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The Story of Astronomy

AN ancient astronomer said that the science of the heavens began with admiration, and from this foundation moved toward observation. Early man, gazing upon the night sky spangled with stars, came finally to notice the orderly motions of these sidereal bodies. Once this motion was observed, curiosity was stimulated, and generation after generation of scientists, philosophers, and even poets contributed their findings and opinions to the body of astronomical lore. But the observationalist is subject to certain limitations, and it is not possible to solve all mysteries by elementary principles of analogy. As man's knowledge of Nature increased, he refined and improved the astronomical science together with other branches of learning. Ancient astronomy divided naturally into three principal sects: the first was the Assyrian, which included the Babylonian and the Chaldean; the second was the Egyptian; and the third was called the Atlantic, meaning specifically *the expansion of Grecian speculation.*

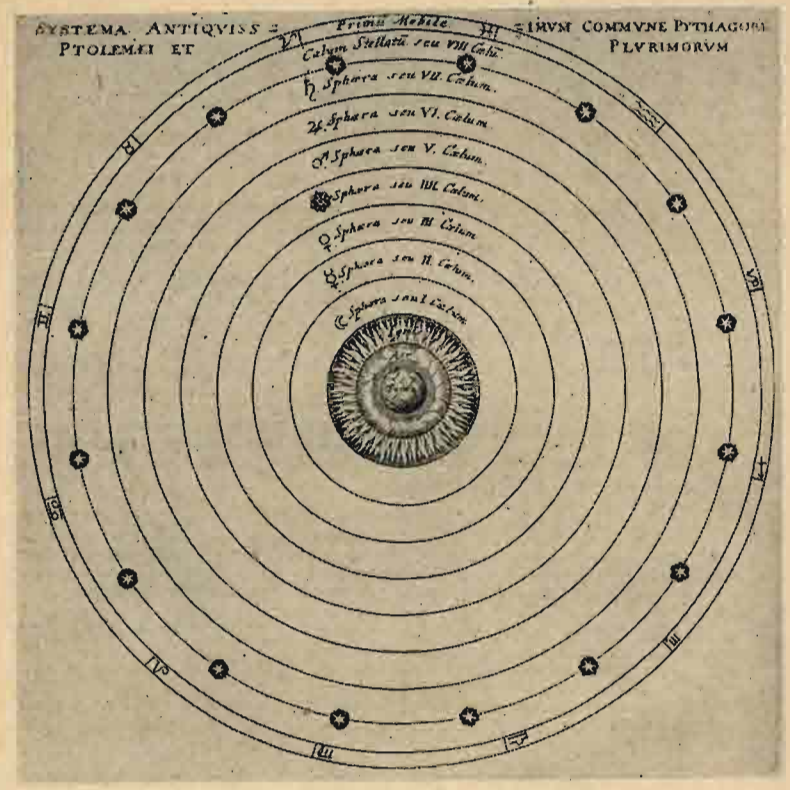
The observations of ancient thinkers preserved in mythology, fable, and legend passed through a period of formal organization and revision in the six centuries preceding the Christian Era. Western astronomy, therefore, may be said to descend from the Pythagorean sect, which influenced both Greece and Italy. Pythagoras had traveled extensively in those regions where astronomy had long been cultivated. He even contacted the Brahman scientists of India, and it is believed that he was indebted to them for some of his choicest reflections. The gradual separation of astronomy from the sacred sciences of the old religious systems followed much the same pattern as that observable in medicine. The civil importance of astronomical research was emphasized in the perfecting of a chronological system and the establishment of a working calendar.

Many of the choicest works on early astronomy were composed in heroic verse. Among these should be mentioned the *Phainonena* of

Aratus of Soli and *The Astronomica* of Marcus Manilius. Aratus flourished in the 3rd century B. C., and Manilius, about whom no historical information is available, lived during the reigns of Augustus and Tiberius. His poem passed through many editions, and while incomplete and probably not intended for publication, revealed profound scholarship in astronomy. An English edition under the title *The Sphere of Marcus Manilius,* translated by Edward Sherburne, was printed in London in 1675. There is an elaborate introduction, including a series of diagrams, showing the progress of astronomical theory from the time of Pythagoras to the late speculations of Tycho Brahe. These figures are sufficiently important to justify their inclusion in the present article. It will be noted that it was customary to represent the solar system as enclosed within a band of fixed stars and constellations. As these systems, especially their reorganization by Ptolemy of Alexandria, dominated man's concept of cosmic structure, they came to be included in the dogma of theology. For this reason they are a valuable key to the interpretation of the astronomical allegories found in the Scriptures.

