XXIV.—The Greek Heliocentric Theory and Its Abandonment

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Copernicus' suppression of Aristarchus' name from his works must not be regarded as an attempt to conceal the source of his heliocentric inspirations. His observations on planetary motions are far too keen to have been much influenced by bare statements about Aristarchus' theory. This paper then examines possible reasons for the Greek abandonment of the heliocentric theory and concludes that there is no reason to deplore its abandonment. In developing the heliocentric theory the Greeks had run the gamut of theorizing. We are indebted to the Alexandrians and Hipparchus for turning away from speculation to take up the recording of precise astronomical data. Here was laid the foundation upon which modern astronomy was built.

It is by now common knowledge that an ancient Greek, and not Copernicus, was the first to maintain a heliocentric system. The English-speaking world has become aware of this fact largely because of the publicity given to the reported beliefs and speculations of that Greek, Aristarchus of Samos, by the late Sir Thomas Heath. Ever since Heath's great work on Aristarchus and his predecessors[1] appeared in print, classicists, motivated perhaps by a desire to uphold the merits of the ancients, have been suggesting that Copernicus is not entitled to credit for originating a heliocentric theory which he knew had been developed by the Greeks. Such an attitude is overdrawn. The Greek heliocentric theory, it is true, was the culmination of a number of gradual steps and is a notable example of the brilliant achievements of Greek astronomers. On the other hand we do not know how Copernicus was first led to embrace heliocentric notions, for his statements on the subject are vague. Numerous passages in his *De Revolutionibus* and his *Commentariolus* indicate how his thoughts might have been developed. He clearly realized that there were many inconsistencies involved in a geocentric orientation, and he was disturbed by them early in his career. It is hard to believe that a man whose grasp of planetary motions was as penetrating as Copernicus' could have been greatly influenced by the bare statements in classical authors that Aristarchus included the earth among the planets and gave it an annual orbit about the sun and a daily rotation on its own axis.

[1] *Aristarchus of Samos, the Ancient Copernicus* (Oxford, 1913).

These statements had been available to astronomers before Copernicus, and had been neglected. Copernicus, however, propounded an elaborate heliocentric theory based upon many precise demonstrations.

Copernicus' debt to classical astronomy was a considerable one, but it is probable that his own judgment about who should be the recipient of the credit is the correct one. His constant use of Ptolemy's *Syntaxis Mathematica* as the basis for his discussions, his comparison of Ptolemy's figures with his own, and his corrections of Ptolemaic inaccuracies clearly show that the *Syntaxis* was the foundation upon which the *De Revolutionibus* was built. That the *Syntaxis* was based upon a geocentric orientation does not lessen its importance. But the scanty statements by classical authors about the Greek heliocentric theory were almost certainly of little importance to Copernicus.

Although it would be absurd for anyone to regard the *De Revolutionibus* as merely a revival of a classical system, Copernicus seems to have been keenly disappointed over the fact that an ancient Greek had maintained a complete heliocentric theory long before him and seems to have deliberately withheld Aristarchus' name from any connection with it. The publication, within a century of Copernicus' death, of two works in whose titles Aristarchus' name appears, one defending, the other refuting Copernicus' theory, reveals that in the seventeenth century it was known that Aristarchus had held heliocentric views.[2] In 1873 new evidence was introduced into the Aristarchus-Copernicus controversy, for in the scholarly Thorn edition of the *De Revolutionibus*, commemorating the fourth centenary of Copernicus' birth, there appeared as a footnote the following statement which Copernicus had deleted from the final draft of his work: Credibile est hisce similibusque causis Philolaum mobilitatem terrae sensisse, quod etiam nonnulli Aristarchum Samium ferunt in eadem fuisse sententia.[3] This is the only acknowledgment by Copernicus that he was aware of Aristarchus' theory. He mentions Aristarchus thrice in the *De Revolutionibus*,[4] but in other connections.

Angus Armitage recently wrote an admirable study of the *De*

[2] Heath, *op. cit.* (see note 1), iv–v.

