

HYSBYSIAD HAWLFRAINT

Atgoffir staff a myfyrwyr Prifysgol Cymru Llanbedr Pont Steffan fod hawlfraint ar y darn hwn ac ar y gwaith y'i cymerwyd ohono. Gwnaed y Copi Digidol hwn yn unol ag amodau trwydded CLA sy'n caniatáu ichi:

- gael gafael ar a dadlwytho copi;
- argraffu copi;

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Rhaid i bob copi (gan gynnwys copïau electronaidd) gynnwys yr Hysbysiad Hawlfraint hwn a rhaid eu dinistrio a/neu eu dileu os a phan fydd hynny gan Brifysgol Cymru Llanbedr Pont Steffan.

Ac eithrio'r hyn y darperir ar ei gyfer gan gyfraith hawlfraint, ni chaniateir unrhyw gopïo, storio na dosbarthu pellach (gan gynnwys trwy e-bost) heb ganiatâd y deiliad hawlfraint.

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by its recurring again and again ; for it is in that way that Time is unlimited' (ii, 289). 'The motion of Time joins the end to the beginning, and this an infinite number of times' (iii, 30³¹).

38C-39E. *The Planets as instruments of Time*

Before proceeding to the creation of all the everlasting heavenly gods who are to be enshrined in the system of revolutions already prepared, Plato takes first those among their number, namely the Planets, whose special utility to mankind lies in their marking off the periods of time and so teaching men to count and calculate. He remarks later (47A) that the observation of these regular periods led to the discovery of number, to all inquiry into nature, and to philosophy itself.

- 38C. In virtue, then, of this plan and intent of the god for the birth of Time, in order that Time might be brought into being, Sun and Moon and five other stars—'wanderers', as they are called—were made to define and preserve the numbers of Time. Having made a body for each of them, the god set them in the circuits in which the revolution of the Different was moving¹—in seven circuits seven bodies :
- D. the Moon in the circle nearest the Earth ; the Sun in the second above the Earth ; the Morning Star (Venus) and the one called sacred to Hermes (Mercury) in circles² revolving so as, in point of speed, to run their race with the Sun, but possessing the power contrary to his ; whereby the Sun and the star of Hermes and the Morning Star alike overtake and are overtaken by one another. As for the remainder,³ where

¹ As Pr. (iii, 59²⁹) remarks, the revolution (περίοδος) of the Different is still spoken of as a single movement of the soul as a whole, going on in all the seven circuits (περιφοραί) among which it is distributed. περιφορά means primarily the circular motion, rather than the circular track ; cf. *circuitus*.

² εἰς [τόν] τάχει μὲν ἰσόδρομον ἡλίῳ κύκλον ἰόντας, Burnet. 'Venus and Mercury are put into circles which have the same period as the sun, but not into one and the same circle. The construction is εἰς (κύκλους) ἰόντας ἰσόδρομον ἡλίῳ κύκλον, κύκλον being an accusative of the internal object after ἰόντας' (Tr.). A.-H. followed Stallbaum in accepting τοὺς, which appears as a correction in Y and yields the same sense as the omission of τόν. The reading τόν is as old as Albinus, *Didasc.* xiv, φωσφόρον δὲ καὶ τὸν ἱερὸν Ἑρμοῦ λεγόμενον ἀστέρα εἰς τὸν ἰσοταχῇ μὲν ἡλίῳ κύκλον ἰόντα (*sic*), τούτου δὲ ἀφεστῶτα. It is possible that those who read τόν understood Plato to have held Heraclides' theory that Venus and Mercury revolve as satellites round the Sun. There would then be only one main circle for all three, the Sun's. But Plato certainly did not hold this. See Heath, *Aristarchus*, pp. 255 ff.

³ The three outer planets, Mars, Jupiter, Saturn. 'Enshrined' rather over-translates ἱδρύσαστο, but the planets are gods and ἱδρύεσθαι θεόν means 'setting up (a statue of) a god' for cult purposes.

- 38D. he enshrined them and for what reasons—if one should
 E. explain all these, the account, though only by the way, would be a heavier task than that for the sake of which it was given. Perhaps these things may be duly set forth later at our leisure.

The only difficulty here lies in the statement that Venus and Mercury (or their circles) 'possess the power contrary to that of the Sun'.¹ As we have seen (p. 80), the Sun, Venus, and Mercury form a group with 'similar speed' (the same angular velocity), which run their race or finish their course together (*ισόδρομοι*), in the sense that all complete their journey through the signs of the Zodiac in a solar year. In contrast with this group, the Moon moves in the same direction as the Sun, but considerably faster. The three outer planets had that 'apparent counter-revolution' mentioned in the Myth of Er, which we explained by the self-moving power of their individual souls. Its result was that, relatively to the circles of the other four, their circles were credited with an additional contrary movement, slowing down the common motion of the Different. The effect of this contrary power or tendency, as so far considered, was that they passed through all angles of divergence from the Sun, returning into conjunction with him only at intervals longer than a solar year.

