

(A pedagogical experiment in universal history) PART III

**THE EGYPTIAN SCIENCE OF SHADOW RECKONING
AND THE DOUBLING OF THE CUBE.
BY CONIC FUNCTION**

by Pierre Beaudry

(Class of constructive geometry for the Philippines LYM. 8/5/2006.)

**4.SOLID PHYSICAL GEOMETRY OF {SPHAERICS} AND THE CREATION OF
THE FIRST SOLAR CALENDAR.**

Today, I'm going to do something unusual and a little bit daring. I am going to show you the Image of God! Oh it's not going to be to the liking of the white bearded man on the ceiling of the Sistine Chapel at the Vatican, but rather it is going to be what it is like to look like Him. So, not only I am going to show you What the Image of God is made of, but I am also going to show you how you can find it, and how you can construct it yourself. Think of {*Sphaerics*} as a science of solid thought objects as Riemann conceived of his {*Geistesmassen*}.

In ancient Classical Greece, solid physical geometry was known as Stereo-Geometry, or solid {*Sphaerics*}. Of course the idea of "stereo" does not refer to two speakers at the two ends of the room. "Stereo" is a Greek term which means "solid" and which was used by the Platonist tradition to express the ironies of projecting a {*stereo-form*} of the celestial sphere onto the shadow of different planes. The results of many of these exercises were the Platonic Solids and Archimedean Solids, which reflected the harmonic ordering of the universe. Here is the crux of the matter in Plato. Plato wrote in the *Timaeus*:

{Now, that which is created is of necessity physical, and also visible and tangible. And nothing is visible where there is no fire, or tangible, which has no solidity ($\sigma\tau\epsilon\rho\epsilon\omicron\upsilon$) and nothing is solid without earth. Therefore, in the beginning of creation, God made the body of the universe out of fire and earth. But, two things cannot be properly put together without a third; so, there must be an intermediary bond to connect the two. And the best of bonds is that which most perfectly unites into one both itself and the things that it binds together; and proportion is what is best suited to express that unity. Therefore, whenever in any three numbers, whether square or cubic, there is a mean which is to the last term what the first term is to it, – and again, conversely, when the mean is to the first term as the last term is to the mean, – then the mean becoming first and last, and the first and last both becoming means, the necessary consequence is that since they are all interchangeable with each other, they all come to be the same, and having become the same with each other, they all come to be one. Now, if the body of the universe had to come into existence as a plane surface, having no depth, a single mean would have sufficed to bind together both itself and its

fellow terms; but now it is otherwise: for the universe must be generated as a solid form (στερεο-ειδη), as solid bodies are always compacted not by one mean but by two mean proportionals. Thus, God placed water and air as means between fire and earth, and made them to have the same proportion as far as possible – such that as fire is to air so is air to water, and as air is to water, so is water to earth – and thus, He joined together and constructed a visible and tangible heaven. And for these reasons, out of such elements that are four in number and in kind, the body of the Cosmos was created and was harmonically conjugated by proportion. These conditions were secured for its Amity, so that being united in this form of identity within itself, it became indissoluble by any agent other than by Him who had bound it together.}” (Plato, {*Timaeus*}, 31b-32c.)

The stereo-forms of the Cosmos that Plato was referring to, as the four elements, are the four Platonic Solids derived from the unique Dodecahedron, and which God used for the decoration of the heavens. These were the same proportionate solids that Kepler used to describe his {*Mysterium Cosmographicum*}. However, what I will show you here is that the {*stereo-form*} of the Cosmos that Plato is talking about can also be generated as the thought object that generates the Astrolabe as a Solar Calendar. That was the discovery of Hipparchus.