[3] Nicolai Copernici Thorunensis *De revolutionibus orbium caelestium libri VI* (Thoruni, 1873) 34.

[4] 3.2.65B, 6.69B, 13.79A.

Revolutionibus, in which he devotes a section to precursors of Copernicus' heliocentric views.[5] Armitage draws attention to the passage in the dedicatory preface of the *De Revolutionibus* in which Copernicus tells of his search through the works of the classical philosophers to determine whether there was among them any precedent for the novel ideas regarding the heavens which were agitating his mind. In this search Copernicus came upon a passage in Cicero (*Acad.* 2.39.123) reporting Nicetus' [Hicetas'] theory of the earth's rotation. Next he found in [pseudo-] Plutarch (*De Plac. Phil.* 3.13.2–3) the statement, which he sees fit to quote, that Philolaus attributed motion to the earth about the central Fire and that Heraclides and Ecphantus assumed a daily rotation but not motion in orbit for the earth. But, as Armitage points out, he makes no mention of the clear statement of Aristarchus' heliocentric theory (*De Plac. Phil.* 2.24.8), which in the edition that Copernicus was using could have been only a few pages ahead of the passage he quotes.

Still more recently Rudolf von Erhardt and Erika von Erhardt-Siebold argue the almost certain acquaintance of Copernicus with Archimedes' *Arenarius*, the work which is our most reliable witness that Aristarchus did evolve a heliocentric theory and which gives us the clearest details of that theory. They point out the similarity between the fourth axiom of Copernicus' *Commentariolus* and the second equation in the Aristarchus passage of the *Arenarius*.[6] The evidence pointing to Copernicus' chagrin over Aristarchus' discovery is quite conclusive. On the other hand, we are not justified in regarding Copernicus' act of vanity as a subterfuge to conceal the true source of his heliocentric inspirations.

Let us now glance for a moment at a few of the salient developments of ancient Greek planetary theories. There is a tradition, reported by Sosigenes,[7] that Plato set his students to the task of accounting for the apparent motions of the planets and that Eudoxus was the first to address himself to the problem. Heraclides Ponticus, as we know, was also a pupil of Plato. This tradition, although of doubtful authenticity, is one which we should be happy to credit, for Eudoxus and Heraclides were the founders of the two prominent schools of planetary theory.

Eudoxus produced an extremely complex system of concentric

[5] *Copernicus, the Founder of Modern Astronomy* (London, 1938) 87–90.

[6] *Isis* 33 (1942) 599–600.

[7] Simplicius *In Aristotelis De Caelo Commentaria*, 2.12.219A (ed. Heiberg, 488).

spheres which has attracted the admiration of astronomers and mathematicians ever since Schiaparelli, the celebrated Italian astronomer of the last century, was able to resolve all of its fine points. The motions of each planet, including the sun and moon, were accounted for by a set of concentric spheres which rotated uniformly about the earth, one inside another, on different axes, and all centered in the center of the earth. The outer sphere of each group made a daily rotation from east to west, accounting for the planet's rising and setting. The sphere next below rotated more slowly from west to east on an axis inclined to that of the outer sphere, producing the planet's motion along the ecliptic. Other spheres were required for retrograde motions and deviations in latitude. Altogether there were twenty-seven spheres in Eudoxus' system.

Remarkably clever as this scheme was, it took only a simple observation of the naked eye to refute it. Venus regularly exhibits marked differences in degree of brilliance which can be explained only by assuming that her distance from the earth varies and that her orbit does not center in the earth. And this was the very reason that the ancients, according to Sosigenes,[8] turned away from the concentric theories of Eudoxus and his followers.

Plato's other pupil, Heraclides Ponticus, is credited with two advanced ideas. He maintained that the vast heavens did not revolve daily about the earth, but that a daily rotation of the earth upon its axis was responsible for the phenomenon. Next he pointed out that the revolutions of Venus and Mercury were not about the earth but about the sun, and thus he accounted for their variations in brilliance. These theories were bound to play an influential part in future developments.

