

Metaphysics Λ 8

How many movers are there?



The book Harmonia Macrocosmica seu Atlas salis et Novus, Gerardum Valk & Petrum Schenck, 1708

Issues Pertaining to Λ 8

- Some Traditional Scholarly Concerns
- The Astronomical Theory of the Chapter

Traditional Scholarly Concerns

- Is Λ 8 a later insertion?
 - Jaeger (1928, 219-227) and Ross: yes; Judson (2019, 238 ff): no
 - Developmental Considerations
 - Stylistic Differences
 - A report (*Met.* Λ 8, 1073b32-38) of work by the astronomer Callippus, dated to 330
 - Alleged inconsistency between *Met.* Λ 6 and 7 (and perhaps 9), which are 'monotheistic', and *Met.* Λ 8, which is 'polytheistic'
 - Unseemly interruption in the flow of discussion, from a treatment of god's status as a living, rational being in *Met.* Λ 6 and 7 to a deep dive into the character of god's thinking in *Met.* Λ 9, which might otherwise be seen as a reasonable, orderly progression
- The question of 'boundary crossing' between astronomy and metaphysics, or, put more neutrally, the question of the relation between the empirically founded astronomy of the chapter and the metaphysical principles, including teleological principles, in terms of which this broadly empirical is adumbrated. —Has modern philosophical cosmology conceded too much ground to the astronomers?
- A question we have already met concerning the relation between efficient and teleological causation in the origination of celestial motion

Questions Broached Λ 8

- The Number of Movers
 1. How many movers are there? What motivates this inquiry?
 2. Astronomical Theory of Homocentric Spheres
 3. A Problem of Overpopulation: the 'Idle' Spheres
 4. How many movers? Four Answers
 5. One cosmos, or more than one?
 6. How is the theory of homocentric spheres related to traditional religion?

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How Many Movers are There? What Motivates this Inquiry?

- ‘We must carry on our discussion on the basis of things that have been laid down and determined’ (*Met.* Λ 8, 1073a22-23; ἡμῖν δ’ ἐκ τῶν ὑποκειμένων καὶ διωρισμένων λεκτέον)
 1. The everlasting and single movement (of the fixed stars) is brought about by a single existing thing which is immovable both in itself and accidentally.
 2. We see, apart from the simple locomotion of the universe, which is moved by the first immovable substance, other motions, which are the circular motions of the planets.
 3. Since the stars are everlasting substances with everlasting motions (for the body in circular motion is everlasting and never still) they too must be moved by everlasting substances, since an everlasting effect has an everlasting cause and a substance is prior to a substance.
 4. A single motion is brought about by a single cause.
 5. Therefore, there are [at least] as many everlasting immovable movers as are required to account for the stellar motions.