As Lyn reported in his 1992 metaphor paper, about Riemann’s idea of {*Geistesmassen*}, or the idea of the metaphorical name of the “Pythagorean Theorem” as a thought object, is the same thing, which is neither an object of sense perception, neither an object that can be communicated directly within any medium of communication. This is why the projection of shadows became the most useful means of establishing such an incommensurable correlation between minds, as the anomalies between the curved surface of the Celestial Sphere and the great circle of the Equatorial Plane on which the representation of the events occurring on the sphere could be represented. However, this relationship between them could never be represented by sense perception. Only a conceptual representation, a {*stereo-idea*} could relate their incommensurable magnitudes. Let me give you an example of such a {*stereo-idea*}, or solid thought object, which the ancients derived from {*Sphaerics*}.

Judging from the undisputed affinity of construction that exists between the Egyptian model and Archytas model for doubling the cube, it can be hypothesized that a certain combination of the two models may have served the purpose of establishing a workable solar calendar at the Egyptian latitude of 30 degrees during ancient times. However, such a difficult enterprise may not be much older than approximately the period of Archytas himself, that is, sometimes during the 3rd century BC, or around the time of Hipparchus, during the 2nd century BC. Unless someone has attempted the construction of such a representation, it is difficult to imagine the magnitude of such a Gargantuesque task. Let me explain.

For reasons that will become clear in just a moment, the difficulty of this conjecture lays in the irony of the task itself, which demands the construction of a {*Sphaerics*} representation of the apparent motion of the Sun during an entire year, that

is, the entire pathway of the Ecliptic. However, here is the rub. Since this pathway of the Sun does not truly exist, but is actually a representation of the elliptical pathway of the Earth orbiting the Sun during that time period, a conceptual representation was nonetheless required whereby the position of the Sun had to be located precisely during every day of the entire year, and had to be represented conceptually, though falsely, as traveling around the universe within the confine of a non existing sphere of the heavens.

The problem, as we shall see, was compounded by the fact that not only the Sun did not really go through that pathway at all, but that, while maintaining that non-existing course, the Sun also had to go out of the universe and come back in, twice during the same year. Is that crazy or what? That was too much. These were times that tried men's soul, as our present time shows! However stretched as it may have been, this difficulty was finally resolved, when it was accepted that since this pathway of the ecliptic was a fictitious pathway to start with, there could be no serious objection for it to go out of the universe and come back in, provided that the two non-existent points at which the Sun would go out of the universe from, and come back into, were solidly established, and were to always occur at the same time. Phew!

