A New Model of the Universe

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Abstract: *The Urantia Book* reveals that the universe revolves around the Isle of Paradise. This idea of a revolving universe contradicts the current model of an expanding universe, which does not revolve and cannot have a universal center. The expanding model explains Hubble's 1929 discovery that galactic redshifts increase in proportion to distance with the hypothesis of space expansion. This paper shows that a revolving model can explain Hubble's discovery and can also explain recently discovered very large cosmic structures which the expanding model cannot. The preconditions appear to be present for a paradigm shift from the expanding model to the new worldview of a revolving model of the universe which is consistent with the cosmology in *The Urantia Book*.

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1. Introduction

A distinctive feature of *The Urantia Book* is its cosmology. This paper describes how this cosmology can be coordinated with scientific knowledge in a new model of the universe. Every civilization evolves a cosmological model, because we are compelled to find an explanation for what we see in the heavens. The book presents the unique idea that the whole universe is revolving around an absolute center. This idea does not arise from observation, since universal revolution has never been observed. From an evolutionary perspective, there is no apparent need for a revolving model of the universe to explain things.

On the other hand, the current model of an expanding universe fulfills the need to explain Edwin Hubble's discovery of the redshift-distance relation. Hubble observed that the light from galaxies is consistently redshifted and their redshifts increase in proportion with their distance. This phenomenon is very perplexing, because it is observed to occur in every direction. What could cause the light from galaxies in opposite directions at the same distance to be redshifted by the same amount? The expanding model explains these galactic redshifts with the hypothesis of space expansion, which causes everything to recede in every direction from any point in space: The redshift-distance relation is caused by universal space expansion.

However, the book states this explanation is wrong; galactic redshifts are not caused by the receding motion of space expansion. There is a different explanation for this phenomenon, which creates the need for a new cosmological model. This need is met by the revolving universe model, which can be developed from certain key ideas in the book. This paper describes how this revolving model can explain Hubble's redshift-distance relation. Although the idea for this model originates with epochal revelation, it emerges from the history of western thought in an evolutionary manner.

Over the last two millennia there have been six consensus universe models, more or less, in western civilization. The geocentric model described by Ptolemy in the second century B.C. was the consensus up until the 17th century. In this model the sun, moon and planets orbit the earth under the firmament of fixed stars. Copernicus' *de Revolutionibus* published in 1543 presented the theory of a heliocentric model, in which the planets revolve around the sun. In 1610 Galileo published his *Sidereus Nuncius* (Starry Messenger), in which he announced his discovery of the four moons of Jupiter and the phases of Venus. These facts refuted the geocentric model. Kepler's discovery of the empirical laws of planetary motion (1609-1619) changed Copernicus' circular orbits into elliptical ones, which more accurately predicted the positions of the planets. This resulted in the heliocentric model superseding the geocentric model.

The next major development was the discovery by William Herschel in 1785 that the Milky Way formed a disk of stars with the sun at its center. This amounted to an expansion of the heliocentric model to include this 'galaxy' of stars. (The modern meaning of 'galaxy' did not emerge until the 1930s, when it began to be used in place of 'nebula'.) This was superseded in 1918 by the galactocentric model, when Harlow Shapley showed that the center of our disk-like galaxy was tens of thousands of light-years from us. Around the same time Einstein published his 1917 theory of a centerless static universe of curved spacetime, based on his theory of general

relativity. This theory provoked others to find alternative solutions to Einstein's gravitational field equations. Among these was a solution found by Alexander Friedmann in 1924 for a centerless expanding universe. When Edwin Hubble discovered the redshift-distance relation in 1929, it was soon realized that Friedmann's expanding universe could explain this phenomenon. Friedmann's expanding model is the basis for the current consensus model of the universe. This model supposes the universe has been continuously expanding for about 14 billion years.

The Urantia Book presents us with the cosmologic worldview of a higher civilization: Everything in the universe ultimately revolves around Paradise. This idea of a revolving universe is not a model *per se;* it is the premise for a model. To attain the status of a cosmological model in this era, a model must give a scientific explanation for the redshift-distance relation, at the very least. Before the revolving model can supersede the expanding model, there must be observations which it can explain that the expanding model cannot. The purpose of this paper is to demonstrate that a revolving model based upon certain key ideas in the book can explain what the expanding model explains and also what the expanding model cannot explain.