The Pythagorean scheme arose from a combination of observations and mathematical calculations. He regarded the solar system as a monochord, with the planets serving as frets on a single string. The intervals between planets were calculated in tones and half tones. It is possible that Pythagoras learned of this concept from the Hindus or the Chinese. Both of these Eastern peoples based their musical theories upon the structure of the universe. There has been considerable doubt as to the actual findings of Pythagoras, as these have descended only from later writers. It is believed that the great Samian was aware of the heliocentric system. In a fragment attributed to him, he described the planets as moving about a central, flaming altar. If Pythagoras were of this mind, the facts have not descended to the present age. Ptolemy, who had access to material now lost, concluded that Pythagoras placed the earth in the center of his system and surrounded it with bands of water, air, and fire. Thales had concluded that the earth was sustained in a humid field, by which its fertility was preserved and in which it floated, like a ship on the ocean. The earth and its atmosphere were enclosed by the concentric circles of the planetary orbits ascending in the following order: the moon, Mercury, Venus, the sun, Mars, Jupiter, and Saturn. Beyond these orbits was the circle of fixed stars enclosed within the zodiac, which was called *the first motion.*

It would seem that the dominating consideration was to represent the solar system in terms of the philosophic concept of the human soul and the world soul. The Chaldeans accepted the Pythagorean system

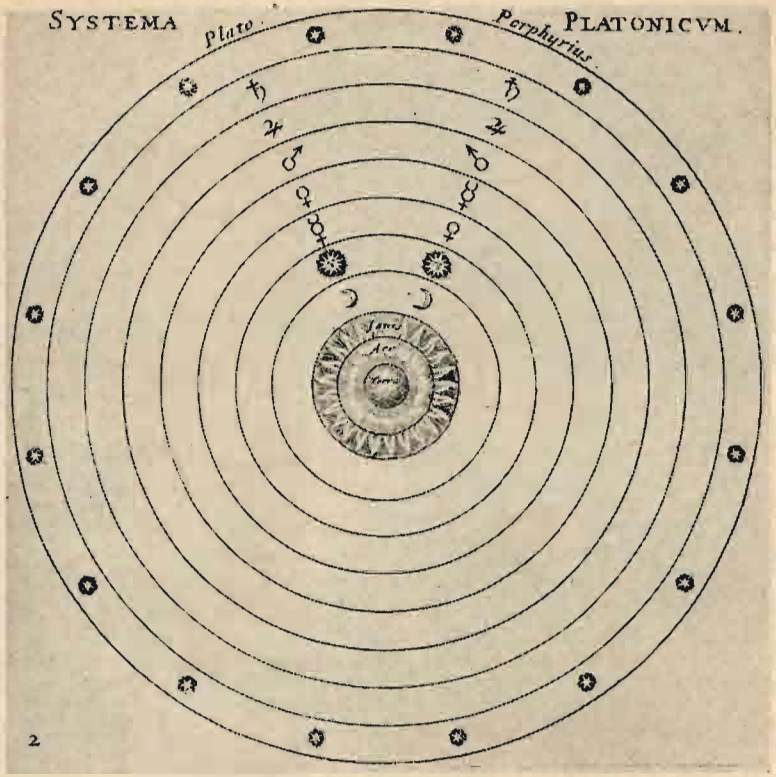


—From *The Sphere of Manilius*

THE ASTRONOMICAL SYSTEM ACCORDING TO PYTHAGORAS AND PTOLEMY

as the basis for their astrological researches, and it is only fair to note that in these early times there was no line of demarcation between astronomy and astrology. The universe was studied principally to determine its relation to man and the place of the human being in the larger scheme. The assignment of certain divinities as rulers over the planets may have been Orphic or symbolical in the beginning, inasmuch as the deities presided over the musical tones and intervals. In time, however, the attributes of the gods were bestowed upon the planets, and the results demonstrated by observation and calculation.