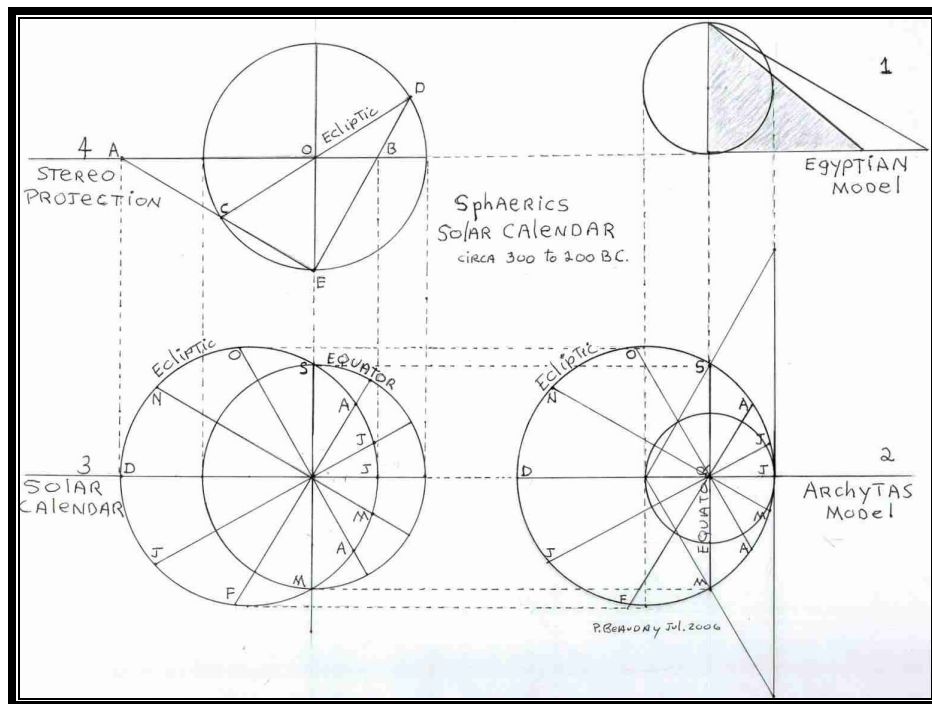


Figure 1. [Projection of a Solar Calendar from Archytas around 300 BC.]

We have already confirmed with ancient Egyptians that on the days of the Equinoxes, at the latitude of 30 degrees, on the plane of Giza, the shadow of the noonday Sun also casts a shadow of 30 degrees. As I stated before, this can also be confirmed by the LYM, in Houston Texas, since their latitude is at 29.97 degrees. **Figure 1** shows a correlation between the Egyptian model, the Archytas model, and a transformation into a twelve month-solar calendar.

Take the horizontal plane projection of the Archytas model **Figure 1(2)** of interlocking of the Torus, the Cone and the Cylinder and use the circular pathway of the Torus, as the pathway of the Sun going in and out of the celestial sphere twice during the 12 months of the year, from the two Solstices at June 21st and December 21st. Next, take the circular cut of the cone intersecting the Torus at the two Equinoxes of March 21st and September 21st, and use that second circle as the Equatorial circle of the celestial sphere. Project those two circles orthographically onto another horizontal plane generating a Solar Calendar **Figure 1(3)**, which interlocks the Equatorial circle of the celestial sphere with the pathway of the Ecliptic.

The Solar Calendar of **Figure 1(3)** represents the intersection of the Ecliptic pathway of the Sun cutting the Equatorial circle of the celestial sphere on the days of the Equinoxes, when the noon sun casts a shadow of 30 degrees on the plane of Giza. When you generate these two circles, not from the Archytas model, but from a Spherical Stereo-Projection (4), the Equinox shadow angle of 30 degrees is locked in, and the reason for the paradox of the Sun going in and out of the celestial sphere becomes apparent. This may have been a necessary predecessor model of a Solar Calendar, before the discovery of Hipparchus during the second century BC.

Lastly, if a correction of the angle of the projection in the sphere at **Figure 1(4)** is made from 30 degrees to 23.5 degrees, then, the paradoxical crossing of the Equator outside of the celestial sphere by the Sun at the two points of the Equinoxes, mark the beginning of a true Solar Calendar. This stereographic projection is attributed to Hipparchus of Nicea who established from there the {*Precession of the Equinoxes*}, which accompanied his discovery of the {*Astrolabe*}.

5. THE HIPPARCHUS DISCOVERY OF THE {*PRINCIPLE OF INVARIANCE*}

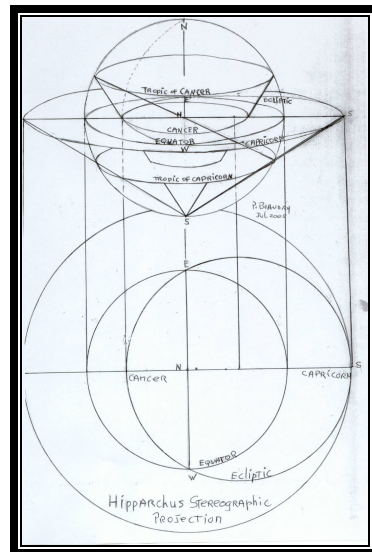


Figure 2. [Hipparchus Conical Stereographic Projection.]