2. The Redshift-Distance Relation and its Explanation

Plot of the Velocity-Distance Relation from Hubble's 1929 Paper

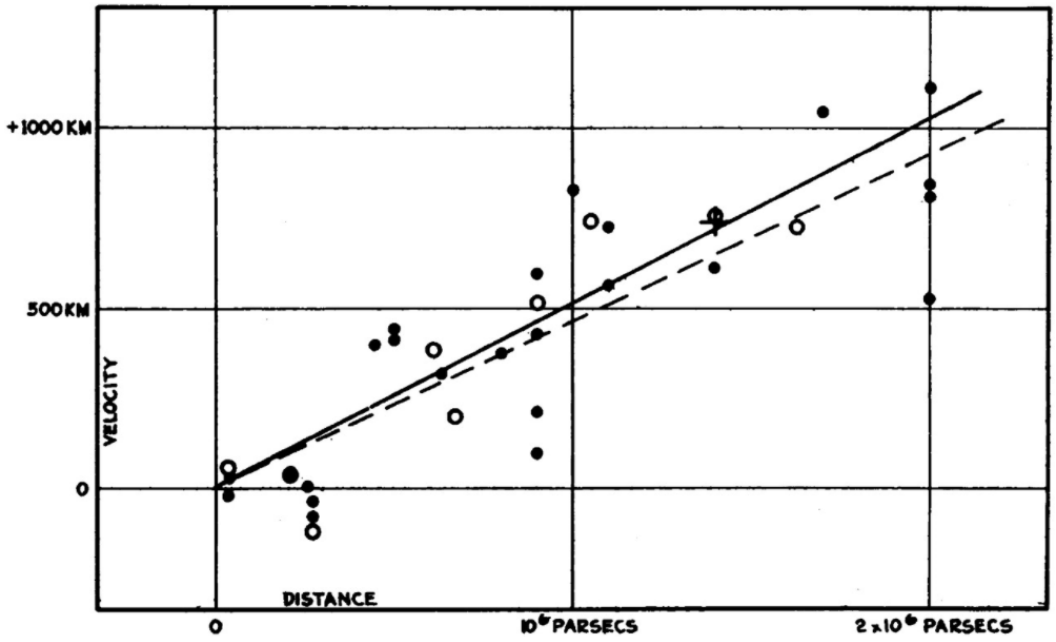


Figure 1: receding velocities of galaxies vs. distance from Hubble's paper

Hubble's discovery of the redshift-distance relation marks the beginning of the modern cosmologic worldview. Hubble measured the redshifts and distances of two dozen galaxies and found there is a linear relationship between them; galactic redshifts increase in direct proportion to distance. The simplest explanation for redshift is receding velocity, since redshift equals receding velocity divided by the speed of light, $z = v/c$. Hubble reasonably interprets the redshift-distance relation as a velocity-distance relation. Figure 1 is a graph of this linear relation from his

1929 paper. [1] Receding velocity equals a constant multiplied by the distance *D.* This constant is called the Hubble constant H_0, and the velocity-distance relation is called the velocity-distance law, $v = H_0 D$. The proportional increase in velocity with distance in any direction can be explained by the hypothesis of universal space expansion, which is described by Friedmann's expanding model; space expansion causes a motion of recession in every direction from every location.

At the time of Hubble's discovery, the hypothesis of universal space expansion was the only apparent explanation for this puzzling phenomenon. This led to the presumption by many that it must be true, even though it was understood by everyone that space expansion is a radically new hypothesis. Hubble was among the first to point out the need to empirically verify its reality and he attempted to do so. As a result of these efforts, by 1935 he began to doubt that galactic redshifts were caused by receding velocity. [2] The receding velocities implied by galactic redshifts seemed to him too large in many cases to be realistic. And his investigation of the relation between the apparent luminosity of galaxies and their redshifts appeared to be more consistent with a static universe than an expanding one. Almost 20 years after his discovery he had changed his mind. He concluded, "It seems likely that red-shifts may not be due to an expanding Universe." [3] He reached this conclusion, even though he acknowledged there was no apparent alternative explanation to space expansion. Nevertheless, he was persuaded there must be "some new principle of nature" which explains the redshift-distance relation.