Now if Venus perceptibly varies in brilliance, the same is true for Mars. Its orbit too could not be centered in the earth. Accordingly a Tychonic system was propounded which represented the planets as revolving about the sun and the sun in turn as revolving about the earth. We do not know who was responsible for this theory. Schiaparelli attributed it to Heraclides or a contemporary,[9] Tannery to Apollonius of Perga,[10] and Heath to someone

[8] Simpl. *In Arist.* 2.12.225B–226A (ed. Heiberg, 504–505).

[9] "Origine del Sistema Planetario Eliocentrico presso i Greci," *Memorie del Reale Istituto Lombardo di Scienze e Lettere, Milano, Classe di Scienze Matematiche e Naturali* 18 (1898) 63 ff.

[10] *Recherches sur l'Histoire de l'Astronomie Ancienne* (Paris, 1893) 245, 253–259.

between Heraclides and Apollonius, one nearer to the time of Apollonius, very possibly Apollonius himself.[11]

In view of the advanced state of these speculations, it is not surprising that someone went a step farther and maintained a complete heliocentric theory, including the diurnal rotation of the earth on its axis and the monthly revolution of the moon, as a satellite, about the earth. That Aristarchus of Samos took that step there can be no doubt, Archimedes, who lived shortly after him, being a most reliable authority.[12] The advantages of the heliocentric theory were: (1) it satisfactorily explained the periodic variations in brilliance of Venus and Mars; (2) it removed the question which for a long time had divided astronomers into two camps, as to whether Venus and Mercury were above or below the sun; (3) instead of conceiving of the vast heavens as sweeping about the earth daily, the same appearance could be produced by the earth's rotation; (4) it seemed more reasonable to suppose that the smaller body revolved about the larger, and the earth was accepted as being much the smaller. Aristarchus calculated the sun's diameter to be approximately 6¾ times as great (volume about 300 times as great) as the earth's, a figure which later Greeks improved upon.

Why, then, after apparently groping to evolve a heliocentric theory which had so much to recommend it, did the Greeks quickly abandon it? That the theory did not receive wide or lasting acceptance is indicated by the fact that we hear of only one man in classical antiquity, Seleucus, who is known to have embraced Aristarchus' views.[13]

Armitage offers for consideration four factors that may have militated against heliocentric speculation: "(1) The reluctance of naïve common sense to believe in a motion of the Earth not directly perceptible; (2) the influence of religious conservatism, anxious to claim a unique and privileged status for man's abode, and successively manifested in Greek, Muslim and Christian circles; (3) the growing authority of Aristotle, whose philosophical arguments were solidly in support of the geocentric theory; and (4) the relative excellence of the planetary tables constructed by Ptolemy and his successors from the standpoint of that theory."[14]

[11] *Op. cit.* (see note 1) 274–275.
[12] *Arenarius* 1.4–6.
[13] Plut. *Plat. Quaest.* 8.1.1006C.
[14] *Op. cit.* (see note 5) 67–68.

The true reasons for the abandonment of the heliocentric theory we can only surmise. The reasons just given might have discouraged philosophers in the Middle Ages from embracing heliocentric views but they could hardly have had much bearing upon the original decision to renounce Aristarchus' theory which was probably made by contemporaries or by men who lived shortly after Aristarchus, a decision which was to continue unchallenged until the time of Copernicus. The first reason would carry much weight with the common man, but it is doubtful whether it would have deterred Greek philosophers and astronomers who from childhood up must have repeatedly reflected upon the likelihood of the old Pythagorean tenets which put the earth in motion. That Greek religious conservatism was a possible factor is acknowledged, for we have Plutarch as authority[15] that Cleanthes prosecuted Aristarchus on religious grounds and he is known to have published his arguments in a book.[16] More than this we do not know. If Aristarchus managed to withstand the charges, others would not have feared to hold his beliefs. The influence of Aristotle upon Alexandrian science was admittedly great, as J. L. Heiberg has clearly pointed out in his *Naturwissenschaften Mathematik und Medizin im klassischen Altertum;* but it is doubtful whether he could have wielded much influence in this matter, for in astronomy Aristotle was markedly backward, adhering to outmoded Eudoxian concepts of concentric spheres. In Aristotle's elaboration of this system the concentric spheres reach the absurd number of fifty-five. The fourth reason given no doubt had much to do with the popularity of the Ptolemaic system and the pre-eminent reputation enjoyed by Ptolemy in the Middle Ages, but it too applies to a period much later than the date when a decision regarding the heliocentric theory was reached. Ptolemy himself does not speculate about alternative theories. With him not only is there no question about the earth not revolving about the sun; it does not even rotate on its axis.

