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An Introduction to Pythagorean Sphaerics

(From *An Introduction to Pythagorean Sphaerics*—A Skit intended
to provide curiosity about why we study the heavens
by the Los Angeles LaRouche Youth Movement Sphaerics Group
from the [Winter 2004 Fidelio](#))

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Box 1

Astronomy of the Great Pyramid

Modern day “establishment” historians of science will fulminate against the notion of an advanced, ancient Egyptian astronomical tradition. Apparently counterposed to them, the “alternative” Egyptian history movement, created under the influence of the Synarchists, claims that ancient Egyptian astronomy derives from either space aliens, or psychotropic drugs, or secret societies. Plato, Herodotus, Diodorus Siculus, and the Great Pyramid itself tell a different story.

In his 1982 *The Toynbee Factor in British Grand Strategy*, Lyndon LaRouche hypothesized that Egypt was founded by the remnants of an earlier Atlantean civilization, moving eastward from the Straits of Gibraltar, as the last Ice Age was ending, and carrying with it a knowledge of astronomy. The First-century B.C.E. historian Diodorus Siculus described Atlas, the father of such an Atlantean civilization, as the man who “discovered the spherical nature of the heavens.” Plato’s masterwork on the physical principles governing the universe, *A* not only cites Egypt as the font of Greek astronomy and mathematics, but dates Egyptian civilization back to at least 9600 B.C.E. And Herodotus reports that the



The Spinx, on the Giza plateau, site of
the Great Pyramid

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Box 1

Astronomy of the Great Pyramid

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Sphaerics, or astronomy, dominated the

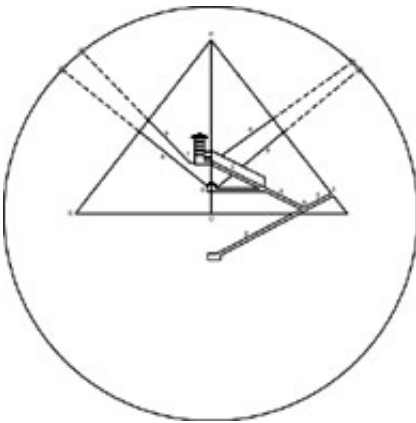
architecture, religion, and economy of ancient Egypt, especially the magnificent Old Kingdom (2700-2180 B.C.E.), which built the Great Pyramid



**The Spinx, on the Giza plateau, site of the
Great Pyramid**



The Great Pyramid of Khufu, (above), and a diagram of the Great Pyramid, showing observation shafts (below).



of Khufu as an astronomical observatory. Located on the Giza plateau, the Great Pyramid is stunning in the precision of its construction, a construction which could only have been meant for astronomical study. It is located precisely at 30° latitude, and is more accurately aligned to the four cardinal points than modern structures built to the same end. Within that alignment, the shafts built into the Pyramid, at crucial angles, allow for precise observations of key stars, such as Sirius, the North Star, and Orion's brightest star, as they transit the celestial meridian.

For the builders of the Great Pyramid to have accomplished such a task, the understanding of the regular motions of the stars and the celestial geometry of sphaerics had to have existed long before such an undertaking. The Pyramid Texts carved on the smaller pyramids of Saqqara, describe important astronomical cycles as myths in which, for example, figures such as Osiris and Isis are represented by the constellation Orion and the star Sirius, respectively. And, while carved in stone during the Old Kingdom, the origin of the Pyramid Texts is presumed to be much older.