The general recognition of this need for empirical verification is evidenced by the fact that half a dozen different critical tests have been designed since 1930 to determine whether or not space expansion is real. In 1987, almost 60 years after Hubble's discovery, a review of such tests by Allan Sandage found their results had not provided "proof or not that the redshift is a true expansion." [4] A 2014 analysis by Martin Lopez-Corredoira of the overall results of many implementations of these critical tests found they remain inconclusive; some results favor a static universe, while others favor an expanding one. [5] After almost a century, it is still an open question whether the redshift-distance relation is explained by space expansion or by some "new principle of nature" in a static universe.

> Spectral lines are displaced from the normal towards the violet by an approaching star; likewise these lines are displaced towards the red by a receding star. Many influences interpose to make it appear that the recessional velocity of the external universes increases at the rate of more than one hundred miles a second for every million light-years increase in distance…. But **this apparent speed of recession is not real**; it results from numerous factors of error embracing angles of observation and other **time-space distortions**. (12:4.14) (*emphasis added)*

The Perfector of Wisdom addresses this open question in Paper 12. He acknowledges that receding velocity causes redshift and refers directly to Hubble's velocity-distance law. "Many influences interpose to make it appear that the recessional velocity of the external universes increases at the rate of more than one hundred miles a second for every million light-years increase in distance." (12:4.14) This rate of increase in velocity with distance is a nearly verbatim recounting of the rate given in Hubble's 1936 work *The Realm of the Nebulae.* [6] The receding

velocity of a galaxy is calculated with the velocity-distance law $v = H_0 D$. But the Perfector of Wisdom states, "…this apparent speed of recession is not real; it results from numerous factors of error embracing angles of observation and other time-space distortions." (12:4.14) The velocity interpretation of the redshift-distance relation is wrong; galaxies are not receding due to the motion of space expansion.

With regard to these 'time-space distortions' he says in the next paragraph that "the greatest of all such distortions" is associated with the space levels, which are revolving around Paradise in alternating directions. At first glance this seems to imply that the counter-rotation of the space levels is the primary explanation for the redshift-distance relation. But counter-rotation produces redshifts in one direction and blueshifts in the opposite direction. This mechanism cannot explain how galactic redshifts consistently increase in proportion to distance in every direction. There must be something else associated with the space levels which causes galactic redshifts. But he does not elaborate further on what it is about the space levels which causes this 'time-space distortion.'

From the standpoint of astrophysics there are three types of causes for redshift which can contribute to galactic redshifts: cosmological, Doppler, and gravitational. Cosmological redshift is caused by the recession of universal space expansion. Doppler redshift is caused by a receding velocity through space. Gravitational redshift is an effect of gravitational time dilation which is caused by gravitational potential. This last cause is described by general relativity and occurs wherever there is a difference in gravitational potential between two locations. Of these three only gravitational redshift might be a possible explanation, since gravitational potential is independent of motion. It is also independent of direction, because gravitational potential results in a spherically symmetric gravitational field that varies in intensity with distance. And the Perfector of Wisdom might be obliquely referring to this possibility by associating galactic redshifts with the gravitational revolution of galaxies around Paradise.

Time dilation is the slowing down of the rate at which time passes. As strange and counter-intuitive as this phenomenon is, it has been thoroughly tested and confirmed over the last century. As a practical example, the effects of time dilation must be factored into the Global Positioning System, which would not work without taking this relativistic effect into account. If there was no correction for time dilation, the positions calculated by GPS would be off by about 11 kilometers per day or more than a quarter of a mile every hour. The phenomenon of time dilation is described in both special and general relativity.