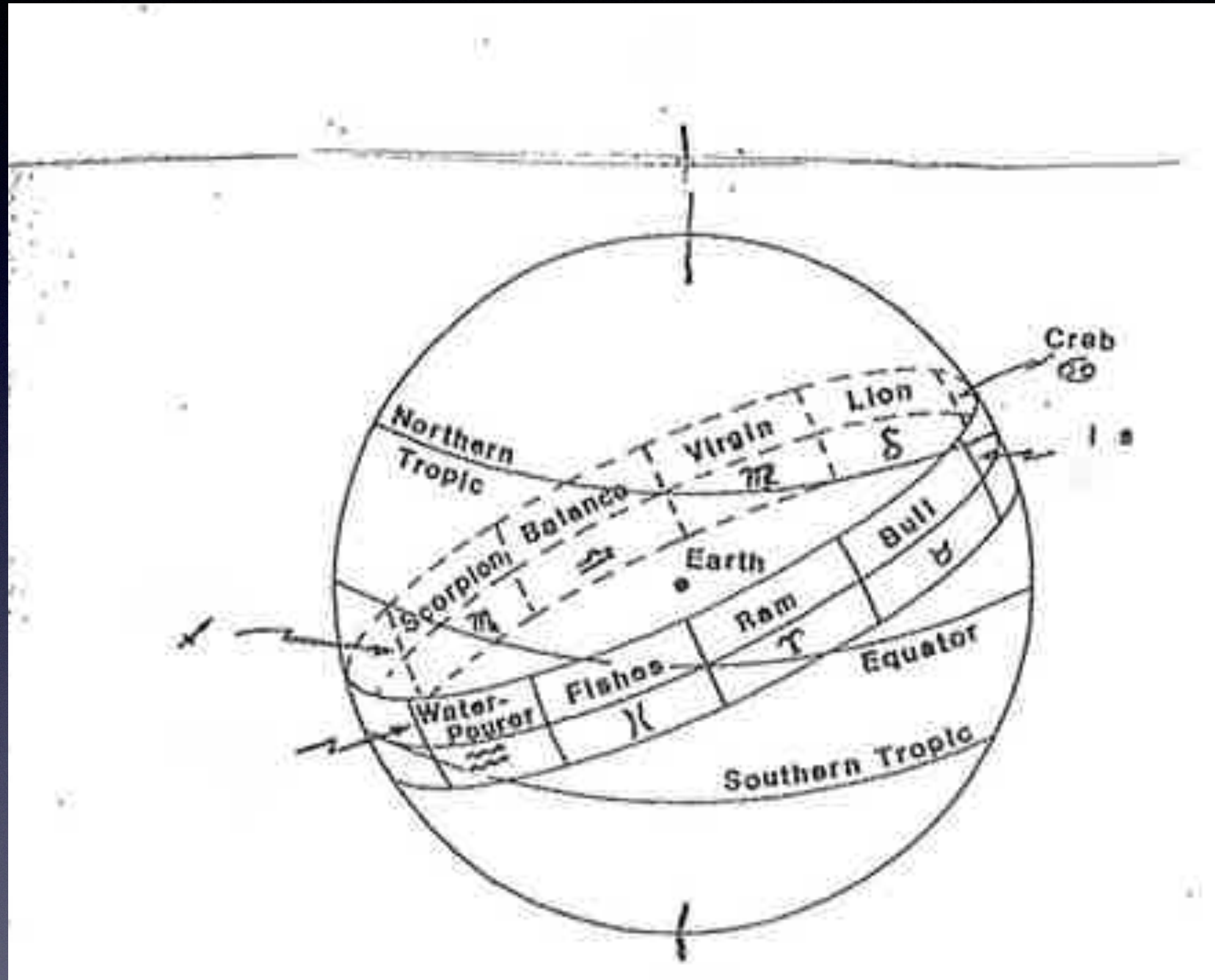
The Theory of Homocentric Spheres

- But the investigation of the number of such everlasting substances is the task of astronomy.
- ‘That the motions are more plentiful than the objects in motion is evident to those with an even moderate grasp, for each of the planets has more than one motion. But as to how many they are in fact, we now report what some of the mathematicians say’ (*Met.* Λ 8, 1073b8-12).
- ὅτι μὲν οὖν πλείους τῶν φερομένων αἱ φοραί, φανερόν τοῖς καὶ μετρίως ἡμμένοις (πλείους γὰρ ἕκαστον φέρεται μιᾶς τῶν πλανωμένων ἀστρῶν)· πόσαι δ’ αὐταὶ τυγχάνουσιν οὕσαι, νῦν μὲν ἡμεῖς ἃ λέγουσι τῶν μαθηματικῶν τινὲς ἐννοίας χάριν λέγομεν
- Three versions of the theory of homocentric spheres:
 1. Eudoxus of Cnidus (c. 408 - c. 355 BCE)
 2. Callippus of Cyzicus (c. 370 - c. 310 BCE)
 3. Aristotle