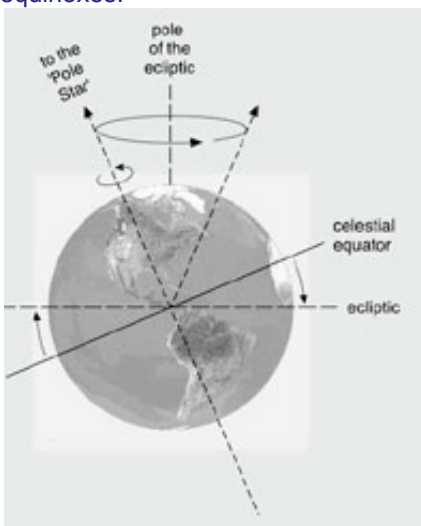
—Susan Kokinda

Box II

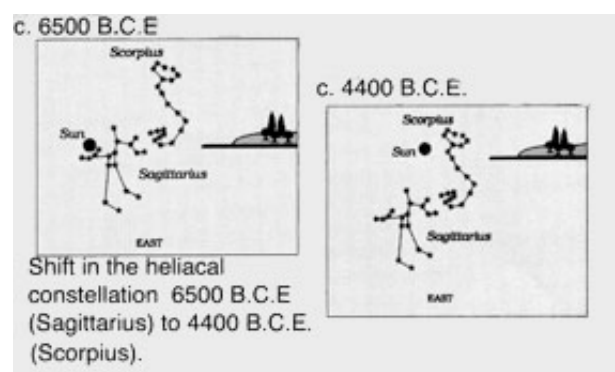
Precession of the Equinoxes

The “precession of the equinoxes” is an observed effect caused by the slow, top-like wobble of the north-south axis of the Earth over a period of 25,900 years. Hence, the “North Star”—which is, by definition, the star to which the axis points—shifts over that period. Today it is Polaris, but during Egypt's Old Kingdom it was Alpha Draconis. This shifting celestial geometry (which is 1-degree every 72 years) results in another important change in observations: The constellation of the Zodiac which rises just before the sun on the vernal equinox, which is

called the heliacal constellation, also changes slowly over time, as if the band of the Zodiac were sliding backwards against the fixed annual position of the equinoctial sun. This effect is known as the “precession of the equinoxes.”



Left: Earth's axis of rotation itself rotates around the “pole of the ecliptic.”



The 12 constellations of the Zodiac are the ones which follow the same path as the sun along the ecliptic, and Egyptian mythology and religion are filled with images of them. The dominance of a particular image, such as the scorpion, the bull, or the ram, often corresponds to the historical period in which that constellation was the heliacal constellation. For example, the death of Osiris, which Freemasons and Synarchists make a great mystical to-do over, can be seen simply as the disappearance of the constellation Orion from the sky, on the vernal equinox, which occurred around 6700 B.C.E.

—Susan Kokinda

Box III

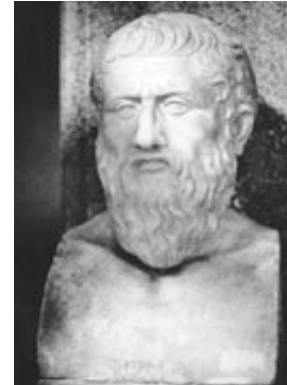
The Legacy of Plato

A physical concept of magnitude was already fully developed by the circle associated with Plato, and expressed most explicitly in the *Meno*, *Thaetetus*, and *Timaeus* dialogues. Plato and his circle demonstrated this concept, pedagogically, through the paradoxes that arise when considering the uniqueness of the five regular solids, and the related problems of doubling a line, square, and cube. As Plato emphasized, each species of action generated a different species of magnitude. He denoted such species by the Greek word *dunamis*, the root of the English 'dynamo' translated as 'power.' The meaning of the term *dunamis* is akin to Leibniz's use of the German word *Kraft*.

That is, a linear magnitude has the power to double a line, whereas only a magnitude of a different species has the power to double a square, and a still different species has the power to double a cube. In Bernhard Riemann's terminology, there magnitudes are called, respectively simply-extended, doubly-extended, and triply-extended. Plato's circle emphasized that magnitudes of lesser extension lacked the potential to generate magnitudes of higher extension, creating, conceptually, a succession of higher *powers*.

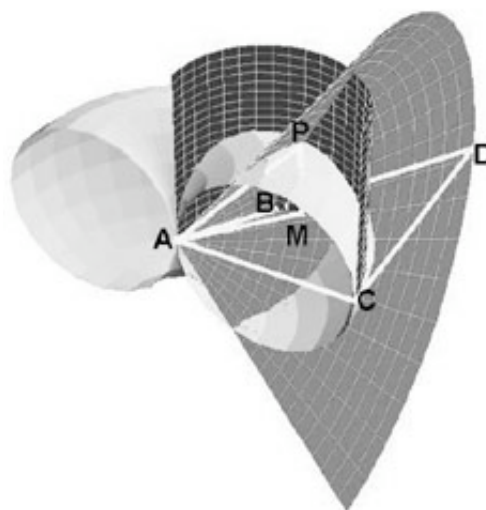
Plato's circle also emphasized, that this succession of magnitudes of higher powers, was generated by a succession of different types of action. Specifically, a simply-extended magnitude was produced from *linear action*, doubly-extended magnitudes from *circular action*, and triply-extended magnitudes from *extended circular action*, such as the rotational actions that produce a cone, cylinder, or torus. Plato's collaborator, Archytas, demonstrated that the magnitude with which a cube is doubled, is not generated by circular action, but by extended circular action, i.e., conic sections.