In special relativity (1905) time slows down, dilates, on a moving body when the duration of an event occurring on the body is measured by a stationary observer. An event which takes one second to occur in a stationary frame takes more than one second to occur in a moving frame, when its duration is measured *from* the stationary frame. The effect of time dilation is like playing back the video recording of an event in slow motion, instead of normal motion, which consumes more observer time. If an atom vibrates at a frequency of 10 billion oscillations per second in a rest frame, it requires more than one second for a stationary observer to count this number of oscillations in an atom in a moving frame. Time dilation causes the frequency of light emitted by a moving object to be lower or redshifted when the light is observed by a stationary observer.

In general relativity (1915) time dilation occurs where there is a difference in gravitational potential between two locations. The passage of time slows down, dilates, in a stronger gravitational potential. Gravitational time dilation causes the light emitted by an object in a stronger gravitational potential to be redshifted, when it is observed in a weaker gravitational potential. For example, light emitted from the surface of the sun is redshifted by about two parts in a million when observed at the surface of the earth. This redshift occurs because the gravitational potential at the sun's surface is stronger than it is at the earth's surface; time is dilated on the surface of the sun relative to time on the earth's surface, because of the difference in gravitational potentials. (This was first predicted by Einstein in a 1907 paper on special relativity.) Gravitational time dilation can be fairly described as a "time-space distortion," to use the Perfector of Wisdom's phrase.

Ultimately, all galaxies are in gravitational revolution around Paradise. The gravitational potential of a galaxy changes as its distance from Paradise changes, and this change in potential causes a spectral shift in its light. The problem with this idea, however, is that outer space galaxies are farther from Paradise than we are and would be located in relatively weaker gravitational potentials, so their light would be blueshifted, instead of redshifted. In the above example, we would be in the position of the sun and distant galaxies would be in the position of the earth. This would eliminate gravitational redshift as a possible explanation, *except for the fact that the book states there are two types of gravity* – linear gravity and absolute gravity.

Linear or local gravity refers to Newton's law of gravity, which is inversely proportional to the square of the distance. (*cf.* 42:11.5) Absolute or Paradise gravity is directly proportional to distance.

> The universal presence of the Unqualified Absolute seems to be equivalent to the concept of a potential infinity of **gravity** extension, **an elastic tension** of Paradise presence. This concept aids us in grasping the fact that everything is drawn inward towards Paradise. The illustration is crude but nonetheless helpful. (11:8.9) (*emphasis added*)

This idea about absolute gravity comes from its comparison by the Perfector of Wisdom to "an elastic tension of Paradise presence. This concept aids us in grasping the fact that everything is drawn inward towards Paradise." (11:8.9) Based on this analogy with elastic tension, the force of absolute gravity can be described by Hooke's law $F = kx$. The force F of elastic tension equals a force constant k multiplied by a distance x of displacement from a position of equilibrium, which would be Paradise in this analogy. Outer space galaxies are more distant from Paradise and, under absolute gravity, are located in stronger gravitational potentials, which means their light would be redshifted. The gravitational redshift caused by absolute gravity might explain the redshift-distance relation.

This concept of absolute gravity as a directly proportional central force appears to be revealed, since it is completely unlike Newton's linear gravity. It was considered as such in a paper given at the 2019 science symposium on *The Law of Absolute Gravity*. [7] This paper shows that a force modeled on Hooke's law is consistent with evidence supporting the book's statements about

certain identifiable cosmic structures and their behaviors. It concludes that the existence of absolute gravity can be reasonably inferred from this evidence. However, this sort of inferential reasoning does not necessarily lead to true conclusions. A case in point is the inference that space expansion causes the redshift-distance relation, which is reasonable but incorrect. The fundamental weakness of the expanding model is the lack of conclusive proof for the reality of space expansion, upon which the whole model depends. There is a similar fundamental weakness in a static model due to the lack of conclusive proof for the reality of absolute gravity. But it turns out this weakness in static model can be overcome.