What are we now to make of the statement that Venus and Mercury 'possess the power contrary to that of the Sun'? Evidently not that their behaviour conforms in all respects to that of the three outer planets. Venus and Mercury do not pass through all angles of divergence. They keep, as Plato knew, always in the neighbourhood of the Sun. We are told what phenomenon is explained by this contrary tendency in the following words: 'whereby the Sun, Mercury, and Venus alike overtake and are overtaken by one another'. Venus and Mercury, though never far from the Sun, sometimes get ahead of him and appear as morning stars, sometimes drop behind, as evening stars.² The three are like a group of racers who reach the goal together (*ισόδρομοι*), but on the way now one, now another, is in front.

The ancients were not agreed as to the nature of the contrary power which accounts for this phenomenon, partly because some were disposed to introduce the complication of epicycles, of which there is no trace in Plato. But Theon, Proclus, and Chalcidius all mention the view that, whereas the Sun keeps steadily on at

¹ 38D: τὴν δὲ ἐναντίαν εἰληχότας αὐτῷ δύναμιν· ὅθεν καταλαμβάνουσιν τε καὶ καταλαμβάνονται κατὰ ταῦτα ὑπ' ἀλλήλων ἥλιός τε καὶ ὁ τοῦ Ἑρμοῦ καὶ Ἑωσφόρος.

² Cf. Tim. Loc. 96E. Pr. iii, 66^a.

the same pace, the other two move sometimes faster, sometimes slower.¹ Since Plato nowhere says that each planet moves with a uniform velocity, this view is consistent with the text. I see no reason why it should not be accepted.²

Plato has not explained here why the motions of Venus and Mercury have this additional complication, not shared by the Sun. Some ancient interpreters accounted for the variations of speed by the volition of the planets, as living creatures with souls having the power of self-motion.³ This explanation may be supported

¹ Pr. iii, 66²⁶. Theon, p. 222, 'The Sun traverses the signs in a year of about 365½ days. Venus and Mercury with a movement that is not uniform (*ἀνωμαλως*), differing to a small extent in their times, but on the whole running their race with the sun, being always seen in his neighbourhood. Hence they overtake and are overtaken by him.' Chalc., p. 176, 'What he means by these stars having a similar speed, Plato himself explains: they all complete their course in a year, but so that, moving sometimes slower, sometimes faster, they now overtake, now are overtaken by, the Sun; p. 137, *Lucifer* (Venus) *et Stilbon* (Mercury) *imparibus quidem gressibus, isdem tamen paene temporibus quibus sol cursus conficiunt, modo incitato uolatu comprehendentes eum, modo pigro tractu demum ab eodem comprehensi.*

² On the question whether and in what sense the motions of the planets are 'uniform' (*ὁμαλῆς*), the ancient commentators are confused. They do not keep distinct (1) what Plato probably thought; (2) various phenomena which were only discovered later; (3) later theories of planetary movement, involving concentric spheres, epicycles, eccentrics, etc., which are foreign to Plato's scheme. Tr. (p. 202) concludes: 'Timaeus does not tell us why the two planets and the sun in turns gain on one another. No explanation could be offered by a man who assumed all three to be revolving with uniform velocities in the same sense and with the same period in concentric circular orbits.' This seems to me a reason for concluding that Timaeus does not make all these assumptions, which would render the phenomenon not merely inexplicable but impossible.

³ Pr. iii, 64⁸, 117¹, 147², δεῖ τὴν ποικιλίαν αὐτὴν ἐξάπτειν τῆς κινήσεως τῶν ψυχῶν, κατὰ τὴν ἐκείνων βούλησιν θάπτον ἢ βραδύτερον κινουμένων τῶν σωμάτων, ἀλλ' οὐ δι' ἀσθένειαν, ὅπερ οἱ πολλοὶ νομίζοντες, κτλ. Id., in *temp.* ii, 233²: according to the *Timaeus* the planets have the following motions: (1) the motion of the Different, a 'single simple motion' carrying the entire spheres (circles) of all the planets from W. to E.; (2) axial rotation of each planet (for every divine body must have a circular movement); (3) composite movement of the spiral twist; (4) 'Some have also a forward and backward movement according to their own will, without ever departing from the movement about their proper centres.' Chalc., p. 179: He says (38E) that the heavenly bodies were 'bound with living bonds', i.e. that the stars are animate and understand the commands of the god, so that not only the planets . . . should possess soul and life, but also the universe with all these should have soul and participate in reason. At *Epin.* 986B the eight circles are actually called 'eight sister powers' (*δυνάμεις*), in which the heavenly bodies move, either of their own motion or like riders in a chariot. The question where the power resides is left open, as at *Laws* 899A. Cf. also Albinus, *Didasc.* xiv, ὁ γὰρ δὲ πᾶσιν ἡ ἀνωθεν δύναμις περιβέβληται. πάντες δὲ οὗτοι (stars and planets) νοερά ζῶσι καὶ θεοί.