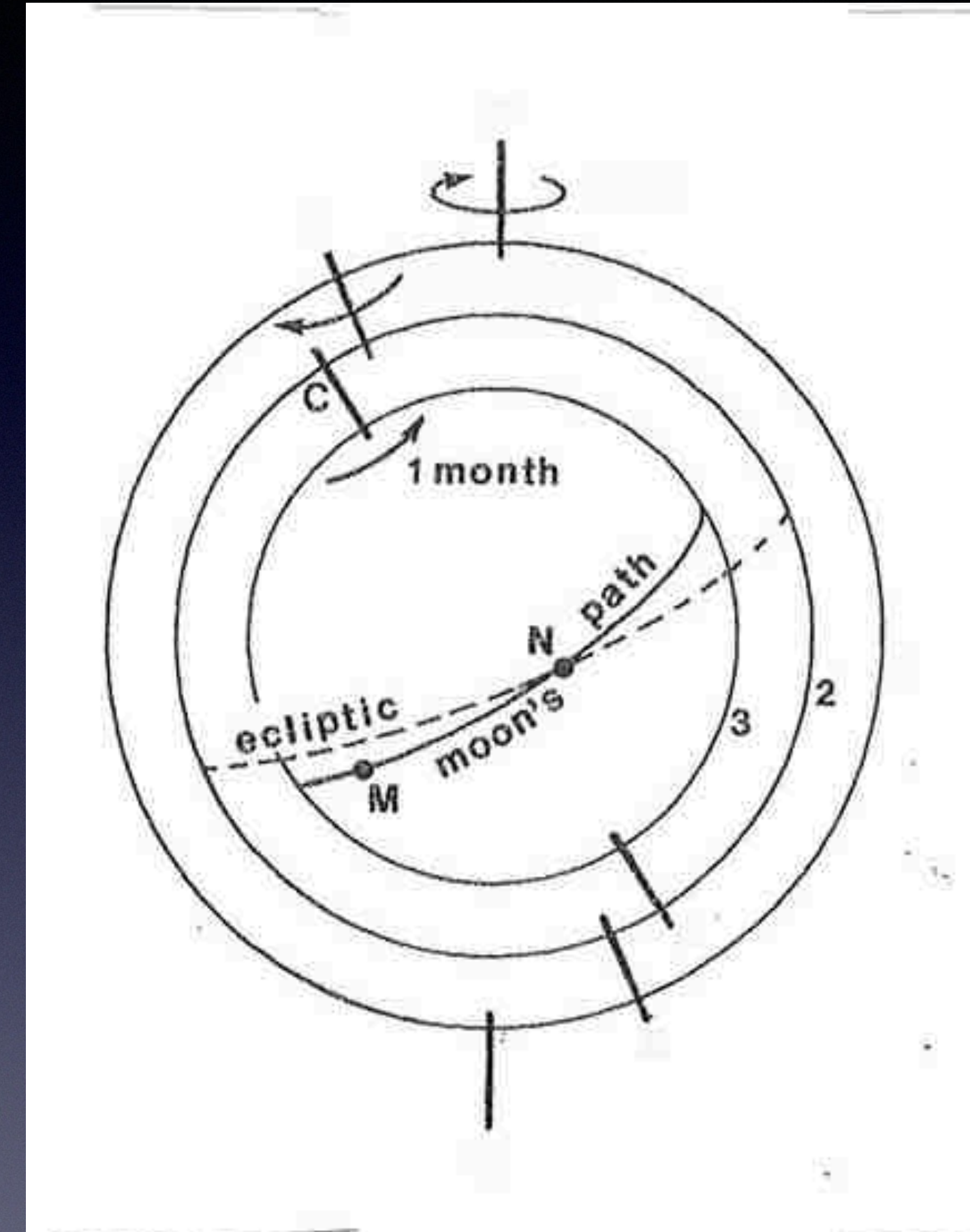
Theses Concerning Homocentric Spheres (I)

- (1) All stellar motions are due to the motions of a series of geocentric (hollow) spheres, each of which has a simple rotational motion at a certain speed along a certain fixed axis.
- (2) Each sphere conveys its motion to the next sphere within it which adds a motion of its own.
- (3) The fixed stars have a simple rotational motion because they are embedded in the outermost sphere which has a simple rotational motion.
- (4) Each of the seven planets (wandering stars) is associated with a series of spheres, each of which has a simple rotational motion and which thus jointly contribute directly to the planet's complex motion.