3. Newton's Discovery of Two Forms of the Law of Gravity

Subsequent to this 2019 paper, the thought occurred that the comparison of absolute gravity to the force of elastic tension, for which there is a known law, might indicate we already know something about this form of gravity. This thought was also suggested by the fact that the revelation of absolute gravity would appear to violate "the laws of revelation … [and] their proscription of the impartation of unearned or premature knowledge." (101:4.1) Revealing that physical law which governs the whole universe would seem to fall into the category of unearned scientific knowledge. In searching through what is known about gravity which might be relevant to this idea of elastic tension, a more certain foundation for absolute gravity was eventually found in Newton's *Principia* (1687).

It is not generally appreciated, since it is rarely noted, but Newton actually discovers two distinct forms of the law of gravity.

1. Outside the surface of a celestial body, gravity varies inversely with the square of the distance. $a \propto 1/r^2$
2. But inside the surface of a celestial body, gravity varies directly with the distance; that is, it behaves like the force of elastic tension. $a \propto r$

More than twenty years before publication of the *Principia*, Newton knew that Kepler's third law of planetary motion could only be explained by a force that "must be reciprocally as the squares of the distances from the centers about which they revolve." [8] But he was not certain if this inverse-square force was determined by the exact distance between the centers of bodies or if this was only an approximation. In Book III, Proposition VIII he discusses this problem he struggled with for two decades.

> After I had found that the force of gravity towards a whole planet did arise from and was compounded of the forces of gravity towards all its parts, and towards every one part was in the inverse proportion of the squares of the distances from the part, I was yet in doubt whether that proportion inversely as the square of the distance did accurately hold, or but nearly so, in the total force compounded of so many partial ones; for it might be that the proportion which accurately enough took place in greater distances should be wide of the truth near the surface of the planet, where the distances of the particles are unequal, and their situation dissimilar. [9]

Newton knew the gravity of a planet is an inverse-square force that varies with the distance from the center for large distances. He also knew this is the result of compounding the inverse-square forces arising from all of the particles which make up the planet. The difficulty was that he could not see exactly how the total force of the whole planet was consistently related to the center near the surface of a planet.

Figure 2: **The Problem Compounding the Attractive Forces of the Parts**

$$a_{AP} = \frac{GM}{AP^2} \quad a_{BP} = \frac{GM}{BP^2} \quad a_{SUM} = a_{AP} + a_{BP} \quad PS' = \sqrt{\frac{2GM}{a_{SUM}}} \quad PS' < \text{PS}$$

The nature of this problem can be suggested by considering two particles A and B of equal mass M located on opposite sides of the surface of a sphere. The inverse-square force a_{AP} between A and P is much less than the force a_{BP} between B and P, because the distance AP is much greater than BP. The total mass of the two particles $2M$ and the sum of their forces a_{SUM} on P are known, so the corresponding distance PS′ can be calculated. This distance varies with the ratio of PB/SB, and the varying distance PS′ is always less than the distance PS to the center of the sphere. $PS' <$ PS When PB is more than 12 times greater than SB, PS′ is over 99% of PS but is never exactly equal to it. When PB is less than SB, PS′ is always less than 67% of PS. The inverse-square proportion measured from the center is "wide of the truth near the surface of the planet, where the distances of the particles are unequal."

Newton finally solves this intractable problem in the spring of 1685 with a series of remarkable geometric proofs. These theorems demonstrate that the force of gravity exerted by a body on an external particle acts as though the total mass of all its parts is concentrated in a single point at the exact center of the body. This proves the inverse-square proportion is true near the surface of the planet, as well as at great distances. The union of the forces exerted by the innumerable parts of the body on an external particle is focused in a centripetal force acting from the exact center.

In his book on the *Principia* the renowned physicist S. Chandrasekhar stresses the singular importance of this solution for the whole of Newton's work. It is not an exaggeration to say that the whole of celestial mechanics arising from the *Principia* rests upon this solution. He quotes remarks made by J. W. L. Glaisher, president of the Royal Astronomical Society, at the bicentennial celebration of the publication of the *Principia* in 1867. Glaisher highlights what this discovery must have meant to Newton.