—Bruce Director



Plato (427-347 B.C.E)

Archytas's Construction For



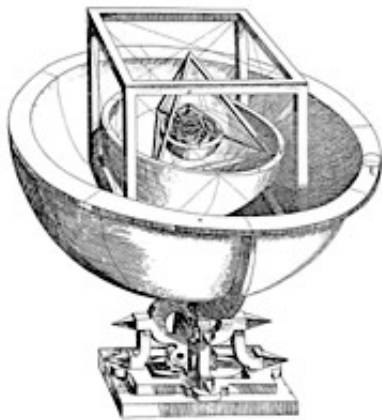
Doubling the Cube

Archytas developed a construction to find two geometric means between two magnitudes. AC and AB. Magnitude AS is drawn as the diameter of circle ABC; AB is a chord of the circle. Using this circle as the base, generate a cylinder. The circle is then rotated 90 degrees about AC, so it is perpendicular to the plane of circle ABC; it is then rotated about point A, to form a torus with nil diameter. (The intersection of the torus and the cylinder produces a curve of double curvature.) Chord AB is extended until it intersects the perpendicular to AC at point D; this forms triangle ACD, which lies in plane of circle ABC, AB, and AC. Triangle ACD is then rotated around AC, producing a cone. The cone, torus, and cylinder all intersect at point P. Perpendicular PM is then dropped from P along the surface of the cylinder, until it intersects circle ABC at point M; this forms right triangle AMP. Through this construction, a series of similar right triangles (only partially shown) is generated, which produces the continued proportion, $AB:AM::AM:AP::AP:AC$. Thus, AM and AP are shown to be the two geometric means between magnitudes AC and AB.

Box IV

The Platonic Solids

Among the many startling discoveries of the application of universal physical principles to the organization of the visible world found in the scientific investigations of Plato and his associates, was the recognition of the unique constructability of the five regular (Platonic) solids. The most important aspect of this discovery did not lie in the visible world, however, but in the necessary implications for the existence of what Bernhard Riemann would call the “complex domain” two millennia later.



Johannes Kepler discovered that the ordering of the visible planets corresponded to the ordering achieved by inscribing and circumscribing spheres around the five Platonic solids, in the order depicted in this illustration from his “Mysterium Cosmographicum.”

The proof that no other regular solids but these—the pyramid, cube, octahedron, dodecahedron, and icosahedron—can be constructed in visible space, was tantamount to the assertion that, contrary to textbook Euclideanism or the dead world of Isaac Newton, physical space was not “empty,” but instead shaped by unseen boundary conditions inherent in the possibilities of physical action. What appear to be the axioms, definitions, and postulates of mathematics, must yield to the causal relations of physics; in fact, the very proof of the uniqueness of the Platonic solids—one of the greatest achievements of Greek geometry, which required the development of a theory of proportions able to deal with incommensurable species of magnitudes (powers)—represented, paradoxically, a complete overturning of the method of deductive (logical) proof upon which it was based.

Although Plato presents these issues directly in his *Timaeus*, they are also embedded at the heart of the *Republic*, in the twinned metaphors of The Cave and the Divided Line.

Here, we see that what we know truly, we know metaphorically—but only by reference to an unseen Power which animates and unifies the more immediate aspects of our experience.

—Ken Kronberg

Box V

Mathematical Models vs. Truth

In *The New Astronomy*, Johannes Kepler demonstrated that Ptolemy's, Copernicus's and Tycho Brahe's planetary systems gave exactly the same computational results, so there was no way to tell which one was true. Despite the fact that all three were radically different, there was a common error that pervaded them. All three were mathematical models for the purpose of predicting the motions of the planets, while making no attempt to discover the physical causes. Consequently, all three imposed the mathematics of perfect circles and uniform motion onto the planetary orbits, when the physical observations showed otherwise. Kepler's investigation of physical causality led him to the discovery that the planetary orbits were elliptical.

(a) The Ptolemaic system, with the Earth at the center and all the planets and the sun moving around it in perfect circles. (b) The Copernican system, with the sun at the center, and all the planets, including the Earth, moving around it in perfect circles. (c) The system of Tycho Brahe, in which the Earth is at the center, and all the planets move about the sun in perfect circles, while the sun moves about the Earth in a perfect circle.

