

“Bright Stars and Wide Whorls” (CAMWS 2021 April)

Plato *Republic* book ten (616c10–617b5), including comparisons with Theon and Proclus:¹

[c10] τὴν δὲ τοῦ σφονδύλου φύσιν |_{d1} εἶναι τοιάνδε· τὸ μὲν σχῆμα οἷαπερ ἡ τοῦ ἐν |_{d2} θάδε, νοῆσαι δὲ δεῖ ἐξ ὧν ἔλεγεν τοιόνδε αὐ |_{d3} τὸν εἶναι, ὥσπερ ἄν εἰ ἐν ἐνὶ μεγάλῳ σφονδύ |_{d4} λῳ κοίλῳ καὶ ἐξεγλυμμένῳ διαμπερὲς |_{d5} ἄλλος τοιοῦτος ἐλάττων ἐγκείτο ἀρμόττων, |_{d6} καθάπερ οἱ κάδοι οἱ εἰς ἀλλήλους ἀρ |_{d7} μόττοντες, καὶ οὕτω δὴ τρίτον ἄλλον καὶ τέ |_{d8} τартον καὶ ἄλλους τέτταρας.

ὀκτώ γὰρ εἶναι |_{d9} τοὺς σύμπαντας σφονδύλους, ἐν ἀλλή |_{d10} λοις ἐγκειμένους, κύκλους ἄνωθεν τὰ χεῖ |_{e1} λη φαίνοντας, νῶτον συνεχὲς ἐνὸς σφονδύ |_{e2} λου ἀπεργαζομένους περὶ τὴν ἡλακά |_{e3} τήν· ἐκείνην δὲ διὰ μέσου τοῦ ὀγδόου |_{e4} διαμπερὲς ἐληλάσθαι. τὸν μὲν οὖν πρῶτον τε καὶ ἐξωτάτω σφόνδυλον πλατύ |_{e5} τατον τὸν τοῦ χείλους κύκλον ἔχειν, τὸν δὲ τοῦ ἕκτου δεύτερον, τρίτον δὲ τὸν τοῦ τετάρ |_{e6} του, τέταρτον δὲ τὸν τοῦ ὀγδόου, πέμπτον δὲ τὸν τοῦ ἑβδόμου, ἕκτον δὲ τὸν τοῦ πέμπτου, |_{e7} ἑβδομον δὲ τὸν τοῦ τρίτου, ὀγδοον δὲ τὸν τοῦ δευτέρου. καὶ τὸν μὲν τοῦ μεγίστου ποικί |_{e8} λον, τὸν δὲ τοῦ ἑβδόμου λαμπρότατον, τὸν δὲ τοῦ ὀγδόου τὸ χρῶμα ἀπὸ τοῦ ἑβδόμου ἔχειν |_{e17a1} προσλάμποντος, τὸν δὲ τοῦ δευτέρου καὶ πέμ |_{a2} πτου παραπλήσια ἀλλήλοις, ξανθότερα ἐ |_{a3} κείων, τρίτον δὲ λευκότετον χρῶμα ἔχειν, |_{a4} τέταρτον δὲ ὑπέρυθρον, δεύτερον δὲ λευ |_{a5} κότητι τὸν ἕκτον. κυκλεῖσθαι² δὲ |_{a6} δὴ στρεφόμενον τὸν

[616c10] And the nature of the whorl was this: its shape was that of those in our world, but from what he said we must conceive it to be as if in one great whorl, hollow and wholly scooped out, there lay within another like it but smaller, fitting into it like boxes that fit into one another, and in like manner another, a third, and a fourth, and four others.

[d8] For there were eight of the whorls in all, lying within one another, showing their rims as circles from above and forming the continuous back of a single whorl about the shaft, which was driven right through the middle of the eighth.

Now the first and outermost whorl had the broadest circular rim, that of the sixth was second, and third was that of the fourth, and fourth was that of the eighth, fifth that of the seventh, sixth that of the fifth, seventh that of the third, eighth that of the second.