The Hipparchus Conical Stereographic Projection represents a fundamental discovery of a universal physical principle, as Lyn developed with his idea of the *{principle of invariance}* in his *{So, You Wish to Learn All About Economics}*. As Lyn put it:

{For us, as for Riemann, experimental physics centers upon those {unique experiments} which prove mathematical (geometrical) hypotheses pertaining to the continuous manifold by means of experimental observations made in terms of the projected images of the discrete manifold. This possibility depends upon a geometrical principle of topology, {invariance}. In first approximation, {invariance} identifies those characteristic features of the geometry of a continuous manifold which are “preserved” through the process of the projection as characteristics of the images of the discrete manifold. In second approximation, higher-order invariances identify those changes in the continuous manifold as transformations in invariants of the discrete manifold. {Relativistic transformations in the metrical properties of action} in the discrete manifold belong to this second, higher-order class of projective invariances. A {unique experiment} has as its subject-matter such a higher-order transformation in metrical characteristics of principles of action in a discrete manifold. Riemann’s 1859 treatise on shock-wave generation is a model of the principles of {unique experiment.}} (p. 56-57)

I venture to say, here, that the discovery of Hipparchus was such a *{unique experiment}*. It is also a direct reflection of Plato’s *{stereo-idea}* of the dynamics of the universe as a whole. So, the Hipparchus discovery was much more than the discovery of an astronomical instrument. What his discovery represented, in terms of technological advance, was the most important instrument of astronavigation mapping of the heavenly sphere, from any point on Earth, and which is still in use today. Furthermore, from the standpoint of an epistemological advance in fundamental science, the Hipparchus discovery was a *{crucial experiment}* in that it gave a glance into the higher-order invariances that Lyn is referring to, by identifying and providing the solution to three important paradoxes of *{Sphaerics}*, or of astrophysics.

First, there is the paradox of the Sun going in and out of the Universe. It is not a true paradox, like the squaring of the circle, but it does reflect the true ingenuity of invention of Hipparchus, and his keen ability in problem solving. The key to solving that paradox was to find a way to express the astrophysical event of the Equinoxes. Study the projection of **Figure 2**, for a moment, and see if you can decipher the conic function behind the intersection of those two circles in the plane. Think of the whole projection as transformations within the continuous manifold.

The stereographic projection from the complete quadrilateral overlapping the sphere in **Figure 1 (4)** establishes a relationship between the outside and the inside of the sphere such that the Ecliptic cycle can be extended proportionately, that is to say, lawfully, outside of the celestial sphere itself and be reflected onto the plane of the Solar

Calendar on the Celestial Equatorial plane. This Ecliptic cycle is the region from which all of the anomalies of the wandering planets can be mapped.

The following double proportionality of the complete quadrilateral whereby $AB : CD :: AE : ED :: DJ : MS$ reflects the double proportion that Plato required and that Archytas replicated in the doubling of the cube. Thus, the two hemispheres of the Celestial Sphere are projected onto the Celestial Equator in such a manner that the angular projection of a point from the northern hemisphere onto the equator is reduced in proportion to an increase of the angular projection of an opposite point from the southern hemisphere onto that same equator. Thus, this apparent paradox solves a second paradox, a true one, whereby the sphere can be flattened onto its equatorial circle!

[NOTE. The practical side of this Stereo-projection is that you can map a significant number of stars precisely, one on one, from the two hemispheres onto the plane of the astrolabe! I want you to note that I will not be able to construct such an instrument with you, because it requires extensive and local observations of the sky where you live. However, for those who are interested in building an astrolabe for your location in the Philippines, I recommend the excellent book of W. Schroeder, *{Practical Astronomy}*, Littlefield, Adams & Co. Totowa, New Jersey, 1965. You will also require a star-map that you can get on the Internet or at the Astronomical Observatories in your city. You will need such a map, because they have to be very precisely located in your projection. Such maps have to be changed every 50 years or so, because of the changes caused by the Precession of the Equinoxes.]