Man, standing upon the earth's surface, examined the universe from his own place and naturally concluded that the heavens were moving about him. Even had he speculated otherwise, he would have held that, for the practical purposes of astrology, he was the center upon



—From *The Sphere of Manilius*

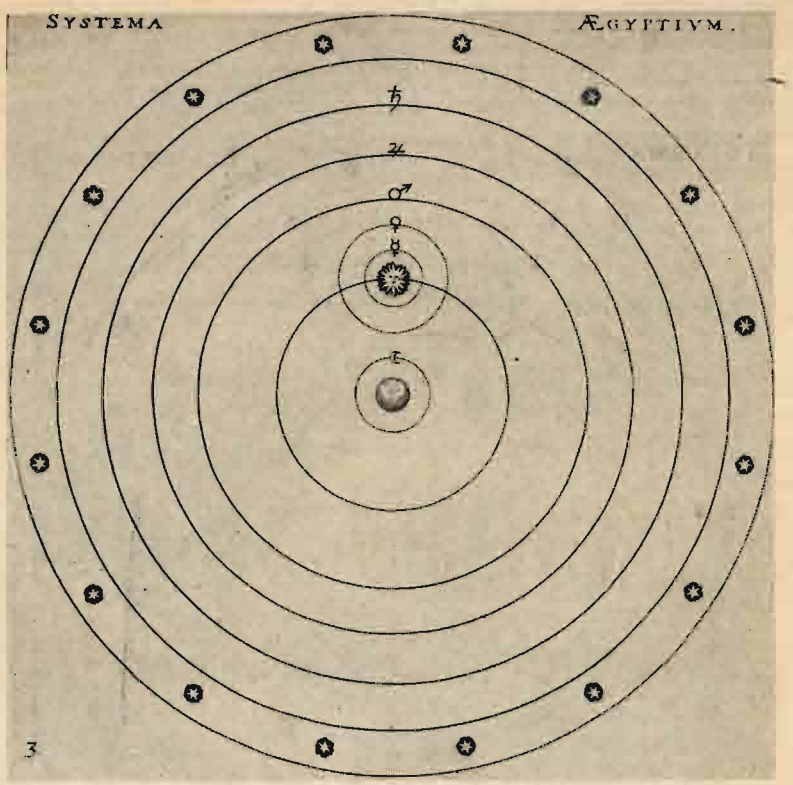
THE SOLAR SYSTEM AS CONCEIVED BY PLATO AND PORPHYRY

which the sidereal energies converged. Pythagoras had already conceived it to be possible that other fixed stars were also the centers of solar systems or had a retinue of such systems. The practical Greeks saw no particular utility in extending their researches beyond the boundaries of their own solar system. The enclosing wall of the zodiac formed a sort of shell for the solar egg. This shell held within it, as within a sphere of glass, a unit of creation. Beyond this shell was space, too rarified to sustain mortal life, and therefore the appropriate abode of divine beings. It was already assumed even in those early days that the body of the solar system was the visible form of a blessed God, within whom we live and move. Thus the research assumed the proportions of sidereal anatomy and physiology. Astronomy was the science dedicated to the study of the corporeal appearances of divine beings substantially invisible.

Plato followed very closely the findings of Pythagoras. He recommended, however, a certain change in the order of the planets. His reform arose from certain refinements in musical theory. Thus music continues to be the basis of astronomical concepts. Plato retained the central position of the earth and its zones of water, air, and fire, but he brought the sun to the orbit directly above the moon. The Neoplatonist Porphyry attempted a further refinement by reversing the orbits of Mercury and Venus. The rest of the system he left unchanged. It is obvious that these alterations were due to a further effort to fit astronomy into a broad philosophic pattern.

In the course of their speculations the Egyptians made the first important modifications of the older systems. Whereas previously the solar system was represented through a series of concentric orbits, the stargazers of the Nile introduced an eccentric factor. They still placed the earth in the center of their scheme, but discontinued the symbolism of its elemental sheaths. The zones of water, air, and fire disappeared, and the moon occupied the first orbit outside the earth. The sun was again represented as moving about the earth, but the planets Mercury and Venus revolved around the sun. Terms were devised to describe this phenomenon. When in their motions Mercury or Venus were in the superior parts of their orbits, they were said to be above the sun; when in the inferior parts of their orbits—that is, between the sun and the earth—they were said to be in the inferior parts of their orbits. This concept was followed by Vitruvius when he involved astronomical symbolism in his architectural designs.