by the statement in the *Epinomis*¹ that the revolutions of Venus and Mercury are 'in speed about equal to the Sun, and on the whole neither swifter nor slower. It must needs be that, of these three, the one which has a mind equal to the task leads the way'. The last words indicate that the individual motions of these celestial gods, as distinct from the two motions (of the Same and the Different) to which they are all alike subject, are due to the volition of their own rational souls. The *Laws* (898b) plainly asserts that, besides the Soul which drives the whole heaven round, every one of the heavenly bodies is moved by an individual divine soul. What function can these individual souls have, if not to originate those elements in the motions of stars and planets which are not attributable to the two motions of the World-Soul? ² *Laws* 898e suggests three possible ways in which the soul of a star might be related to its body. (1) The soul may reside within the whole spherical body, and move it as our souls move our bodies. (2) Or the soul may provide itself with a body of its own, consisting of fire or air, which envelopes the star's body on the outside and moves it mechanically.³ (3) Or the soul may have no body at all and guide the star by 'some surpassingly wonderful powers (*δυνάμεις*) which it possesses'. The 'contrary power' possessed by Venus and Mercury may be one of these wonderful powers, residing in their individual souls. The Sun leads the whole group because of his superior intelligence, as the *Epinomis* says. The other two possess a power which sometimes counteracts his to some small extent, but on the whole they follow his lead, as he keeps steadily on his course with the actual motion of the Different.

On this view 'the power contrary to that of the Sun' (and to the Different) is, as the words would naturally imply, the power already mentioned in the original account of the planetary circles. The three outer planets exhibited that power constantly, with the result that they passed through all angles of divergence. Venus

¹ 986E, δεῖ (Burnet: δέῖ libri) τοῦτων τριῶν ὄντων τὸν νοῦν ἱκανὸν ἔχοντα ἡγεῖσθαι (trans. Harward).

² Pr. iii, 70, recognises the two revolutions of the World-Soul as a whole, and seven souls of the planets. In his Platonist period Aristotle maintained that the heavenly bodies (including the planets) were gods and that their motion was voluntary, Π. φιλοσ. fragg. 23, 24.

³ 898E, ἥ ποθεν ἔξωθεν σῶμα αὐτῇ πορισμένη πρὸς ἢ τινος ἀέρος, ὡς λόγος ἐστὶ τινων, ὥθεϊ βίῃ σώματι σῶμα. I take this to mean that the star's soul might reside, not in the star's body as a whole, but in an envelope of fire or perhaps of air, 'somewhere on the outside' (?) of the star's body. The envelope would then be directly moved by its indwelling soul, and would 'push' the star's body along with it. This seems to be the meaning, even if ποθεν ἔξωθεν be taken with πορισμένη (which seems most natural) or with ὥθεϊ.

and Mercury exhibit it only intermittently, sometimes dropping behind the Sun, but then quickening their pace to overtake and pass him. Hence their two circles were not reckoned among those which have a motion in the opposite sense to the Sun and Moon. The intermittent dropping behind of Venus and Mercury could not be mentioned in that earlier passage, because it was concerned only with circles representing motions, not with the bodies which have now been created to occupy the circles and possess the motions. Only the main, constant, motions could there be described.

But, it has been objected, if the contrary power here is the same as that mentioned in the account of the soul circles, why is it ascribed only to Venus and Mercury, not also to the three outer planets? The answer is that Plato does not deny it to them. In this passage he mentions the planets in their order from the Earth outwards: first the Moon, then the group of three, Sun, Venus, and Mercury. Of these he notes that, though all three have the same (annual) period, two possess the contrary power which explains why they sometimes drop behind, sometimes get ahead. The remaining three (Mars, Jupiter, Saturn) are dismissed in the last sentence, with the remark that it would take too long to describe their individual motions in detail.¹ It is not denied that they too possess the contrary power which has been already assigned to them for another purpose. The implication is rather that they do possess it, since we are told that their motions are too complicated for description here (cf. 40c), i.e. even more complicated than those of Venus and Mercury. It must be emphasised once more that Plato is not writing a treatise on astronomy, but a myth of creation. The scale of the work demands that the astronomical passages shall be extremely compressed, and we must never assume that some feature which is not explicitly mentioned was unknown to Plato.