That of the greatest was spangled, that of the seventh brightest, that of the eighth took its color from the seventh, [617a] which shone upon it. The colors of the second and fifth were like one another and more yellow than the two former. The third had the whitest color, and the fourth was reddish; the sixth was second in whiteness.

The staff turned as a whole in a circle with the

¹ Following Burnet (1903) and Slings (2003) for the text. My translation is based on Shorey (1935) 501–505, repr. in Hamilton and Cairns (1961) 840–841; and on Grube and Reeve (1992) 287–288.

² For κυκλεῖσθαι Theon of Smyrna reads κυλίεσθαι (Hiller 1878, 145, lines 12–13): the syncopated verb κυλίω is found in Aristotle and later, derived from the aorist of κυλίνδω.

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ἄτρακτον ὅλον μὲν τὴν ^{a7} αὐτὴν **φοράν**³, ἐν δὲ **τῷ** ὅλῳ περιφερομέ^{a8} νω τοὺς μὲν ἐντὸς ἑπτὰ κύκλους τὴν ἑναν^{a9} τίαν τῷ ὅλῳ ἡρέμα **περιφέρεσθαι**,⁴ αὐτῶν δὲ ^{a10} τούτων τάχιστα μὲν ἰέναι τὸν ὄγδοον, δευτέρους ^{b1} δὲ καὶ ἅμα **ἀλλήλοις**⁵ τὸν τε ἕβδομον καὶ ἕ^{b2} κτον καὶ πέμπτον· τρίτον δὲ φορᾶ ἰέναι, **ὥς** ^{b3} **σφίσι**⁶ φαίνεσθαι, ἐπανακυκλούμενον **τὸν τέταρ^{b4}τον**,⁷ τέταρτον δὲ τὸν τρίτον καὶ πέμπτον τὸν δεύ^{b5}τερον.⁸

same movement, but within the whole as it revolved the seven inner circles revolved gently in the opposite direction to the whole, and of these the eighth moved most swiftly, and next, [617b] and together with one another, the seventh, sixth and fifth; and third in swiftness, as it appeared to them, moved the fourth with returns upon itself, and fourth the third, and fifth the second.

³ For φοράν Theon of Smyrna reads φορὰν τῷ κόσμῳ (Hiller 1878, 145, line 14), the extra phrase probably taken into the text from a marginal gloss (either in Theon’s copy of Plato, or in Theon’s own work). Proclus’ lemma here differs in two places from our manuscripts of Plato, 617a4–5, namely: (a) Proclus omits the δὴ in 617a6, after δὲ; (b) instead of φοράν in 617a7, Proclus reads περιφοράν. That is, Proclus’ lemma reads: κυκλεῖσθαι δὲ <δὴ> στρεφόμενον τὸν ἄτρακτον ὅλον μὲν τὴν αὐτὴν [περι]φοράν, Kroll vol. 2 (1901) 226, line 30, to 227, line 1.

Proclus’ reading might be due to harmonization with the two following περιφέρω.

⁴ For περιφέρεσθαι Theon of Smyrna reads περιάγεσθαι (Hiller 1878, 145, line 15).

⁵ After ἀλλήλοις Theon of Smyrna adds ἰσοταχῶς (Hiller 1878, 145, line 17), perhaps again a marginal gloss.

⁶ For ὥς σφίσι Theon reads ὃν φασι (Hiller 1878, 145, lines 18–19), distinctly the *lectio facillior*, and perhaps originating in a haplography, ΩΣΦΙΣΙ, that was then miscorrected to ΟΝΦΑΣΙ, in an era when the pronoun σφίσι was no longer in common use.