The next and most vital change was effected by the Polish astronomer, Copernicus. A preliminary account of the Copernican theory was printed in 1540. The master's complete exposition *De revolutionibus orbium coelestium* was issued in 1543. The first copy reached Copernicus on his deathbed. Substantially, the Copernican system corresponded with that in vogue today. The sun was placed in the center of the solar system, and the earth in the third orbit with the moon revolving around it. For some time this arrangement was held to be highly speculative, but gradually gained favor. It is believed that Copernicus was stimulated in his thinking by a question advanced by Seneca in the 1st century A. D. In his *Natural Questions,* Seneca proposed the following as "necessary to be discussed." In his quaint wording he inquired "to know whether the earth standing still, the heavens be moved about it; or the heavens standing still, the earth be carried around." Later he philosophized as to "whether God turns all things about us, or we ourselves are turned about." It is probable that Seneca was referring to a tradition already held by at least a few ad-



—From *The Sphere of Manilius*

THE UNIVERSAL SYSTEM ACCORDING TO THE EGYPTIANS

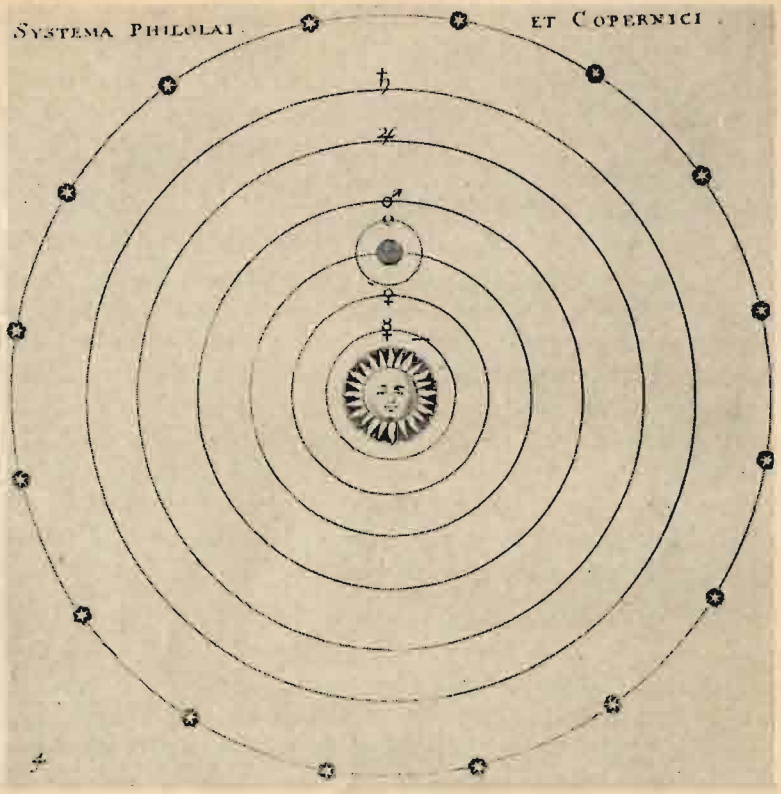
vanced thinkers. The uncertain reference by Pythagoras might have started a long controversy.

The celebrated Danish astronomer, Tycho Brahe (1546-1601), was among the later astronomers to be deeply involved in astrology. Although he was aware of the findings of Copernicus, he was also deeply immersed in the older systems. Brahe, therefore, attempted to accomplish a compromise. In his system the earth remained immovable, and the moon circled about it. The sun and all the other planets revolved about the earth. Thus, with the exception of the earth and moon, the system was heliocentric. It is interesting to note that several philosophical writers held to the geocentric theory in one form or another until the middle of the 17th century, when the advances made by Galileo settled the main issue.

The gradual separation of astronomy from religion and philosophy resulted in both gains and losses. The gains were in the direction of scientific accuracy, and the losses were in terms of ideas, or overtones. As the machinery of the solar system became more intriguing, there was a tendency to overlook what may be termed *moral astronomy*. The ancients regarded astronomy proper as the physiology of the universe, and astrology as the psychology of the celestial structure. To them the solar system revealed the will of the gods and the method by which the divine administration of Nature was accomplished. If, therefore, they placed the earth in the center, they considered it primarily as an element rather than as a planet. They believed that the human body, which is the earthy part of man, was immovable in the midst of zones or bands of psychic and magnetic power. By this interpretation they preserved an analogy between the individual and the universal. They explained man in terms of the universe, and the universe in terms of man. Some of the choicest fragments of ancient thinking were sustained by this concept and have remained unchanged even though astronomy has been revised.