In any case, these minor voluntary modifications of planetary motion merely account for changes in the positions of the planets relatively to one another and to the signs of the Zodiac. They do not distort the track of the planet's proper motion, which remains circular. They only counteract, or accelerate, the motion common to them all along their several tracks, as some of our seven passengers on the moving staircase counteract or accelerate its motion by walking in one or the other direction (p. 85).

The upshot, so far, is that the motion of all the planets except

¹ In just the same way the *Epinomis* 990b describes the monthly period of the Moon, next, the Sun, who brings the solstices, and 'with him we must group the bodies that keep pace with him' (Venus and Mercury), and then dismisses 'the remaining paths' (*ἄλλους*) as the most difficult to understand.

the Sun is the resultant of at least three components: the motions of the Same and of the Different, which they all share and which are due to the World-Soul as a whole, and individual motions due to the intelligent volition of the planets' own souls, which account for the changes in their relative positions. The Moon alone constantly accelerates the motion of the Different. The remaining five all have the power contrary to the Sun's. Mars, Jupiter, and Saturn exercise it constantly, as we have seen; Venus and Mercury only intermittently.

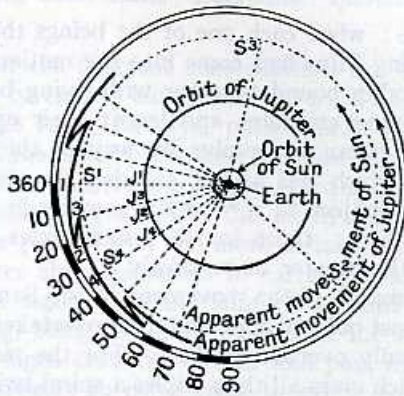
There remains the question whether Plato was aware of the phenomenon of retrogradation, as distinct from a mere lagging behind without change of sense in the planet's motion. Against the background of the signs, all the five planets, Venus, Mercury, Mars, Jupiter, Saturn, appear not merely to slow down their main movement, but actually to stand still in their courses, move backwards a certain distance, and then forward again. Proclus¹ held that Plato did recognise actual retrogradation, and there is good reason to believe that this striking phenomenon had been observed. It was provided for in the system of Eudoxus, which must have been familiar to Plato. I suggest that this backward movement, exhibited by all five planets, is here accounted for by the 'contrary power', explicitly in the case of Venus and Mercury, and implicitly (as I contend) in the case of the other three. Venus and Mercury have the power periodically to reverse the motion they share with the Sun, to come to a stand, and then catch up with him and pass him, though their main annual movement has the same sense and period as his. Mars, Jupiter, and Saturn are always dropping behind the Sun with their constant counter-revolution; and they have also the power to modify this motion in retrogradation, come to a stand, and then make good the lost ground by speeding up on their normal course. All this might well be thought too complicated to be explained here, without a model of the celestial motions. The accompanying diagram² may help the reader to grasp the apparent motions of retrogradation exhibited by Jupiter as seen from a central Earth. The lines marked S¹ and S⁴ are those on which the Sun and Jupiter come

¹ Pr. iii, 68, 'The Sun does not diminish or augment his speed and has no stations, but Mercury and Venus have advances, stations, and retrogressions; hence you may say that, according to the observed facts, they possess contrary powers relatively to the Sun. . . . And since they sometimes move quicker, sometimes slower, and do not all move more quickly, or more slowly, at the same time, naturally the more quickly moving overtake the others, and then are overtaken in their turn.'

² Adapted, with simplifications, from Bouché-Leclercq, *L'astrologie grecque* (1899), p. 120.

THE PLANETS

into conjunction, the Sun moving about twelve times as fast as Jupiter. Between each conjunction and the next Jupiter appears



RETROGRADATION OF JUPITER.

The Sun at S^1 and Jupiter at J^1 are in conjunction. When the Sun has moved about 120° to S^2 Jupiter has moved about 22° to J^2 (the first station). While the Sun is moving from S^2 to S^3 Jupiter appears to go back about 10° to J^3 (second station). He then goes forward again and returns at J^4 to conjunction with the Sun at S^4 .

to stand still, move backwards, stand still again, and then move forwards with accelerated speed. While moving backwards (from J^2 to J^3) Jupiter is exercising his contrary power with more than his normal vigour. Mars and Saturn, having different speeds from his, behave in this way at widely different intervals. All these complications are obviously too intricate for description without models or diagrams.