⁷ For τὸν τέταρτον, Theon reads μάλιστα τῶν ἄλλων (Hiller 1878, 145, line 19). This was probably a marginal gloss, made when the “recycling” of the five planets was widely recognized. Burnet (1920) 304, n. 1, followed by Brumbaugh (1954) 197, with 293–294, n. 149, argues that μάλιστα τῶν ἄλλων is an authentic line of Plato, from an early MS with 15-character lines, omitted by a scribe. Burnet’s argument is based on Clark (1918) 388–393, who does not include this line in his examples, and provides examples whose lengths vary.

⁸ Simplicius quotes the passage 617a9–b5, in *Commentary on Aristotle’s ‘On Heaven’*, Heiberg (1894) 475, lines 16–18: “αὐτῶν δὲ | τούτων τάχιστα μὲν <ἰέναι> τὸν ὄγδοον, δεύτερον | δὲ καὶ ἅμα ἀλλήλοις τὸν τε ἕβδομον καὶ ἕκτον καὶ πέμπτον, τρίτον δὲ φορᾶ ἰέναι <ὥς | σφίσι φαίνεσθαι, ἐπανακυκλούμενον> τὸν τέταρτον, τέταρτον δὲ τὸν τρίτον καὶ πέμπτον τὸν δεύτερον.” The omission of ἰέναι is probably simply due to Simplicius adjusting the quoted words to their quoted context; likewise, the switch of singular to plural, δεύτερον / δευτέρους, makes no difference to the sense. Proclus evidently had a text of Plato that included ἐπανακυκλο–, since he writes “ὅπως ἐπανακυκλεῖσθαι τὸν τ[έταρτον],” Kroll vol. 2 (1901) 226, line 26. (What Proclus said next is lost in a 72-character lacuna.)

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Order of Widths

<i>Whorl</i>	Fixed Stars (I)	Saturn (II)	Jupiter (III)	Mars (III)	Mercury (V)	Venus (VI)	Sun (VII)	Moon (VIII)
<i>Width</i>	1	8	7	3	6	2	5	4

Bright Stars

“bright-shining” (παμφαίνων) Arcturus rises in the east at sunset (Hesiod, *Works and Days* 564–567)

Sophocles, *Oedipus the King* 1136–1137, “from spring to Arcturus,” and Thucydides 2.78.2

Bright Sirius: *Iliad* 5.4–6; 11.61–62; and 22.25–31: “bright-shining” (παμφαίνων), “most bright” (μάλιστα λαμπρόν), or “brightest” (λαμπρότατος); “his conspicuous rays / shine amid many stars” (ἀρίζηλοι δὲ οἱ αὐγαὶ / φαίνονται πολλοῖσι μετ’ ἀστράσι)

Scorching Sirius: Hesiod, *Works and Days* 582–588 ≈ *Shield of Herakles* 393–397 ≈ Alcaeus of Mytilene (ca 600 BCE), fr. 347 in Lobel and Page (1955) 270 = Voigt (1971) 315–316

Aeschylus, *Agamemnon* 4–6, the “bright potentates conspicuous in heaven” (λαμπροὺς δυνάστας, ἐμπρέποντας αἰθέρι)

Sirius and Arcturus in the Hippocratic corpus, *Regimen*, book 3, §68 (Littré 6.594); *Airs, Waters, Places* §10 (Littré 2.50.6–8) and §11 (Littré 2.52.4–7), and *Epidemics*

Plato, *Theaetetus* 208d: ἡλίου πέρι ... ὅτι τὸ λαμπρότατόν ἐστι τῶν κατὰ τὸν οὐρανὸν ἰόντων περὶ γῆν (i.e., other stars are less bright)

Constellations

Hesiod, “When the Pleiades, daughters of Atlas, are rising, / begin your harvest, and your ploughing when they are going to set.” (*Works and Days* 383–384); “When Orion and Sirius come into the middle / of heaven, and rosy-fingered Dawn looks at Arcturus” (609–610); “the Pleiades and Hyades and strong Orion” (614–616); “when the Pleiades plunge into the misty sea” (619–620)

Sophocles, *Trachiniae* 129–131, “sorrow and joy circle to all, like the turning paths of the Bear,”

Euripides, *Electra* 467–468, “... the heavenly choros of stars, the Pleiades, the Hyades”

Euripides, *Ion* 1152–1158, tent-roof tapestry, depicting the Pleiades, Orion, the Bear, and the Hyades.