Figures



Sphere of the Fixed Stars



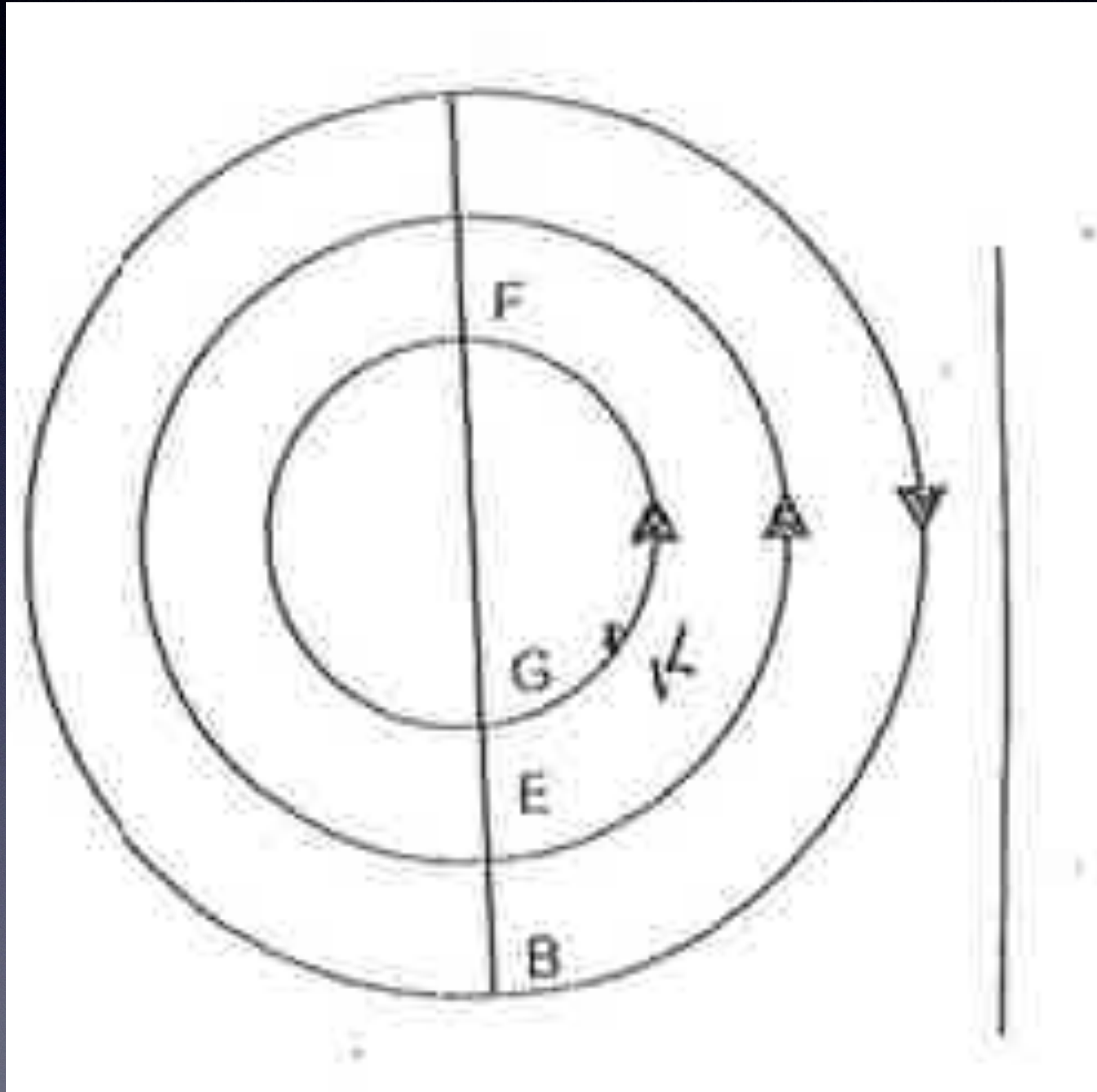
Lunar Spheres

Theses Concerning Homocentric Spheres (II)