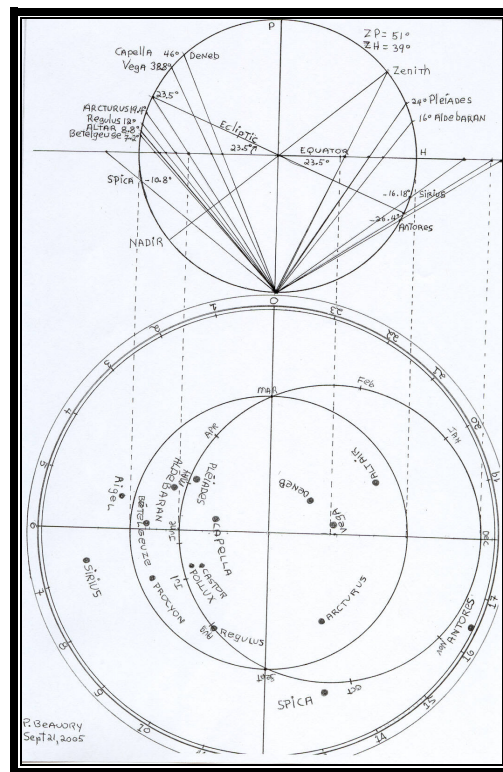


Figure 3. [Hipparchus Sky Map for Leesburg Va. Sept. 2005.]

Let's look at each of those paradoxes, and remember how Lyn identified a true paradox in his Metaphor paper. He says that the squaring of the circle by Cusa represents such a true paradox because “*{the more we appear to succeed, the more we truly fail.}*” This is a very important state of perplexity to be in if we want to understand the paradox of the financial Baby-Boomers of today, and get out of the present crisis. I am not referring to the Nazi bankers like Felix Rohatyn, who are pure evil. I refer to the people you meet in the street every day and who believe that if we improve the current system by giving more tax breaks to the rich, as the recent U.S. Senate vote showed in favor of the 7,000 richest people in the United States.

The first paradox of the Sun going out of the universe, and back in again, is represented by a double conic projection, which became known as stereographic projection. It is not a true paradox because it is not true at all that the Sun travels like that. So, you might wish to ask the question: why then, should we work with this imaginary sphere, if it is just a mere visual construct? Is that not a fallacy of composition? Are we indulging in sophistry, by doing this? As Ver asked earlier, If this is not what the real universe looks like, then what does it really look like?

This question on what the universe should look like, outside of the spherical mode of projecting it, is an extremely important question, because it poses indirectly the question as to why God decided to give us the imaginary sphere as the only way of knowing the celestial universe. I have always considered that this imaginary spherical projection was a wonderful gift from God, because if we did not have this great proportional instrument to seek the truth of universal physical principles behind it, we would be totally lost! Thank God we have that lie of perception to guide us to the truth! And thank God, as we shall see, we have the Zenith Function to guide us to His likeness in that truth. So, this imaginary construction of a spherical universe is a useful metaphor to work with because that imaginary sphere is well ordered within its boundary conditions. And it is the anomalies of the continuous manifold that occur within these boundary conditions of the sphere that we must study, in order to understand the universe we live in. That's the secret.

Now, when you study history, it is the same thing: always look for the anomalies, because they will lead you to see that behind these historical anomalies, there are principles to be discovered. This is why when you look at the sky, you are looking very much into Plato's Cave, and you must realize that even though what you see may be false, the ordering principle behind what you see is not false, because it points to an invisible principle which truly arranges and organizes what you see, and so, you look for the higher-order invariances that cause axiomatic changes within the relationships between the continuous and the discrete manifolds.

So the question of what the universe really looks like, must become what it looks like to our mind. And the answer to that is that the universe is composed of an ensemble of universal principles which are all multiply connected to form what Lyn called the higher-geometries of invariances that keep changing the continuous manifold and are

carried as effective changes as well into the discrete manifold by the sort of projections that we are doing. So, that is what I think is the best answer to Ver's question.