—Bruce Director



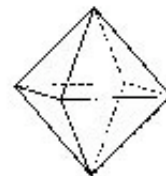
Johannes Kepler



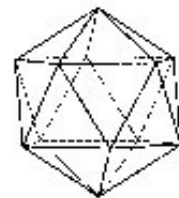
Tetrahedron



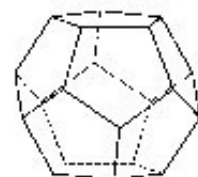
Cube



Octahedron



Dodecahedron



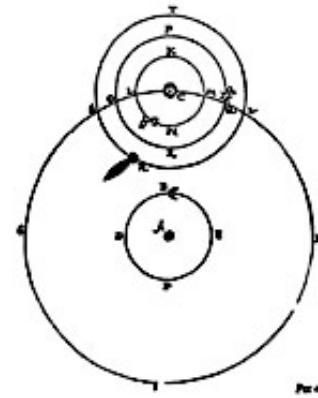
Icosahedron



(a) Ptolemaic system:
Earth-centered.



(b) Copernican system:
sun-centered.

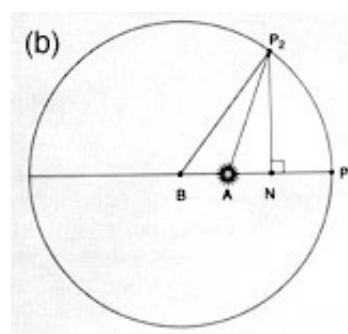
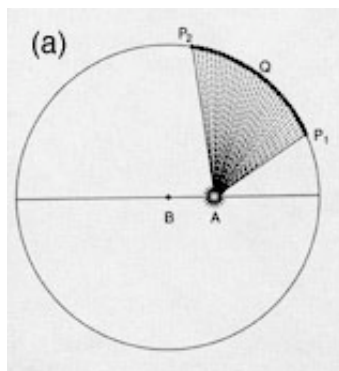


(c) System of Tycho Brahe:
mixed Earth and sun-centered.

Box VI

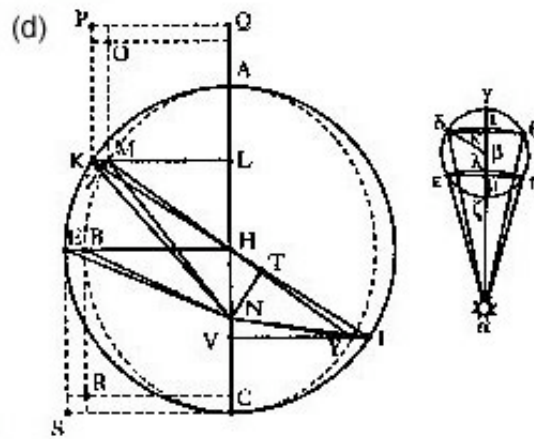
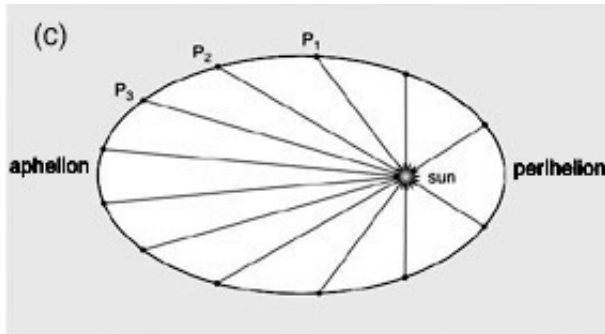
Kepler's Physics of Non-Constant Change

Kepler's revolution was, to derive the principles of planetary motion from physical principles, not mathematical ones. He conceived that the sun moved all the planets by a virtue (*power*) emanating from it, whose intensity diminished with distance. Thus, if the planet were moving in an orbit in which its distance from the sun varied, it would physically speed up and slow down as it moved around the sun. (a) The planet at P_1 is closer to the sun A, than at P_2 . Thus, as the planet moves from P_1 to P_2 , it is always slowing down. This means that equal portions of the planet's period do not correspond to equal distances along its orbital path. Kepler showed that these equal areas swept out by a line connection the planet to the sun.