In seeking an explanation for the ancient abandonment of the heliocentric theory we should first of all put out of our minds conceptions and orientations which modern astronomical science has proven beyond a doubt and approach the problem in the frame of mind of the ancient Greek. We should not take the

[15] *De Facie in Orbe Lunae* 6.922F–923A.
[16] Diog. Laert. 7.5.174.

attitude that the Greeks were gradually *progressing* [sic] towards the heliocentric theory because this is the correct one, and become provoked at them because they reverted to the incorrect orientation. From the modern point of view it may be hard to account for their abandonment of a theory which was the culmination of a series of progressive steps and which apparently had so much in its favor. But from an ancient point of view not only is it not hard to understand why they took the backward step but there is reason to wonder whether much consideration ever was given to the forward step.

We must admit at the start that we cannot be sure that the Greeks "abandoned" the theory at all, since we have no evidence to indicate that Aristarchus' views ever received wide approval. The few extant notices regarding his theory and the fact that we know of only one man who embraced it would seem to indicate that it probably did not arouse much interest. Perhaps his was just another brilliant revelation much too far in advance of its time to be very influential.

Moreover we must bear in mind that to the Greeks astronomy was much closer to the realm of pure mathematics than it was to our conception of it as an applied science. There is an interesting passage by Geminus (ca. 50 B.C.), author of the popular handbook *Elementa Astronomiae*, in which he distinguishes between the interests of the physicist and the astronomer. The former is concerned with the true nature of the universe. The latter is interested only in hypotheses and demonstrations which will coincide with observed phenomena, and he does not care whether his hypotheses are physically true or not.[17] This attitude could be traced throughout classical Greek astronomy. It finds expression in Socrates' advice that a true knowledge of astronomy is obtained by approaching its study as one approaches the study of geometry, and by disregarding the starry sky.[18] The visible heavens are merely *παραδείγματα* of the real heavens, which are absolute numbers. Any astronomer whose preoccupations with geometrical demonstrations detracted from his interest in physical realities would find it much more con-

[17] Frag. 1 (ed. Manitius, 283–285): *ὅλως γὰρ οὐκ ἔστιν ἀστρολόγου τὸ γνῶναι, τί ἠρεμαῖόν ἐστι τῇ φύσει καὶ ποῖα τὰ κινητά, ἀλλὰ ὑποθέσεις εἰσηγούμενος τῶν μὲν μενόντων, τῶν δὲ κινουμένων σκοπεῖ, τίσιν ὑποθέσεσιν ἀκολουθήσει τὰ κατὰ τὸν οὐρανὸν φαινόμενα.*

[18] Plato *Rep.* 7.530B–C. For another statement on the distinction among astronomers between physical realities and mathematical demonstrations, see note 25 below.

venient to base his demonstrations of epicycles and eccentrics upon a geocentric earth. To the mathematician the orientation is of no consequence. In fact Aristarchus himself used a geocentric orientation in his calculations to determine the dimensions and distances of the sun and moon.