Assuming that astronomical research was inspired by admiration, we should also recognize that man drew upon his own inner resources in his effort to explain natural phenomena. Seeking within for the explanation of his environment, he conceived himself to be immovable. His own life circled in orbits around his concept of selfhood. As a person, his immediate environment was the earth on which he lived. Things had no meaning except what they meant to him. He drew all knowledge to the central core of his own life. It was therefore essential to him that he explain the world as it affected him and as it appeared from his point of observation.

In a strange way the Copernican system actually returned the solar system to its sovereign power, the sun. All ancient peoples venerated the sun as a visible symbol of the invisible power of God. Thus Seneca's question was both scientific and moral. The universe was no longer believed to have been created for man. The earth and its creatures retired to a subservient position. The philosophy was inescapable: man was part of Nature, and moved with other living things around the blazing source of power. It was natural that this change should coincide closely with the Renaissance and the Reformation. It attacked the supremacy of man as a peculiar creation, but gave him new dignity as a member of a universal family. Everything depended upon the interpretation of the earth in this concept. Classical thinkers would have used both the planet and the element earth to signify mortality. To them the earth was the sphere of forms and of bodies,



—From *The Sphere of Manilius*

PHILOLAUS OF CROTONA INSPIRED THE UNIVERSAL CONCEPT DEVELOPED BY COPERNICUS

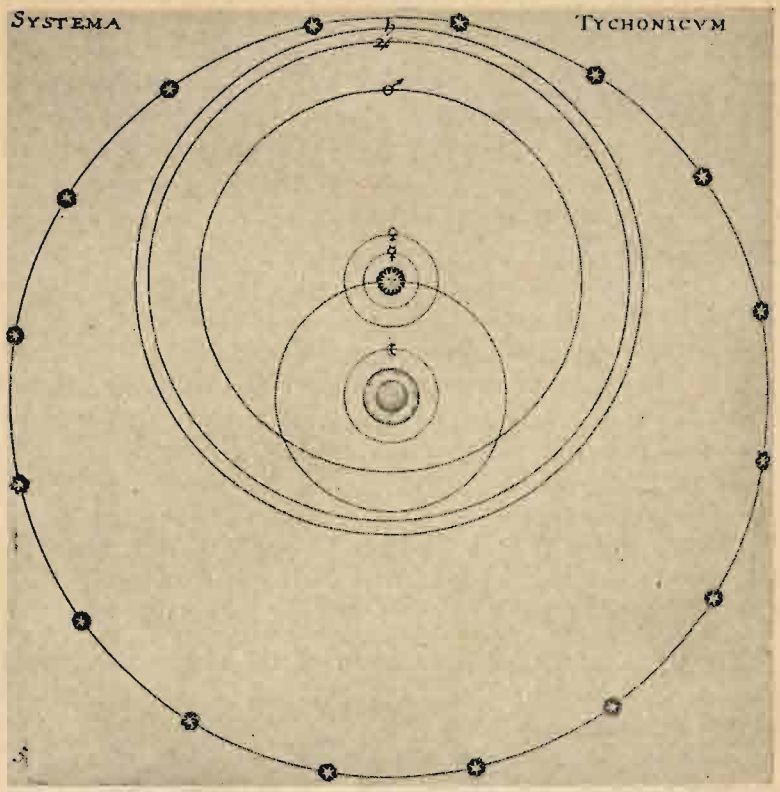
whereas the sun was considered an appropriate figure to represent soul and spirit. If the sun moved about the earth, then spiritual life was merely a servant of material activity. But if man and the earth moved about the sun, then the axis of the solar system was its spiritual focus, and all planetary bodies were dependencies of this superior life-principle. This general thinking was certainly inspired by Pythagorean contemplations.

From researches in Eastern astronomy we come upon a number of elements which undoubtedly drifted westward and mingled with the classical traditions of the Near East and southern Europe. In the Hindu system, astronomy is frankly metaphysical. It is neither required nor expected that the analogies to natural phenomena be exact. The universe as energy moves from a circumference which is pure life, and therefore the Supreme Deity, toward a center which is matter and

of which the earth is an appropriate symbol. For convenience, the planet itself is used to represent the element, but the concept is much larger. All matter is implied, including the material structure of every sidereal body moving in the infinite vistas of space. Matter is therefore a condition, a universal state placed like an island in the midst of the sea of spirit. In this sense, and not in the astronomical sense, earth, or matter, is in the center of the creation.