For example, we know that at every infinitesimally small moment of the day the Precession of the Equinoxes acts universally on all of the multiply connected motions of the celestial bodies that you see, not only the wandering planets, but including the so-called "fixed stars." What does that tell you about the principle of universal gravitation that Kepler set out to discover, when he saw that the true elliptical pathway of Mars was not closing on itself, as you would do by a simple conic section, or as you would draw on a corkboard with a string and two push pins? As a result, Kepler recognized that his law of equal time and equal area became faulty. That is why Kepler called for future mathematicians to invent a calculus. Which is what Leibniz did. Those circles or closed ellipses are sophistries. So, you have to be able to make the difference between the anomaly shadows that are useful for a discovery of principle and those shadows that are mere sophistries. As Gauss showed in his 1799 dissertation against d'Alembert, Euler, and Lagrange, there is a difference between the shadows of complex numbers and the "shadow of a shadow" of imaginary numbers.

6.THE ZENITH FUNCTION AND THE DYNAMICS OF ALMUCANTARS AND AZIMUTH CIRCLES.

As I have stated before, one of the most crucial discoveries of ancient {*Sphaerics*}, is the discovery of the {*Zenith Function*}. The idea of such a function began with Thales of Miletus when he discovered the height of the Great Pyramid. Though he was many times dwarfed by the magnitude of the gigantic Egyptian monument, it was the invention of his own unit of measure of {*One Thales*} that made him discover the height of the Pyramid by similarity and proportionality. The ({*Zenith Function*}) is a similar subjective discovery. It is your personal point located on the surface of the heavenly sphere; above the city where you live and from where you make your observations. From that standpoint, you can consider that it is the entire universe, which is rotating around that Zenith point. So you can never be lost. The best way to conceive of the {*Zenith Function*} is to imagine yourself walking from the north pole down to the latitude where you live, but as you walk away from the pole, you bring with you the overhead grid of the latitude and longitude circles which form straight lines at the celestial north pole, but which become curved as you proceed away from the pole, as Bruce showed in his animation. Those imaginary lines across the heavens are called Almucantars and Azimuths because Arabic Astronomers were the first ones to make systematic use of the Astrolabe.

It is only from your {*Zenith Function*} that you can solve the paradox of representing the boundary conditions of the curvature of the celestial sphere onto a plane. This is the most amazing discovery of Hipparchus, and one of the most extraordinary discoveries in the entire history of projective geometry, because it shows an amazing application of the Dirichlet Principle whereby you can change completely the angular arrangement of the entire sphere of the heavens, by moving to another location. However, by maintaining the same underlying ordering principle of proportionality throughout the

transformation, you can reconstitute the physical-space-time of any astrophysical event as viewed from any geographic location you choose to go to and maintain the invariance of the universal characteristics.

The modern description of stereographic projection, however, has somewhat stultified this amazing projective property of invariance from the spherical figures as Hipparchus established them, and as they were later developed by Monge and Poncelet at the Ecole Polytechnique, in Paris. The two main projective properties of spherical stereo-geometry are that any circle of the surface of the sphere may be projected onto a plane as its inversion circle, and that since all spherical and plane angles are conic functions, they are all proportional. This type of stereo-geometry was also replicated in the United States at the West Point Military Academy by Charles Davies, as part of his class in {*Descriptive Geometry*}, which he gave during a period of over 20 years, beginning 1817.