(b) Kepler measured these areas. The area swept out as the planet moves from P_1 to P_2 is the white area (P_1-P_2-A). That area is measure by the portion of the circle, P_1-B-P_2 , minus the triangle P_2-B-A . The area of that triangle is the distance BA times the height P_2-N . But, the line P_2-N , as Nicolaus of Cusa showed, is incommensurable with the arc P_1-P_2 . Thus, the principle of non-

uniform planetary motion is dependent on magnitudes which are not susceptible of precise calculation. This gave rise to the famous "Kepler problem": If Kepler knew where the planet had been, he could calculate what portion of the orbit (time) had elapsed. But, owing to the transcendental relationship between the line and curve, he could not precisely calculate where the planet would be when an equal amount of time would have elapsed. Kepler called on future geometers to solve this problem, which provoked Leibniz to develop the calculus.



(c) Keplers's initial discovery of the "equal areas, equal times" principle was developed under the assumption that the orbit was circular, with the sun at an eccentric point. After comparing his results to the true observations, Kepler found he was 8' of arc off. It is a tribute to Kepler's genius, that he saw that this small discrepancy was a matter of principle, not simply a minor error. He subsequently revised all his work, and discovered that the planetary orbits were ellipses with the sun at one focus.

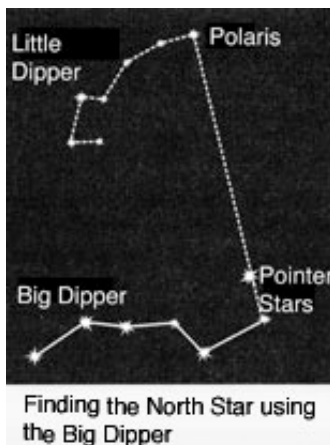
(d) Kepler's diagram from the New Astronomy. The dotted curve is an ellipse. As you can see, this ellipse is very close to a circle, but as Cusa has forecast in On Learned Ignorance, there is no perfectly circular motion in the created world.

—Bruce Director.

Box VII

'Follow the Drinking Gourd'

"When the sun comes back
And the first quail calls,
Follow the Drinking Gourd.
For the old man is a-waiting for to carry you to freedom,
If you follow the Drinking Gourd. ..."



This haunting folk song, first sung by slaves in Alabama and Mississippi before the Civil War, was rediscovered in 1912 by folklorist H.B. Parks, who overheard an African-American man in North Carolina singing it. The words were a puzzle, but the singer flatly refused to explain thir meaning. A year later, Parks heard the song again in Louisville, Kentucky—but again, the singer kept mum. It was only after 1918 that he learned from a Black man in Texas, that the lyrics gave escaping slaves directions to find their way north to freedom. They would always travel under the cover of night. By finding the "Drinking Gourd" in the sky—the constellation we call the Big Dipper, which points to the North Star, Polaris—they would follow a route north (described in "code" in the song), along first the Tombigbee River, then the Tennessee, and finally crossing the Ohio River into the free state of Illinois.

The idea of using the vast, unfettered expanse of the starry heavens to find one's way to freedom, became more than just a navigational "trick," but a

metaphor for the quest for freedom. Frederick Douglass, the great leader of the movement to free the slaves, named his newspaper *The North Star*. He understood profoundly that science means the liberation of man; only if your oppressors can keep you ignorant, can they control you.

As most people know, the slaves were helped along their way by the "Underground Railroad" of people who would feed and safehouse them, and direct them on to the next "station." The most famous "conductor" on the "railroad" was Harriet Tubman, known as the Moses of her people. Frederick Douglass wrote to her in 1868: "I have had the applause of the crowd and the satisfaction that comes of being approved by the multitude, while the most you have done has been witnessed by a few trembling,

scared, and foot-sore bondsmen and women, whom you have led out of the house of bondage, and whose heartfelt 'God bless you' has been your only reward. The midnight sky and the silent stars have been the witnesses of your devotion to freedom and your heroism."



Helping slaves to freedom on the "Underground Railroad."

and I nebber los' a passenger"—a quote which was inscribed on a plaque in her honor by the citizens of Auburn, New York, at the court house in Cayuga County, where she died in 1913.

—*Susan Welsh*

Tubman, herself a slave in Maryland, had escaped to freedom at the age of 28, with only the North Star as her guide. She then helped more than 300 others to do the same, telling them:

"Children, if you are tired, keep going; if you are scared, keep going; if you are hungry; keep going; if you want to taste freedom, keep going." She kept a six-shooter under her skirt, to provide a little encouragement to anyone who fearfully complained that he could not take another step. Tubman summed up her life's work: "On my Underground Railroad I nebber run my train off de track



Harriet Tubman

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