If matter is the focal point of objective manifestation and is the invisible reduced to the ultimate state of visibility, it is also the center from which radiate all those manifestations of life which can be revealed only through their material constitutions. From the union of spirit and matter, form comes into existence as a primary compound, and from form as a principle come all forms as particulars or manifestations of that principle. Matter is, therefore, the imperishable foundation of an eternally growing structure which is expanding by degrees toward universalization in space. From forms, as from seeds, grow the infinite differentiations of embodied life. Body is, therefore, the visible center of a radiant sphere of influences and overtones which surround it like the concentric orbits of planets.

Perhaps, then, the Pythagorean figure of the universe should be interpreted psychologically as man's experience of living. Thus considered, the old pattern has many valuable interpretations. Religions have sensed these deeper meanings and held to them in spite of the progress in the exact sciences. Let us think for a moment of the Pythagorean system as applicable to the study of man himself and of his psychic nature. The central earth is his body, from which emanates a humid or generative principle, an airy or intellectual principle, and a fiery or spiritual principle. These enclose the body and sustain and support it in the midst of a qualitative space. Cicero described the human being as surrounded by a luminous globe, likened to a magnetic field in which there were bands or zones. The body does not support these zones, but is supported by their energies. Because they are invisible, these zones cause the body to appear suspended from nothing, when in reality it is the lesser part of a great and complex compound. The energies which support man manifest through him as his faculties, powers, and activities. The whole personality with its energies is then suspended in a larger sphere represented by the zodiac. This is the sacred dodecahedron, or twelve-faced symmetrical solid described by the Pythagoreans as the most perfect of all forms. Pythagoras reported that while in the Egyptian temples he had seen the Supreme Deity so represented. The complete solar system is therefore suspended within the field of spirit itself, which is the ultimate source of all life and activity. In the old arrangement, the sun was placed in

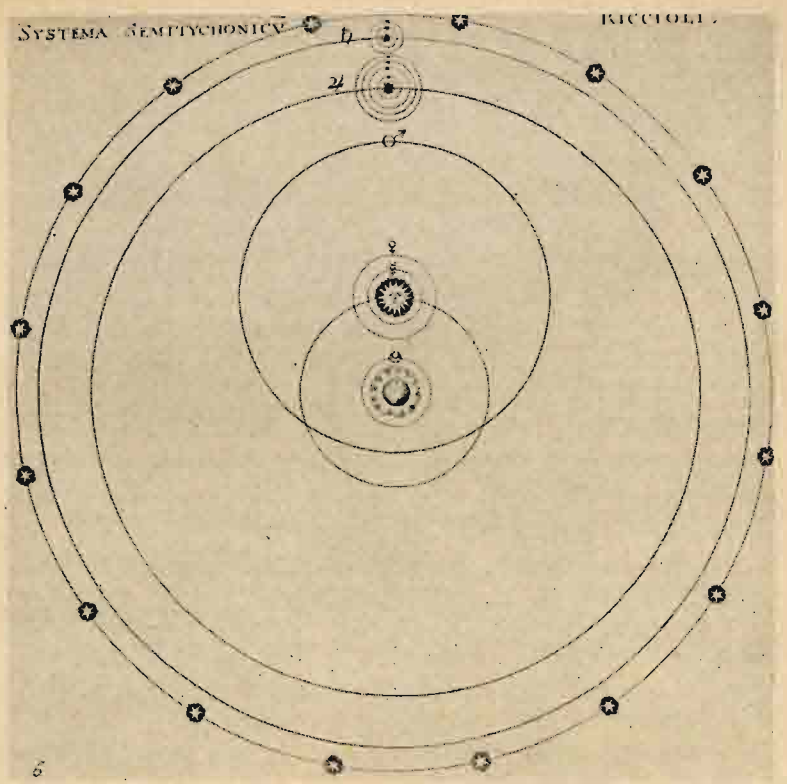


—From *The Sphere of Manilius*

TYCHO BRAHE ATTEMPTED TO RESTORE THE OLDER CONCEPTS OF THE UNIVERSAL STRUCTURE

the fourth orbit from above or below, and was properly the figure of the soul which occupied the middle distance between spirit and body. It is the soul which was recognized as the source of form, for it united opposites and held contraries in compatible relationships.