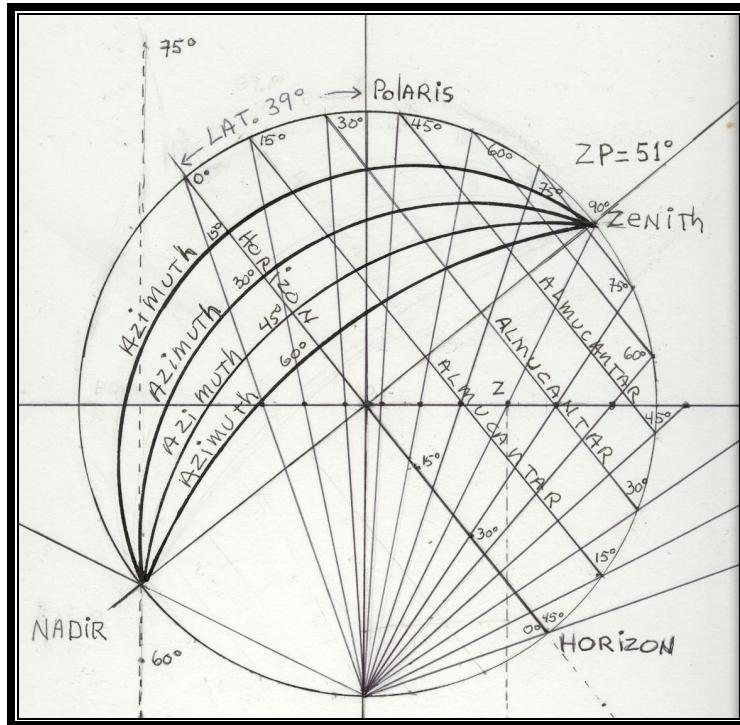


Figure 4. [Sphere Almucantars and Azimuths.]

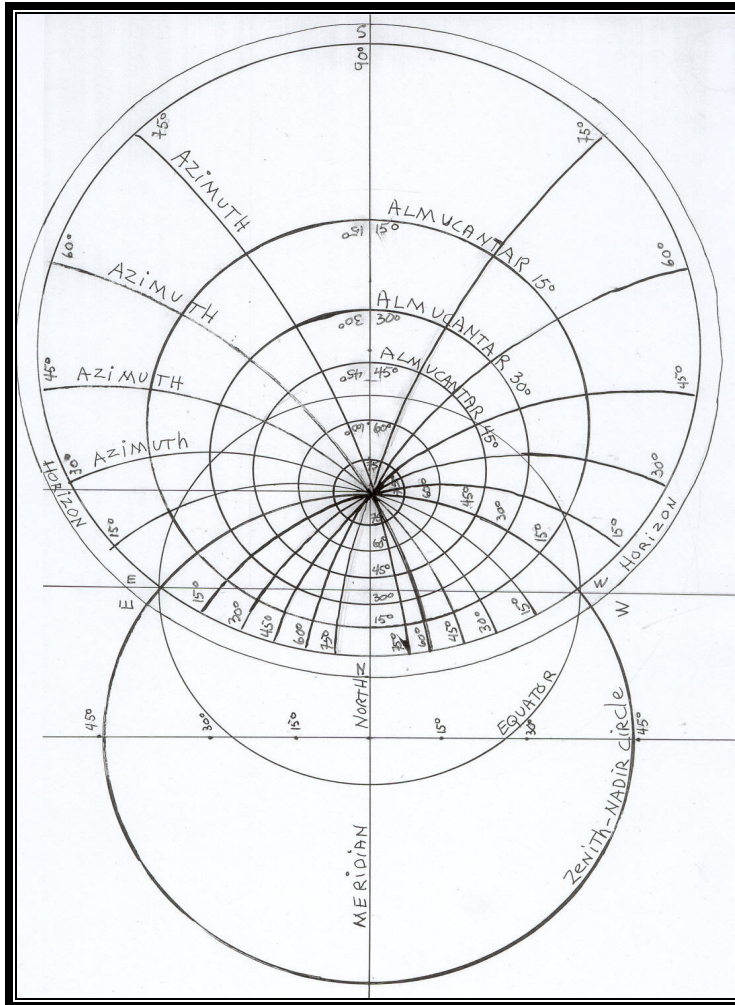


Figure 5. [Plane Almucantars and Azimuths.]