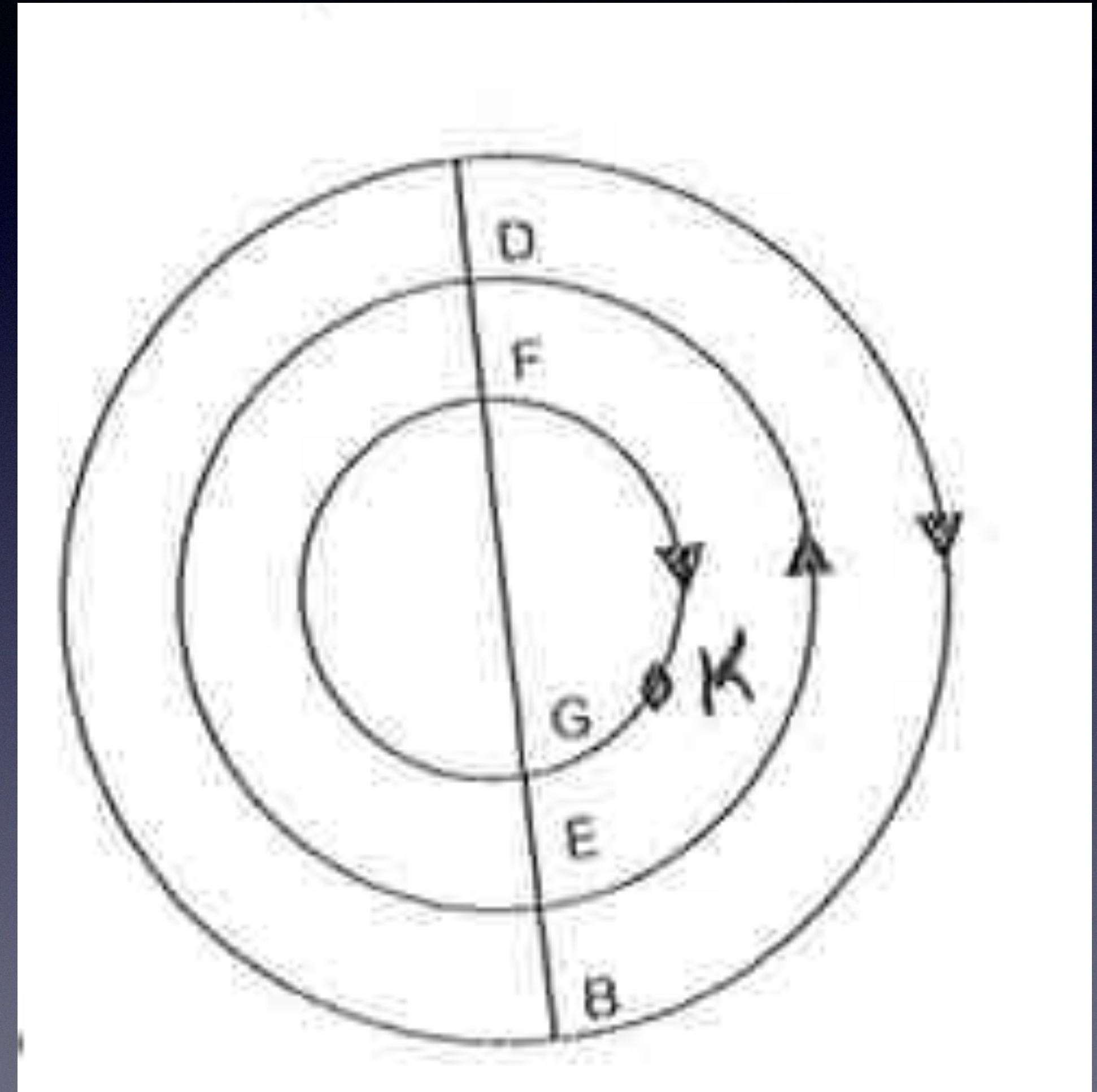
(5) Since the planets move independently of each other, there is also associated with each planet (except the innermost) another series of spheres which counteract the planet's contributory spherical motions.