It may be added that Chalcidius, where he mentions the (correct) view that some of the planetary circles have a movement contrary to others, enumerates the three sets of phenomena which this contrary movement is to account for.¹ They are the three which my explanation covers: (1) the contrast between the steady, forward movement of Sun and Moon and the retrogradations of the other five planets; (2) the contrast between the evening appearance of the Moon (as the fastest) and the morning risings of Mars, Jupiter, Saturn (as the slowest); (3) the peculiar behaviour of Venus and Mercury, appearing sometimes at dawn, sometimes as evening stars. Chalcidius himself does not understand *how* these phenomena are accounted for, being confused by epicycles and eccentrics, which he invokes. But when we find the same sets of

¹ Chalc., pp. 167-8.

phenomena in Theon's explanation, it looks as if both were reproducing a tradition which had come down from someone who did understand what Plato meant.

- 38E. To resume: when each one of the beings that were to join in producing Time had come into the motion suitable to it, and, as bodies bound together with living bonds, they had become living creatures and learnt their appointed task,¹ then they began to revolve by way of the motion of the Different, which was aslant, crossing the movement of the Same and subject to it²: some moving in greater circles, some in lesser; those in the lesser circles moving faster, those in the greater more slowly.

So, by reason of the movement of the Same, those which revolve most quickly appeared to be overtaken by the slower, though really overtaking them. For the movement of the Same, which gives all their circles a spiral twist because they have two distinct³ forward motions in opposite senses, made

- B. the body which departs most slowly from itself—the swiftest of all movements—appear as keeping pace with it most closely.

This paragraph explains two consequences of the theory that the two main factors in the motions of any planet are the motion of the Same (affecting the whole universe) and the proper motion of the planet itself in the opposite sense. This proper motion was represented by one of the seven circles among which the motion of the Different was distributed. Here, once more, the motion of the Different is spoken of as a single motion, common to all the seven circles. We are now concerned only with the effects of these two main factors, leaving out of account such complications as retrogradation and the slowing down of the main motion by the 'apparent counter-revolution'. We have only to think of all the planets revolving at various speeds in the sense of the Different.

(1) Earlier cosmologies, based on the notion of the vortex, had supposed that all the heavenly bodies were carried round by the cosmic eddy in one direction only. The apparent backward move-

¹ Here, as at *Laws* 898, it is clearly stated that every planet, like the other heavenly gods, is a living creature with a body and an intelligent soul. So *Pr.* iii, 70¹; *Chalc.*, p. 179²³.

² Reading *ἰούσαν . . . κρατουμένην*. The accusatives (read by Cicero and Chalcidius) are necessary to the sense. *Pr.*'s comments (iii, 74²⁷, *ἡ θατέρου περιφορά διὰ τῆς ταύτου τε εἶσι καὶ κρατεῖται ὑπ' αὐτοῦ*, 75³ *τῆς δὲ θατέρου φοράς ἰούσης διὰ τῆς ταύτου καὶ κρατουμένης ὑπ' αὐτῆς*) show that the accusatives should be read in his lemma, p. 73²³.

³ 'distinct' (*διχῆς*), as being in two different planes. Cf. 89E, *τρία τριχῆς*.

ment of the planets from W. to E. through the signs of the Zodiac was accordingly explained by their being 'left behind' by the more swiftly travelling fixed stars. Lucretius¹ quotes this view from Democritus:

'The nearer the different constellations are to the earth, the less they can be carried along with the whirl of heaven; for the velocity of its force, he says, passes away and the intensity diminishes in the lower parts, and therefore the Sun is gradually left behind with the rearward signs, because he is much lower than the burning signs. And the moon more than the sun: the lower her path is and the more distant she is from heaven and the nearer she approaches to earth, the less she can keep pace with the signs. For the fainter the whirl is on which she is borne along, being as she is lower than the sun, so much the more all the signs around overtake and pass her. Therefore it is that she appears to come back to every sign more quickly, because the signs go more quickly back to her.'

On this theory of the 'leaving behind' (*ὑπόλειψις*) of the planets, the Moon, overtaken and passed by all the signs in a month, is really moving more slowly than Saturn, who is overtaken and passed by them all only once in about thirty years and so comes much nearer to keeping pace with the outside of the eddy.

Plato's theory reverses the situation. The outermost movement, which alone affects the fixed stars, is still the swiftest of all; for they complete their circuit in twenty-four hours. But the contrary movement of the planets is now attributed to their own proper motion, at various rates of speed, in the reverse direction. The 'swiftest' of them is the one which completes this journey in the shortest time, namely the Moon. The 'slowest' is the outermost, Saturn, 'the body which departs most slowly from the swiftest of all movements'. Thus the smaller the orbit, the quicker the body.