It is a very useful exercise to try and rediscover the means by which these Almucantar and Azimuth circles were discovered in the first place. As you will find, it is by no means self-evident that all of the correlations of circular and angular conic functions between **Figure 4** and **Figure 5** can be projected by some parallel orthographic projection. That cannot be done, for instance with the Azimuths. So, I will leave you to struggle with this problem until we meet again in a couple of weeks, in the hope that some of you will have persevered in reliving this original discovery of Hipparchus. I have marked on those two figures all of the necessary shadows that are required for solving this anomaly.

Lastly, consider that when you make the two discoveries of Hipparchus concentric to each other, that is, when you unite the projection of the *{Solar Calendar and Polar Star Map}* concentric with the plane projection of your *{Zenith Function, Almucantars, and Azimuths}*, you can go outside of your home any evening of the year, locate a star, find its angular location with respect to your time and location of observation, and see its projection at that precise angular position inversed on your

Personal Astrolabe, as if in the simultaneity of eternity. Then, surprisingly, you find yourself perplexed to discover that the dynamics of your PA is more precise and more real than the mechanics of your PC!

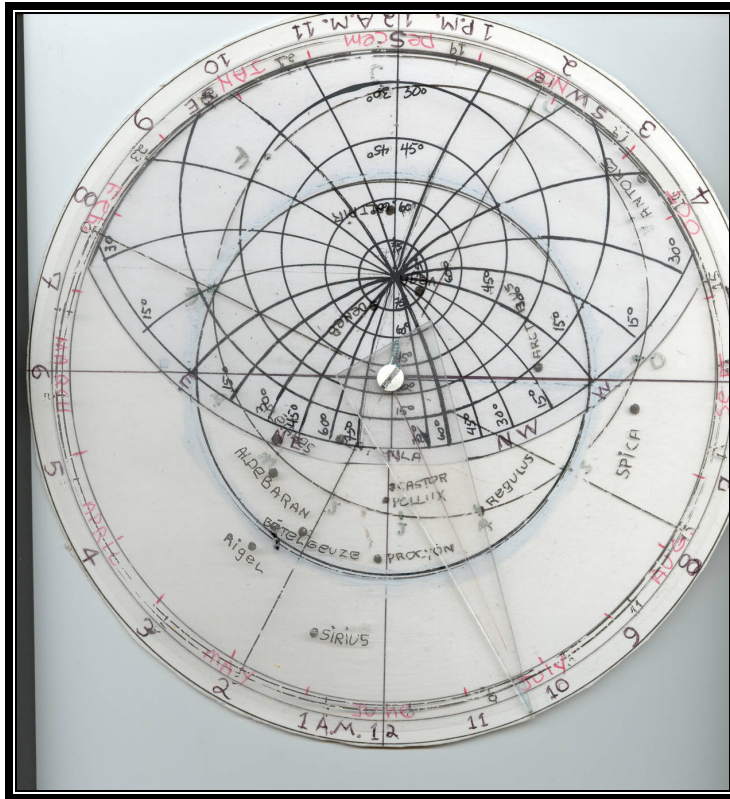


Figure 6. [The Astrolabe for Leesburg Virginia, 2005.]

So, in conclusion, this is what I meant by the Image of God. This new center of the universe, which is represented by your **{Zenith Function}**, is not an egocentric point around which the universe turns, like the Satanist, Felix Rohatyn, who thinks that the world turns around him. The **{Zenith Function}** is the self-fulfilling function of the role that you have to play in the universe as a scientist and political leader, the function that King Bulan of the Khazars Kingdom had chosen to adopt for himself, in order to be in the proximity of God. The irony is that those two different poles of the celestial sphere become proportional *{as if in a glass darkly}* inside of Plato's Cave, making visible in the night sky the discovery of Hipparchus by combining, proportionately, the intelligence in the heavens with your own powers of reason. That is what I wanted to convey to you as the Riemannian **{Geistesmassen-Stereo-form}** of the invariant relationship between the continuous manifold and the discrete manifold. This is what the universe looks like from the standpoint of principles as opposed to sense perception and which reflects the power of the creative process itself. See you in two weeks.

FIN PART III, August 5, 2006.