- Sosigenes (ap. Simplicius *in Cael.* 498, 4-10): 'It is necessary for the counteracting spheres which to be attached to the hypotheses for two reasons: so that there will be the proper position for both the sphere of the fixed stars for each planet and for the spheres under it; and so that the proper speed will be present in all of the spheres. For it was necessary both that a sphere move in the same way as the sphere of the fixed stars or as some other sphere around the same axis as it and that it rotate in an equal time, but neither <property> could possibly belong to it without the addition of the spheres mentioned by Aristotle.'
- ὅτι δυοῖν ἔνεκα ταύτας, ἅς ἀνελιπτούσας καλεῖ, φησὶν ἀναγκαῖον εἶναι προσγενέσθαι ταῖς ὑποθέσεσιν, ἵνα τε θέσις ἢ οἰκεία εἴη τῇ τε καθ' ἕκαστον ἀπλανεῖ καὶ ταῖς ὑπ' αὐτῇ, καὶ ὅπως τάχος τὸ οἰκεῖον ἐν πάσαις ὑπάρχοι· ἔδει γὰρ τὴν γε ὁμοίαν τῇ τῶν ἀπλανῶν ἢ ἄλλη τινὶ σφαίρᾳ περὶ τε τὸν αὐτὸν ἄξονα ἐκείνη φέρεσθαι καὶ χρόνῳ ἴσῳ αὐτὴν περιστρέφεσθαι, ὧν οὐδὲν ἄνευ τῆς προσθέσεως τῶν ὑπὸ Ἀριστοτέλους λεγομένων σφαιρῶν ὑπάρξαι δυνατόν.
- As Sosigenes further explains, an inner sphere counteracts an outer sphere by moving at the same speed about the same axis but in the opposite direction (cf. 504, 7-15).

Figures



Without Counteracting Spheres



With Counteracting Spheres

Theses Concerning Homocentric Spheres (III)

- (6) The everlasting motion of each sphere is caused by a mover which is immovable *per se* and *per accidens*. Corollary: this mover must be a separate substance rather than a soul.
- (7) There are at least as many separate substances as there are spherical motions.
- (8) The immovable movers constitute a finite 'divine multitude', each of which is related to its sphere in the same way, but the movers of the inner spheres depend on the prime mover of the outer sphere.

Theses of the Theory of Homocentric Spheres (IV)

- Two types of final cause: 'That the final cause is found among the things that are immovable is made clear by this distinction, since the final cause is for someone (beneficiary) and of something (benefit), of which the latter is [immovable] but the former is not. And it brings about movement in so far as it is loved . . .; (*Met.* Λ 6, 1072b1-4).
- ὅτι δ' ἔστι τὸ οὐ ἔνεκα ἐν τοῖς ἀκινήτοις, ἢ διαίρεσις δηλοῖ· ἔστι γὰρ τινὶ τὸ οὐ ἔνεκα <καὶ>τινός, ὧν τὸ μὲν ἔστι τὸ δ' οὐκ ἔστι. κινεῖ δὴ ὡς ἐρώμενον. . .

(9) There are no more separate substances than there are spherical motions. For each separate substance is a end (τέλος), *i.e.* a final cause, so there must be something of which each of them is the [sole] final cause (as benefit), namely a particular spherical motion (*Met.* Λ 8, 1074a18-24).

(10) Every spherical motion must contribute in some way to the motion of a star, because each motion exists for the sake of a star which is its final cause (as beneficiary).

(11) Conclusion: there are precisely as many separate substances as are required to explain the motions of the stars.

A Problem of Overpopulation: Are There 'Idle' Spheres?

- Sosigenes (cf. Simplicius *in Cael.* 503,19-27): The purpose of the counteracting spheres is to ensure that the first (outermost) sphere of each planet has the same motion as the sphere of the fixed stars. But in Aristotle's scheme it turns out that the first (outermost) and last (innermost) spheres for each planet both have the same motion as the sphere of the fixed stars. For example, the motion of the seventh sphere (Saturn's innermost sphere) is the same as that of the eighth (Jupiter's outermost sphere) so that the latter is redundant. This recurs for all six planets beneath Saturn. If Aristotle realised this himself, he would have seen that only forty-nine are required.

How Many Movers? Four Answers

	Eudoxus	Callippus	Aristotle	Sosigenes
Saturn	4	4	4+3	4+3-1
Jupiter	4	4	4+3	4+3-1
Mars	4	4+1	4+1+4	4+1+4-1
Sun	3	3+2	3+2+4	4+2+4-1
Venus	4	4+1	4+1+4	4+1+4-1
Mercury	4	4+1	4+1+4	4+1+4-1
Moon	3	3+2	3+2	3+2
Total	26	33	55	49