If we consider only these proper motions of the planets (neglecting the movement of the Same which equally affects them all), the Moon 'overtakes' Saturn. Taking only a month to complete her orbit, she will pass Saturn nearly once every month. But, as Plato adds, 'by reason of the movement of the Same, those which revolve most quickly *seem* to be overtaken by the slower, though really overtaking them'. The movement of the Same carries stars and planets together round the Earth once every day. Suppose that at 10 p.m. to-night the Moon and Saturn are in a line with a certain star in the Zodiac. By 10 p.m. to-morrow the fixed star

¹ Lucr. v, 621 ff. (trans. Munro) = Democritus 55A, 88. Cf. Frank, *Plato u. d. sog. Pyth.* 204.

will have come round to the same position. Saturn will have shifted only a very little way eastwards, the Moon a much longer distance. If (as on the vortex theory) we think only of this diurnal movement of the Same and of the planets as trying to keep pace with it, Saturn will have lost much less ground than the Moon and will appear to overtake and pass her. Thus, 'by reason of the movement of the Same those which revolve most quickly appear to be overtaken by the slower, though really overtaking them'. But if we realise that all the planets are trying to make their own way *against* the diurnal movement, Saturn will have gained least ground and be really the slowest; and the Moon will overtake and pass him.

Plato makes the same point again at *Laws* 822A, where he declares that the planets do not really 'wander' about, but each one (in respect of its proper motion) 'always travels in a circle one and the same path'. He adds that 'the quickest of them is wrongly supposed to be the slowest, and vice versa'. The false opinion was due to not recognising that each planet has its own proper motion in the reverse direction, and imagining that the planets were merely 'left behind' by the fixed stars.

(2) The second consequence of the double motion theory is the spiral twist. Martin¹ explains as follows: 'The Sun, for example, which in this system is a planet, describes from the winter to the summer solstice, on the surface of a sphere whose radius is the distance of the Sun from the centre of the Earth, an ascending spiral contained between the two tropics; then it descends again from the summer to the winter solstice describing on the same sphere a spiral inverse to the former one. The two spirals taken together make up as many turns as there are days in the year. The turns of the two spirals become larger as they approach the equator, but they are all traversed in equal times.' If we imagine a model of the celestial Sphere revolving as a whole towards the right, while the planetary rings inside revolve more slowly to the left, the spiral twist will be the track followed by any one of the planets on a sphere with the same radius as that planet's own circle. It will none the less be true that the planet, in respect of its proper motion, keeps always to one circular track, represented by the ring to which it is fixed.

The only connection between the spiral twist and the other question, which planet is really the swiftest, lies in the point that both involve the recognition of a proper motion opposite in sense to the movement of the Same. Plato is writing with extreme compression, in order to keep this astronomical section within due bounds.

¹ Martin ii, 76. Theon, pp. 324, 329, gives a clear account.

- 39B. And in order that there might be a conspicuous measure for the relative speed and slowness with which ¹ they moved in their eight revolutions, the god kindled a light in the second orbit from the Earth—what we now call the Sun—in order that he might fill the whole heaven with his shining and that all living things for whom it was meet might possess number, learning it from the revolution of the Same and uniform.
- c. Thus and for these reasons day and night came into being, the period of the single and most intelligent revolution.²

The purpose of the Demiurge is that mankind shall learn to count and develope mathematics by the exercise of reckoning periods of time, days, months, and years. The unit for this reckoning is the shortest division of time produced by the celestial revolutions, the period of day-and-night (*νυχθήμερον*)³ marked by the daily revolution of the whole heavens in the movement of the Same. Mankind would not observe this revolution, if the Sun were no brighter than the other planets. The brilliance of the Sun 'shining through the whole heaven', followed by the darkness of night and a new sunrise, brings it home to man that this daily revolution does occur. The Sun thus provides a 'conspicuous' unit of measurement, in terms of which the other periods can be calculated, with 'their relative speed and slowness'.⁴

- 39C. The month comes to be when the Moon completes her own circle and overtakes the Sun; the year, when the Sun has

¹ καθ' ἃ, A.-H., Fraccaroli. The subject of πορεύονται is easily supplied from the previous sentence or from πρὸς ἀλλήλα. Plut. 1007A, alluding to our passage, has the phrase μέτρον ἐναργὲς τῆς πρὸς ἀλλήλας βραδυτῆτι καὶ τάχει τῶν ὀκτὼ σφαιρῶν διαφορᾶς. This might support the conjecture τί<νι> πρὸς ἀλλήλα βραδυτῆτι καὶ τάχει [καὶ] τὰ περὶ τὰς ὀκτὼ φορές πορεύονται 'a conspicuous unit to measure with what relative slowness and speed the bodies involved in the eight revolutions travel'.

² The single (undivided) revolution of the Same, which is the only motion of translation possessed by the fixed stars.

