatus at the end of the text lists all variants except changes in spelling. I have standardized the spelling in the text itself and added paragraph divisions, punctuation, and biblical references. Sentences are numbered in order to facilitate use of the apparatus.
Namely, the vernal and autumnal equinoxes.

Heat and light cause generation, whereas the absence of heat and light causes corruption. This is also why there is more generation in the summer and more corruption in the winter. Note also that too much heat and light can cause corruption, as in the southern hemisphere where, according to medieval geography, habitation is impossible. It should be added that establishing the celestial causes of heat and light, mixture and blending, generation and corruption, is one of the main purposes of Ibn Tibbon's Solomon in Ecclesiastes, as is explained at length in his commentary on Eccl. 3:1–22. For background in Aristotle and Averroes, see especially the series of articles by G. Freudenthal: “Providence, Astrology, and Celestial Influences on the Sublunar World in Shem-Tov Ibn Falaquera's De'ot ha-Filosofim,” pp. 335–370 in The Medieval Hebrew EncyclopedUs of Science and Philosophy; “The Medieval Astrologization of Aristotle's Biology: Averroes on the Role of the Celestial Bodies in the Generation of Animate Beings,” Arabic Sciences and Philosophy 12 (2002): 111–38; “Averroes' Changing Mind on the Role of the Active Intellect in the Generation of Animate Beings,” in Proceedings of the Congreso internacional VIII centenario de Averroes (Cordoba, 9–11 December 1998), ed. Ahmed Hasnaoui (forthcoming). I thank Gad Freudenthal for giving me a preprint of his article.

For the identification of Ezekiel's Hayyot with the celestial orbs, see Guide 3:1–7. Note that Ibn Tibbon's explanation of the verse is based upon the etymological relation between cegel, calf, and siggul or agullah, circle or sphere, a connection which is made by Maimonides in Guide 3:2.

The complete verse is: “As for the likeness of their faces, they had the face of a man; and they four had the face of a lion on the right side; and they four had the face of an ox on the left side; they four also had the face of an eagle” (1917 JPS translation). See again n. 23 regarding the notion of desire with respect to celestial movement.

For the meaning of "firmament," see Guide 3:1–7.

Here the source text is awkward, so the translation is paraphrastic.

Here too the translation is paraphrastic, because of the awkwardness of the text.

[תוקף א: קהלת]

[18] דרכם שנאתי על פירוטו הזה המוסק, ואכדיך שם ידיעתי המ שטריך ימנישו.

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גלגול המול_Response וה诂שת אכות היה צוי שהעדין צפי והודח אלעד רזים פג גורמים כים בוהק קדחת. [21] במישורי השמש בצק
ובים הקוק השון, כי יקר וחם לא שוך לתוך אמות מה낀ות והanime. בא啮 והanime, אחר כך זימן והanime, היו בעי
גלגול התませת낫 לזרח זים כי שוחר אחר האמות והanime. בצק
 là בהכרת צפי השון. [22] במישורי הבהר הנות הצל עד דים ים בימי ושוחי פאות הדור咨询服务
ושוחי הצל בער יסוד על ירי השון.

[23] אזור שהדקמתי והזקakah אמור כי באשר ידיקות בפסוק אאשר לו לזרח השון והצל
דוח אב ושוחאצור הצל הים, כי באנימי החם טלבל טמודה [זאת הקהלת אום], אל כולם
שבוא ברוח שוחי השם והanime, לספי הצל אחד את אחד הסבסות והanime של השם, שארן
כן נורית שעון, כי והanime גנבה את הגנבה השחר הanime והanime לשהיון קיים
סתוח הצל והanime, שומע ומון שיריאים בדשה קרים עם מבוקש יסוד הקוה שהanime של השון
לזרח, זיינטע בצל הצל הanime. [24] אפור שות השחר הצל המידי בלוט, שלוש
וזוריית הanime, זור אמור: ידוק מוקמו שאר והanime את המוסר של השון הצל
תמי לזרח לכל ים מסוק משורו או מאכל כי זכר ל. [25] המיתודתוחר הצל הanime א
סבתו הanime והanime.

[26] זה מוסבר מוכל התוככיים.