Let us now suppose that Aristarchus' theory was widely circulated and that it was given careful consideration by leading astronomers. There is one objection that immediately arises when the earth is put in motion, the very difficulty which must have disquieted Copernicus and which caused Tycho Brahe shortly afterwards to renounce Copernicus' heliocentric system and to put the earth again at rest. (Tycho reverted to a system first suggested by some ancient Greek, who made the planets revolve about the sun and the sun about the earth.) The difficulty is this. As soon as the earth is set in motion in an annual revolution about the sun, the distance between any two of the earth's positions that are six months apart will be twice as great as the earth's distance from the sun. Over such vast distances some displacement in the positions of the stars ought to be observed. The more accurate the astronomical instruments and the greater the estimated distance of the sun, the more reason should there be to expect stellar displacement. Now it so happened that Aristarchus reached his conclusions at the very time when interest was keen at Alexandria and elsewhere in the Greek world in accurate observations and when marked improvements were being made in precision instruments. To appreciate these developments we need only recall the careful stellar catalogues of Aristyllus and Timocharis early in the third century B.C., the work of the latter enabling Hipparchus to discover the precession of the equinoxes, and the armillary sphere of Eratosthenes by which he was able to determine the obliquity of the ecliptic and the circumference of the earth. Hipparchus continued to make improvements in the next century. He, as we shall see, had a much better appreciation of the sun's great distance than Copernicus. Of course it was impossible to observe stellar displacement without the aid of a telescope. Inability to observe it left astronomers with only two alternatives: either the stars were so remote that it was impossible to detect displacement, or the earth would have to remain at rest.

The most impressive feature about Aristarchus' theory is that he seems to have realized that his heliocentric orientation necessitated a new conception of the vastness of interstellar space and that he seems to have made allowances, as we learn from Archimedes.[19] After reporting Aristarchus' theory that the sun and stars are unmoved and that the earth revolves about the sun, Archimedes goes on to say that according to Aristarchus the orbit of the earth is so small in comparison with the vast dimensions of the sphere of the fixed stars that it bears to it the proportion of the center of a sphere to its surface. Now the center of a Euclidean sphere is a mathematical point which has no magnitude, and Aristarchus is thus setting up a proportion which is mathematically impossible. Archimedes hereupon points out the impossibility; but it is clear that Aristarchus did not intend to have his proportion understood mathematically but was merely indicating that by comparison with the earth's distance from the sun the distance of the sphere of the fixed stars was virtually infinite. Thus we see that Aristarchus was verging upon a light-year conception of stellar space. It is interesting to note in passing that notwithstanding the rapid improvements that were made in telescopes, it was not until 1838 that Bessel first detected annual stellar parallax and was able to offer this as proof of the earth's revolution about the sun. With our present knowledge we can appreciate the difficulty of measuring parallax. If we represent the earth's orbit about the sun as the circumference of a period on a printed page, the nearest star on this scale would be a microscopic dot two hundred feet away. The difficulty is one of measuring the change in the star's direction as seen first from one side of the period and then from the other. Perhaps it is fortunate that the telescope had not been invented in Copernicus' life time. He might have decided not to publish his work in the face of such apparently conclusive evidence to the contrary.

Even if we assume that Aristarchus' theory did receive wide notice, it seems to have been destined to be short-lived. It appeared at a time when theories were going out of fashion and accurate observation and practical application were coming in. Those who are familiar with any phase of the Alexandrian Move-

[19] *Arenarius* 1.5: *ὑποτίθεται γὰρ τὰ μὲν ἀπλανέα τῶν ἄστρων καὶ τὸν ἅλιον μένειν ἀκίνητον, τὰν δὲ γᾶν περιφέρεσθαι περὶ τὸν ἅλιον κατὰ κύκλου περιφέρειαν, ὅς ἐστιν ἐν μέσῳ τῷ δρόμῳ κείμενος, τὰν δὲ τῶν ἀπλανέων ἄστρων σφαῖραν περὶ τὸ αὐτὸ κέντρον τῷ ἁλίῳ κειμέναν τῷ μεγέθει ταλικαύταν εἶμεν, ὥστε τὸν κύκλον, καθ' ὃν τὰν γᾶν ὑποτίθεται περιφέρεσθαι, τοιαύταν ἔχειν ἀναλογίαν ποτὶ τὰν τῶν ἀπλανέων ἀποστασίαν, οἵαν ἔχει τὸ κέντρον τᾶς σφαίρας ποτὶ τὰν ἐπιφάνειαν.*