> [In] 1684 he was unaware that the sun and earth exerted their attractions as if they were but points. How different must these propositions have seemed to Newton's eyes when he realized that these results, which he had believed to be only approximately true, when applied to the solar system, were really exact! [8]

Chandrasekhar cites a June 1686 letter from Newton to Edmund Haley which shows Newton attached the greatest significance to these results.

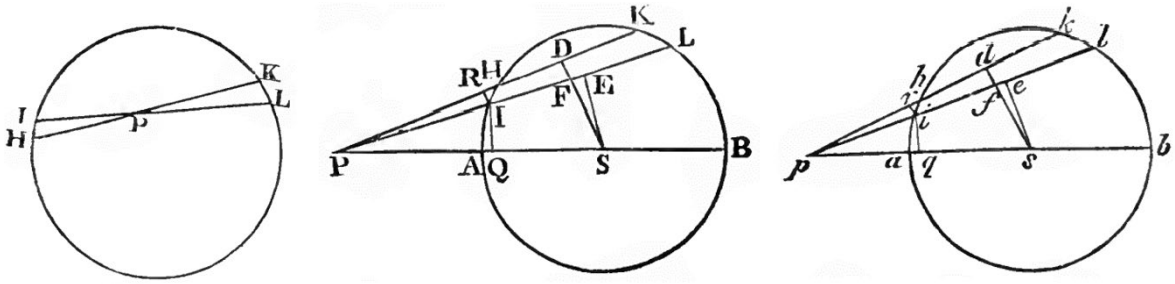
> I never extended the duplicate proportion lower than the surface of the earth, and before a certain demonstration I found last year, have suspected it did not reach accurately enough down so low; and therefore in the doctrines of projectiles never used it nor considered the motions of [the] heavens. [8]

The problem Newton encountered with the inverse-square force near the surface of the earth discouraged him from applying it to celestial motions. The trajectories of celestial bodies should be exactly described by mathematics, since the doctrine of projectiles (ballistics) exactly describes the motion of objects in the earth's gravity near its surface. He found the solution to this problem by distinguishing between the nature of the force of gravity above and below the surface of the earth. It is this distinction which leads to his discovery of two forms of gravity.

Newton develops theorems with this distinction in mind, which are reflected in the geometric constructions he uses, shown in figure 3. These theorems conclusively prove that the force of gravity exerted by a celestial body beyond its surface is inversely proportional to *exactly* the square of the distance from its center. In the process of demonstrating this, he also conclusively proves that the force of gravity on a particle inside the surface of a celestial body is directly proportional to *exactly* its distance from the center. These geometric proofs comprise Newton's famous shell theorem.

Figure 3: **Geometric Constructions for Newton's Shell Theorem**

Proposition 70 for both Propositions 71 & 72



Based on Kepler's laws of planetary motion, Newton postulates an inverse-square force of attraction acts from each particle of matter. In Proposition 70 he supposes there is a very thin spherical shell made up of many such particles and places a single particle somewhere inside this empty shell at a point P. He proves that the sum of the attractions from all of the particles in this shell results in no net force acting on this single particle ($a = 0$). Any net attraction of it in one direction is canceled out by an equal net attraction in the opposite direction; the force of gravity is effectively nullified inside the surface of the shell.

The theorem for Proposition 71 proves that a particle outside this hollow shell at a point *P* is attracted to the center of the shell by a force that is inversely proportional to PS squared. ($a \propto 1/r^2$) This is a surprising result, which Newton later said he did not expect. The sum of the

forces exerted by all of the particles making up the shell on P is different from the force of the total mass of these particles acting from the exact center on P. The same inverse-square relation holds for a particle P outside a solid sphere of matter, as proven by Proposition 74: An external particle is attracted toward the center of a solid sphere by a force that is inversely proportional to PS squared.