Plato, *Republic* 7 (529c), refers to constellations (ποικίλματα)

Morning and Evening Stars

Iliad 22.317–318, Achilles’ spear-tip shone like the evening star among the other stars, “the Evening Star, which is set in heaven as the most beautiful star” (ἔσπερος, ὃς κάλλιστος ἐν οὐρανῷ ἴσταται ἀστήρ); cf. 23.226–227, the morning star heralds the light of dawn

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Odyssey 13.93–94, as his ship reaches shore just before dawn, when the “brightest”

(φάαντατος) star rose, “messenger of the dawn light” (ἀγγέλλων φάος ἡοῦς)
Pindar, *Isthmian* 4.40–41 (23–24), “Dawnbringer wondrous among the other stars”

(Ἄωσφόρος θαητὸς ὧς ἄστροις ἐν ἄλλοις)

Euripides, *Ion* 1147–1151, “shining light of the Evening star” (λαμπρὸν Ἑσπέρου φάος),
thus brighter than the other stars that attend Night, 1150–1151.

Celestial Illusion

Herodotos 3.104.2–3, sun hottest in morning (θερμότατος δέ ἐστι ὁ ἥλιος τούτοισι τοῖσι
ἀνθρώποισι τὸ ἐωθινόν) and quite chilly in evening (ἐπὶ μᾶλλον ψύχει, ἐς ὃ ἐπὶ
δυσμῆσι ἐὼν καὶ τὸ κάρτα ψύχει) – because India is at the east edge of a flat earth.

Ctesias, *Indika* = *FGrHist* 688 F45.12 and 45.18 = Photios, *Library* §72 (p. 45b)

Hippocratic corpus, *Airs, Waters, and Places* §§12, 16, and 23 (Littré 2.52–54, 2.62–64,
and 2.82–86)

Euripides, *Phaethon*, fr. in Diggle (1970) 55 (lines 1–7) and 78–83 (commentary)

Strabo 3.1.4–5 quotes Posidonius, as disputing the report of Artemidorus that the Sun set
much larger than it was during the day

Whorl Widths and Brightness Ranges

<i>Relative Width</i>	<i>Whorl Number</i>	<i>Modern Brightness Range</i>
(1) widest	I. Fixed Stars	5
(2) second widest	VI. Venus	≈ 1.9 or 2.0
(3)	III. Mars	≈ 1.9 or 2.0
(4)	VIII. Moon	1.5
(5)	VII. Sun	1.5
(6)	V. Mercury	≈ 1.4 or 1.5
(7) second narrowest	III. Jupiter	≈ 1.2 or 1.3
(8) narrowest	II. Saturn	less than 1.0

Bibliography

James Adam, *The Republic of Plato* vol. 2 (Cambridge: University Press, 1902); 2nd ed. with an
introduction by D. A. Rees (Cambridge: University Press, 1963).

Alan C. Bowen, *Simplicius on the Planets and Their Motions: In Defense of a Heresy* (Leiden
and Boston: Brill, 2013).

Robert S. Brumbaugh, *Plato’s Mathematical Imagination* (Bloomington, 1954).