³ So in the *Epinomis* 978D the Heaven, causing the stars to revolve 'for many nights and days', teaches man to count 'one and two' and so to advance to other numbers. Cf. 47A and p. 91, note 1 above.

⁴ It is man, not the planets and stars, who is to benefit by this 'conspicuous measure'. This point involves rejecting the MSS. reading καὶ τὰ at 39B, 3. Tr. (retaining καὶ τὰ) translates: 'That there might be a plain measure of their relative slowness and speed, and the eight revolutions go on their way, God kindled a light. . . . The planets, he explains (quoting Cook Wilson) need a light to see their way—a humorous touch'. The humour, if it can be detected, is irrelevant. Also the *eight* revolutions include the fixed stars. Can these need the Sun's help to see their way? Tr.'s suggestion that all planets (like the moon) reflect the sun's light is supported by no evidence. Plato's point is that the Sun is the only planet bright enough to make the difference of day and night conspicuous to mankind.

- 39c. gone round his own circle. The periods of the rest have not been observed by men, save for a few; and men have no names for them, nor do they measure one against another by numerical reckoning. They barely know that the wanderings of these others are time at all, bewildering as they are in number and of surprisingly intricate pattern. None the less it is possible to grasp that the perfect number of time fulfils the perfect year at the moment when the relative speeds of all the eight revolutions have accomplished their courses together and reached their consummation, as measured by the circle of the Same and uniformly moving.
- D. In this way, then, and for these ends were brought into being all those stars that have turnings¹ on their journey through the Heaven; in order that this world may be as
- E. like as possible to the perfect and intelligible Living Creature, in respect of imitating its ever-enduring nature.

Men have no names like 'month', 'year', for the periods of planets other than the Moon and Sun. These two are the most conspicuous and they both proceed uniformly on their course. The five remaining planets exhibit apparent irregularities, some of which have been mentioned. The complete analysis of their composite motion involves factors additional to the two great motions of the World-Soul. The result is a 'bewildering' (*ἀμυγχάνω*, not 'incalculable') number of motions of surprisingly intricate pattern. Plato must have been acquainted with the system of Eudoxus, which required for each of these five planets not less than four spheres revolving on different axes, in order to reduce their apparent irregularity to a compound of circular motions. Three spheres each were enough for the Sun and Moon. The total of twenty-seven spheres would certainly make a pattern whose intricacy would bewilder a layman. Plato does not commit himself to Eudoxus' system, which may have been recognised at the time as only giving an approximate picture, and was soon to be still further complicated by Callippus and Aristotle. If the 'contrary power' of the five planets has been rightly explained above as causing variations in speed without change of track, Plato's own system is different, and an armillary sphere representing the planetary movements, if it were not required to work mechanically, would be of much simpler construction.

Though the readers of the *Timaeus* would be bewildered by these complications, 'none the less it is possible to grasp' the notion of

¹ *τροπαί*. The Sun, for instance, 'turns back' at the top of its spiral when it touches the *tropic* of Cancer at midsummer.

a Great Year, completed when all the heavenly bodies come back to the same relative positions. This notion was an ancient one, going back to the earliest attempts to arrive at a period of years which would coincide with a number of complete months. Plato extends it to include the periods of the remaining planets. He gives no estimate of its length.¹ There is, as Taylor remarks, no suggestion that the end of the period is marked by any cosmic cataclysm. Such a catastrophe is, in fact, out of the question. The hands of a perfect clock would regain at every moment the position at which they were twelve hours before. Since the celestial clock was never set going at any moment of time, there was never any original position to serve as starting-point. The period, whatever it may be, is beginning and ending at every moment of time. This perpetual recurrence, as the concluding sentence remarks, is the nearest approach that the visible world can make to the eternal duration of the unchanging model. If the language of our passage suggests a period beginning at some one date and ending at another, that is only because the myth speaks as if Time and its instruments had been created at some moment which would mark the beginning of such a period.

39E-40B. *The four kinds of living creature. The heavenly gods*

So far, the planets are the only living creatures, within the universal frame, whose creation has been described. Among the everlasting gods who were to take up their positions in that frame, the planets were singled out because they are, in a special way, the 'instruments of Time'; and Plato wished first to define Time in order to contrast the temporal existence of even the everlasting gods with the unchanging duration of the eternal model. Time cannot exist without the clock. Plato, accordingly, had to anticipate the creation of the heavenly gods by mentioning the planets. He now repeats the statement (37c, 38d) that the Demiurge designed to make his image as like as possible to the model. This is to be done by making all the four chief families of living creature, corresponding to the four regions of fire, air, water, and earth.