Proposition 72 addresses the force of gravity on a particle *inside* a solid sphere of matter. It proves that a particle at a point P inside the sphere is attracted toward the center by a force that is directly proportional to PS. $(a \propto r)$ The nature of gravity changes below the surface, because by Proposition 70 the mass beyond the internal distance PS exerts no net force on particle P. The particle is only attracted by the mass within the distance PS (Proposition 73) and this mass is proportional to the cube of PS. $(M \propto r^3)$ Consequently, the force of gravity is proportional to the distance PS, instead of being inversely proportional to PS^2.

$$a \propto \frac{M}{r^2} \propto \frac{r^3}{r^2} \quad \rightarrow \quad a \propto r$$

The relationships between these geometric proofs can be approached in a different way by deriving the internal equation for gravity from the equation for external (linear) gravity. The acceleration exerted by a body on an external particle equals Newton's gravitational constant G multiplied by the total mass M divided by the square of the distance r^2 from the particle to the center of the body by Propositions 71 & 74.

$$a = \frac{GM}{r^2} \tag{1}$$

By Propositions 70 & 73 a particle inside the surface of this body is attracted by a smaller total mass. The mass M attracting this particle equals the volume defined by the particle's distance r from the center multiplied by the mass density ρ (Greek letter *rho*) of the body.

$$M = \frac{4}{3}\pi r^3 \rho$$

Substituting the right hand side of this equation for the total mass M in the external equation (1) gives the internal equation (2) for acceleration.

$$a = \frac{G\left((4/3)\pi r^3 \rho\right)}{r^2} \quad \rightarrow \quad a = \frac{4\pi G \rho r}{3} \tag{2}$$

This proves that within the surface of a celestial body the acceleration increases in direct proportion to the distance from the center. This derivation also demonstrates that at the surface of a celestial body the acceleration of the internal and external forms of gravity is identical, since the mass and distance are the same in both cases. The relationship between these two types of gravitational acceleration is shown graphically in Figure 4.

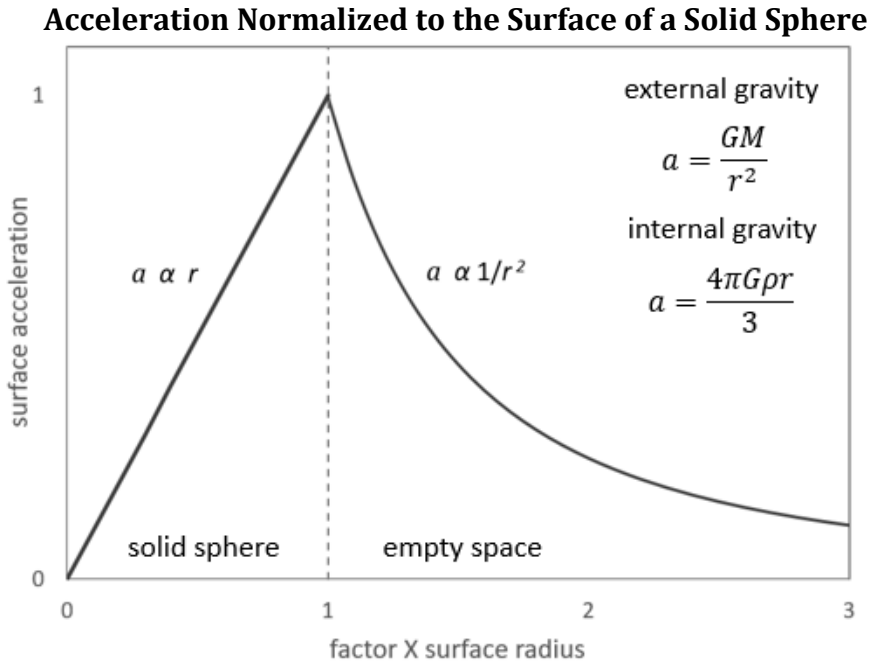


Figure 4: Centripetal acceleration inside/outside a sphere with a uniform mass density

There is a change in the nature of gravitational acceleration at the surface of a celestial body. Inside the surface, acceleration increases in direct proportion to the distance from the center. Outside the surface, acceleration decreases inversely with the square of the distance from the center. The key point of this graph is: The equation for external gravity is *only valid* from the surface out to infinity, and the equation for internal gravity is *only valid* from the center out to the surface.