The superior planets, those whose orbits were outside the sun, were the superior powers of the soul represented by Saturn, Jupiter, and Mars. Here we have the divine triad of will, wisdom, and action. The inferior orbits, within the orbit of the sun, were associated with Venus, Mercury, and the moon. These corresponded with the lower attributes of the soul: emotion, intellect, and imagination; intellect in this case meaning the material activities of the mind. To the seven parts of the soul which have survived in the seven sacraments, the seven cardinal virtues, and the seven deadly sins, the Pythagoreans added an eighth attribute. This was the generative or seminal part which made possible



—From *The Sphere of Manilius*

A DIAGRAM OF THE SOLAR SYSTEM ATTRIBUTED TO RICCIOLI

the production of the physical body. In old times the body was not regarded as a principle or as a part of the creative process. It was a vessel or container of principles, in which the superior powers mingled to produce the mystery of human existence.

Perhaps the ancient concept had an accuracy beyond what we know today. We cannot dispute the findings of astronomy on a physical level, but the ancients would move this entire level with all that it contains into the position of the earth and surround it with an invisible universe of causes, for which the diagram of concentric circles seemed to them to be entirely appropriate. This may also bring a more mature understanding of the places of the gods in the lives of our classical ancestors. The seven popular deities of the Greeks and the Romans originally associated with the planets would then be qualities of soul power. They would represent zones or planes of soul energy, and by their mutations exercise a profound influence upon human life and,

in a larger sense, upon the life of Nature. This was the position held by Paracelsus, who insisted that the celestial bodies affected the soul chemistry of man's invisible nature, and in this way brought about those consequences which finally became visible or apparent. The human 'soular' system is identical in structure with that of the larger world; thus sympathies exist between superiors and inferiors. It is amazing that students of Pythagorean philosophy have not more generally recognized the implications. When the old philosopher built his scheme upon harmonic intervals and tonal qualities, he set the universe in a pattern of vibration. He also assumed that man himself was a sensitive musical instrument which responded to the music of the spheres. What better symbolism could have been devised to imply the psychic structure of the world soul and the human soul and their interrelationships. All intervals in the invisible world must be considered as qualitative, but they can be diagrammatically depicted. If at an early time man was not aware that the physical structure of the solar system was not in obvious conformity with his philosophical findings, it was simply a case of an inadequate symbol. When we choose any figure or emblem to represent qualities themselves formless, our representation can never be complete or perfect. The Pythagorean concept was not dependent upon solar structure; it merely used this structure as a concrete example of an abstract concept. The concept stands until it is disproved on its own level, and does not fall because of changes in astronomical theory.

Figures reminiscent of old solar diagrams occur in modern textbooks on psychology. The tendency to revert to basic ideas is noticeable and helps to explain and even to justify the earlier findings. We can go a little further and consider the meaning of that first motion, which was believed to have contributed itself to all parts of its creation. This first motion was, of course, the fiat, or spoken word, which set into vibration all of the particles within the great circle reserved as a field for creation. This motion originated in the absolute sciences of the Infinite. It was the first impregnation by which the sleeping seed of the solar system was impregnated. Here were the bands of the universal unconscious, which the Chaldeans called the thrice-deep darkness and the unknowable. Of this threefold cause, man himself has no definite awareness. It is the sleep which bounds all life. To a degree, ancient man feared this great sleep, but gradually he filled this darkness with an overconcept of good. That which is the source of all must be the Good, and its works must be forever benevolent.

The solar system rests, therefore, in a silent benevolence, and, exploring within himself, man seems to approach this silence, which has gradually come to be identified with God. As the old Rosicrucian

wrote: "The clamorings come forth from the silence and finally return to it." In The Revelation of St. John is described a door in the heavens, through which the mystic ascends in his meditation. Above the firmament of the fixed stars was the abode of the hidden causes of all things. The mystic in his reverie becomes dimly aware of the inner psychic door within himself which leads from the labyrinth of soul complexity into the infinite substance of eternal peace. As we look at the old diagrams, they draw something out of us. We remember the ancient traditions, and consider the many useful implications suggested by the symbolism. Most of all, however, we wonder if these figures were not inspired by a kind of inward reflection upon outward things. If this be true, it may lead us to a better understanding of the threefold universe of spirit, soul, and body.