39E. Now so far, up to the birth of Time, the world had been made in other respects in the likeness of its pattern; but it was still unlike in that it did not yet contain all living creatures brought into being within it. So he set about accomplishing this remainder of his work, making the copy after the nature of the model. He thought that this world must possess all the different forms that intelligence discerns contained in the Living Creature that truly is. And there

¹ See Tr., pp. 217 ff. Heath, *Aristarchus* 172.

39E. are four : one, the heavenly race of gods ; second, winged
40 things whose path is in the air ; third, all that dwells in the
water ; and fourth, all that goes on foot on the dry land.

The Demiurge himself, however, makes only the living creatures of the first class, the gods within the heaven.¹ These are the fixed stars, the planets, and Earth. Since the planets and some of their motions have already been mentioned, the following sentences refer specially to the fixed stars. But the planets are brought in at the end of the paragraph.

40. The form of the divine kind he made for the most part of fire, that it might be most bright and fair to see ; and after the likeness of the universe he gave them well-rounded² shape, and set them in the intelligence of the supreme to keep company with it, distributing them all round the heaven, to be in very truth an adornment (*cosmos*) for it, embroidered over the whole. And he assigned to each two motions : one uniform in the same place, as each always thinks the same thoughts about the same things ; the other a forward motion, as each is subjected to the revolution of the Same and uniform. But in respect of the other five motions he made each motionless and still, in order that each might be as perfect as possible.

B. For this reason came into being all the unwandering stars, living beings divine and everlasting, which abide for ever revolving uniformly upon themselves ; while those stars that having turnings and in that sense³ 'wander' came to be in the manner already described.

The stars have spherical bodies, mostly composed of fire, but containing some portions of the other primary bodies. Without earth, as Proclus says, they would not be 'solid' masses resistant to touch ; and the other two primary bodies are the 'means' which hold fire and earth together (31B). Their composition is similarly described in the *Epinomis* (981D) in a passage which refers to all the heavenly bodies. There is no reason to doubt that the statement here applies to the planets, as Proclus held.

'The intelligence of the supreme', in which the stars are set, is a short expression for the revolution of the Same, that rational

¹ At *Rep.* 508 the heavenly bodies are called 'the gods in the heaven' (τῶν ἐν οὐρανῷ θεῶν).

² εὐκύκλον for 'spherical' is reminiscent of Parmenides 8, 43, εὐκύκλου σφαίρης, quoted by Plato at *Soph.* 244E.

³ τοιαύτην. But only in that sense. They are not really 'wanderers', but keep to their regular paths, though they 'turn' back at the limits of their spiral tracks.

motion of the World-Soul which was described (36c) as having the supremacy over the interior motion and in fact affects the whole universe.¹ The circle symbolising the plane of that motion is the equatorial circle of the sphere, over the whole of whose surface the stars are scattered. All the fixed stars move together in the daily revolution, as if they were set in a solid sphere. But there is no material sphere; the stars move freely, though they keep their relative positions. The rotation of the heaven thus becomes for each individual star an imparted motion of translation: the star moves 'forward' along its circular track parallel to the equator. Every star has also, we are now told, a second motion, rotation on its own axis. The reason is that 'each always thinks the same thoughts about the same things'. Here, for the first time in the *Timaeus*, it is explained why axial rotation is regarded as 'that one of the seven motions which above all belongs to reason and intelligence' (34A).

Every star has its own intelligent soul, 'and accordingly its own proper motion; for the soul is the source of motion' (Pr. iii, 119). The same is true of the planets, as Proclus remarks. They also must have axial rotation; and, in fact, the Moon is the only heavenly body whose rotation could actually be observed. She must rotate on her axis in order to keep the same face always towards the Earth. This is a consequence of the free movement of stars and planets. If they were set rigidly in material spheres or rings which carried them round, they would, of course, all have the same face always turned towards the Earth, but it would be possible to deny (as Aristotle does) that they have an independent motion of rotation. Since Plato's circles symbolise movements only and are not material rings, he recognises this rotation as an independent proper movement, due to the individual soul of star or planet.

The last sentence is intended to convey that the statements about the composition and proper movements of the heavenly gods cover the planets, which are, just as much as the 'unwandering stars', divine and everlasting living beings, and must have the movement proper to their intelligent souls.² Earlier the planets were treated merely as the instruments of Time, and the periodic motions relevant to this function were alone described. Their axial rotation was not there relevant; we are to understand that it is added here, as the movement of intelligence, which they possess equally with the fixed stars.

¹ Cf. 47B, 7, 'the circuits of intelligence (νοῦ νοῦ) in the heaven'.

² So also Albinus, *Didasc.* xiv, 'All these (stars and planets) are intelligent living beings and gods and spherical in shape.' The *Laws* and *Epinomis* leave no doubt on this point.