ment will readily appreciate the spirit of this age. The imaginative and creative genius of Greek literature was supplanted by catalogues, canons, and punctuation marks. The patronage of the Ptolemies and the erudition of the Library and Museum had a stifling effect upon letters. But science flourished under these conditions, just as it does today in endowed research institutes. In the field of medicine, for instance, the heated debates of rival schools of medical theory seemed inconsequential in comparison with the wonderful revelations made by the scalpels of Herophilus and Erasistratus on the dissecting tables at Alexandria.

As medical science was undergoing radical changes, so was the field of astronomy. Delicate instruments were turned upon the heavens in a land where careful observation of the stars and planets had been an ancient art. From the recent campaigns of Alexander the Great there were brought to Alexandria records of Chaldean observations of earlier centuries which afforded the basis of comparison requisite to Greek astronomers who were just beginning systematic observations. Planetary theories were giving way to stellar charts and tables. Moreover, interest was shifting to astronomical geography as a result of Alexander's conquests. During the reign of Ptolemy Philadelphus the canal joining the Gulf of Suez and the Nile was repaired and reopened and shortly afterwards stations were established as far as Cape Guardafui in Somaliland.[20] Detailed reports of Eastern India by Megasthenes, who had been serving as Seleucus Nicator's ambassador to the court of Chandragupta on the Ganges, must have reached Alexandria by this time. It was at this time, too, that the account of the voyage of Pytheas of Massilia around England and Scotland and along the coast of the North Sea was making a profound impression upon Eratosthenes. The latter, third Librarian of Alexandria and one of its leading astronomers, may be cited as typical of the new spirit. He used astronomical means for measuring the earth's circumference and for laying out latitudes. In short, the emphasis of the Alexandrian Age was upon the determinable and upon precise observation and data — two factors which would have a dampening effect upon planetary theories and upon the heliocentric theory in particular. It is not surprising that Archimedes' statement is the only contemporary notice of Aristarchus' theory that has come down to us.

[20] H. F. Tozer, *A History of Ancient Geography* (Cambridge University Press, 1935) 146–147.

Heath was of the opinion that Hipparchus was responsible for the death of Aristarchus' theory, that the adherence of so pre-eminent an astronomer to a geocentric orientation sealed the doom of the heliocentric theory.[21] This is a reasonable conjecture. Hipparchus was noted for his careful observations, his stellar catalogues, and the remarkable precision of his recordings of solar and lunar motions. According to Ptolemy he was devoted to truth above all else and because he did not possess sufficient data, he refused to attempt to account for planetary motions as he had for those of the sun and moon.[22] His discovery of the precession of the equinoxes attests to the keenness of his observations. He came much closer to appreciating the vast distance of the sun than Copernicus did. Ptolemy informs us that he was unable to ascertain its distance with his instruments and was therefore not sure whether its parallax ought not to be considered zero.[23] According to the statement of another authority, Theon of Smyrna,[24] it follows that Hipparchus' estimate of the sun's distance was approximately 2,500 earth-radii. Copernicus' figure for the mean distance was 1,142 earth-radii and Ptolemy's 1,210. In reality it is about 23,000.

We do not know whether or not Hipparchus ever seriously entertained Aristarchus' views about the earth's motions,[25] but from what we have seen of his cautious and accurate methods, it

[21] *Op. cit.* (see note 1) 308.

[22] *Synt. Math.* 9.2.

[23] *Ibid.* 5.11.