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- John Burnet, *Platonis Opera, Tomus IV, Tetralogiam VIII Continens* (Oxford: Clarendon, 1903).
- John Burnet, *Early Greek Philosophy*, 3rd ed. (London: Black, 1920; repr. 1930, as 4th ed.).
- A. C. Clark, *The Descent of Manuscripts* (Oxford: Clarendon, 1918).
- D. R. Dicks, *Early Greek Astronomy* (Ithaca and London: Cornell, 1970).
- James Diggle, ed., *Euripides Phaethon* (Cambridge: Cambridge University Press, 1970).
- James Evans, *The History and Practice of Ancient Astronomy* (Oxford and New York, 1998).
- Gerd Graßhoff, *The History of Ptolemy's Star Catalogue* (Berlin and New York: Springer, 1990).
- Andrew Gregory, *Plato's Philosophy of Science* (London: Duckworth, 2000).
- G. M. A. Grube and C. D. C. Reeve, trans., *Plato Republic* (Indianapolis: Hackett, 1992).
- Stephen Halliwell, *Plato Republic 10* (Warminster: Aris and Phillips, 1988).
- Eduard Hiller, *Theonis Smyrnaei Philosophi Platonici Expositio Rerum Mathematicarum ad Legendum Platonem Utilium* (Leipzig: Teubner, 1878; repr. New York: Garland, 1987).
- Lloyd Kaufman and James H. Kaufman, “Explaining the Moon Illusion,” *Proceedings of the National Academy of Sciences of the United States of America* 97 (2000) 500–505.
- Lloyd Kaufman, Vassias Vassiliades, Richard Noble, Robt. Alexander, Jas. Kaufman, and Stefan Edlund, “Perceptual distance and the moon illusion,” *Spatial Vision* 20 (2007) 155–175.
- Paul T. Keyser, “Polemarchos of Kyzikos,” in *Biographical Encyclopedia of Astronomers*, ed. Thomas Hockey, et al., 2nd ed. (Berlin and New York: Springer 2014) 1744–1745.
- Wilhelm Kroll, *Procli Diadochi in Platonis Rem Publicam Commentarii*, vol. 2 (Teubner, 1901).
- François Lasserre, ed., *Eudoxos. Die Fragmente* (Berlin: de Gruyter, 1966).
- H. L. Lorimer, “Stars and Constellations in Homer and Hesiod,” *Annual of the British School at Athens* 46 (1951) 86–101.
- Anthony Mallama and J. L. Hilton, “Computing apparent planetary magnitudes for *The Astronomical Almanac*,” *Astronomy and Computing* 25 (2018) 10–24.
- Davide Neri, “Bayer, Johann,” in *Biographical Encyclopedia of Astronomers*, ed. Thomas Hockey, et al., 2nd ed. (Berlin and New York: Springer, 2014).
- D. L. Page, *Poetae Melici Graeci* (Oxford: Clarendon, 1962).
- James M. Pfundstein, “Λαμπροὺς Δυνάστας: Aeschylus, Astronomy and the *Agamemnon*,” *Classical Journal* 98.4 (2003) 397–410.
- Helen E. Ross and Cornelis Plug, *The Mystery of The Moon Illusion: Exploring Size Perception* (Oxford: Oxford University Press, 2002).
- Lucas Siorvanes, *Proclus: neo-platonic philosophy and science* (New Haven: Yale, 1996).
- S. R. Slings, ed., *Platonis Rempublicam* (Oxford: Clarendon, 2003).
- Henri Étienne, ed., *Platonis opera quae extant omnia*, 3 vols. (Geneva: Stephanus, 1578).
- Harold Tarrant, *Thrasyllan Platonism* (Ithaca and London: Cornell, 1993).
- Eva-Maria Voigt, ed., *Sappho et Alcaeus Fragmenta* (Amsterdam: Athenaeum, 1971).
- M. L. West, *Iambi et Elegi Graeci Ante Alexandrum Cantati*, vol. 1 (Oxford: Clarendon, 1971).
- Malcolm Wilson, “Hippocrates of Chios's Theory of Comets,” *Journal for the History of Astronomy* 39.2 (2008) 141–160.

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Walt Whitman, “When I Heard the Learn’d Astronomer” in *Drum Taps* (1865); David Lehman and John Brehm, ed., *The Oxford Book of American Poetry* (2006) 145.

When I heard the learn’d astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure
them,
When I sitting heard the astronomer where he lectured with much applause in
the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander’d off by myself,
In the mystical moist night-air, and from time to time,
Look’d up in perfect silence at the stars.