[24] See his *Expositio rerum mathematicarum ad legendum Platonem utilium* (ed. Hiller), where Theon states (197) that Hipparchus estimated that the sun was 1880 times as great as the earth and the earth 27 times as great as the moon. These figures refer to volume and not diameter. The cube root of 1880 is approximately $12\frac{1}{3}$, and of 27, 3.

$$\text{Earth:moon:sun} = 1:\tfrac{1}{3}:12\tfrac{1}{3}, \text{ or, } 3:1:37$$

Hipparchus estimated the moon's distance as $67\frac{1}{3}$ earth-radii. Since the sun and the moon have the same apparent angular diameter, the sun's distance would then be $67\frac{1}{3} \times 37$, or $2491\frac{1}{3}$ earth-radii. See Hultsch, "Hipparchos über die Grösse und Entfernung der Sonne," *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig, Philologisch-historische Classe* 52 (1900) 190–191.

[25] According to Theon (188) Hipparchus adopted an epicyclic system for planetary motions, admitting that he was not versed in natural science and that accordingly he did not know which were the real and which were the apparent motions of the planets: *ὅπερ καὶ συνιδὼν ὁ Ἵππαρχος ἐπαινεῖ τὴν κατ' ἐπίκυκλον ὑπόθεσιν ὡς οὖσαν ἑαυτοῦ, πιθανώτερον εἶναι λέγων πρὸς τὸ τοῦ κόσμου μέσον πάντα τὰ οὐράνια ἰσορρόπως κεῖσθαι καὶ ὁμοίως συναρηρότα· οὐδὲ αὐτὸς μέντοι, διὰ τὸ μὴ ἐφωδιάσθαι ἀπὸ φυσιολογίας, σύνοιδεν ἀκριβῶς, τίς ἡ κατὰ φύσιν καὶ κατὰ ταῦτα ἀληθὴς φορὰ τῶν πλανωμένων καὶ τίς ἡ κατὰ συμβεβηκὸς καὶ φαινομένη.*

is likely that he would have quickly rejected the heliocentric theory in the absence of visible stellar displacement.

It is perhaps regrettable that Heath, with his surpassing qualifications and capacities for investigating problems in Greek astronomy, was so attracted to Aristarchus as to regard all earlier developments in the perspective of their culmination in him and all later developments as an anticlimax, of depreciated significance because they begin from a geocentric orientation. Where was Greek astronomy to proceed once it had arrived at a heliocentric theory? It had run the gamut of theorizing. It is indeed fortunate for modern science that the Alexandrians did carry on, recording observations and preparing voluminous tables, stellar catalogues and intricate geometrical drawings. The discovery of stellar proper motion in 1718 by Halley was made possible through comparison with Ptolemy's catalogue.[26] Without Hipparchus' and Ptolemy's groundwork, the world would have had to wait a long time, perhaps a century or longer, for a contribution such as Copernicus made.

This lack of respect for the achievements of the Alexandrians is not confined to astronomy. Because genius seems to have died there and because tedious observations and recordings seem to have taken its place, we have been wont to approach the accomplishments of the Alexandrians with a feeling of disappointment. Much of their work is dull and unimaginative — no more inspiring than the grocer who stocks his show window with cans of tomatoes and then carefully notes the effect it has upon the sale of his tomatoes — but this is the true spirit of science. The voluminous works of the Alexandrians with their elaborate tables and intricate geometrical diagrams were an awe-inspiring monument to the humble philosophers of the Middle Ages and later became the basis upon which the brilliant achievements of the Renaissance were built.

Consider on the other hand what the corpus of classical astronomy would have been like if astronomical science had ceased its development with Aristarchus. There would have been brief references in the doxographers to the various theories held by philosophers and mathematicians and there would have been the erudite commentaries, largely occupied with Plato's works — a rather flimsy body of literature upon which to build a science of astronomy.

[26] Comparison showed that in the course of sixteen centuries Sirius, Betelgeuse, Aldebaran, and Arcturus had moved as far as the moon's apparent diameter from positions assigned by Ptolemy.