4. Proof of the Law of Absolute Gravity

It can be inferred from the comparison of absolute gravity to an elastic tension by the Perfector of Wisdom that it is a directly proportional force described by Hooke's law. Because this is an inference, it is not necessarily true. But Newton proves the inverse-square and directly proportional forms of gravity are necessarily true by geometric deduction. This eliminates any reasonable doubt that there is a type of gravity that is like the force of 'elastic tension.'

The derivation of Newton's internal form of gravity from the external form is also consistent with the stated mathematical relationship between absolute and linear gravity. The Perfector of Wisdom tells us that the gravity researchers on Uversa are able to estimate the "total of absolute gravity presence" in the universe. He concludes this paragraph with, "These calculations all refer to absolute gravity; linear gravity is an interactive phenomenon which can be computed only by knowing the actual Paradise gravity." (12:3.8) Since absolute gravity and internal gravity are both mathematically related to linear (external) gravity, logically they must be the same thing.

Absolute and Newtonian internal gravity have the same relation to space; they are both directly proportional to distance. They also have the same relation to time. Absolute (material)

gravity acts instantaneously over all distances. It is one of "four absolute-gravity circuits in the master universe." (12:3.1) These "are absolute *presence* circuits and like God are independent of time and space." (12:3.6) Linear (external) gravity also acts instantaneously, since pervaded space can attenuate this force but "cannot delay it." (11:8.3) Newton concluded the force of gravity must act instantaneously over any distance. Because it acts between the exact centers of bodies, if there was any time delay in the transmission of this force, it would act upon where the center of an orbiting body *was* instead of where it *is*. This would result in unstable orbits, instead of the stable planetary orbits which are observed. The fact that his law of gravity explains celestial motions means it must act instantaneously between the centers of bodies.

Continental philosophers of the time strenuously objected to Newton's idea of gravity as an instantaneous force. It contradicted René Descartes' influential vortex theory (1644) which provided a philosophical explanation for planetary motions in terms of a material mechanism. Thinkers like Leibniz and Christiaan Huygens accused Newton of introducing occult, metaphysical forces into science. They held there must be a material medium to convey a material force, and it is theoretically impossible for a material mechanism to transmit force instantaneously. In a 1693 letter to Richard Bentley, Newton responds to a question about whether the force of gravity can be conveyed without mutual contact. Newton writes it is philosophically absurd to suppose that one body can act upon another in the absence of some medium connecting the two. This appears to agree with the criticism leveled by Leibniz and Huygens. But he then immediately adds, "Gravity must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, I have left open to the consideration of my readers." According to the philosopher of science Alexandre Koyré, Newton believed gravity was a direct and continuous manifestation of the sovereign power of God in the material universe. (Koyré: *From the Closed World to the Infinite Universe,* pub. 1957)

Einstein also rejected the idea that gravity acts instantaneously, since it requires unmediated action-at-a-distance. In general relativity gravity propagates at the speed of light as waves of gravitational energy, similar to waves of electromagnetic energy. This raises a question: How can gravity unify an expanding universe, if its force propagates at light speed? Galaxies at the Hubble distance of 14 billion light-years (c/H_0) are currently receding at the speed of light, so they are no longer in causal contact with our region of space. The gravitational energy they emit now can never reach us. The model predicts the universe has a current radius of 46 billion light-years. Since galaxies are uniformly distributed, over 95 percent of all galaxies in the universe are beyond any possible physical interaction with our space region. If each region of space is causally isolated by time delays from almost all other regions of space, how can gravity dynamically unify all matter in the universe? How can spacetime be a coherent topological manifold generated by matter, if it is not causally unified by gravity? This question does not arise for the instantaneous force of Newtonian gravities.

To the extent that science can be certain about anything, it can be stated with certainty that Newton's internal law of gravity is absolute gravity. It, therefore, has a cosmic significance which has not been previously recognized. Following Einstein, a premier postulate of modern cosmology is: The universe is a finite sphere of matter with a uniform mass density. This postulate is consistent

with the law of internal gravity, which applies within any finite sphere with a uniform mass density. In Newtonian theory gravitational potential V is equal to the centripetal acceleration times the radius: $V = ar$. Multiplying the internal equation for acceleration (2) by the radius gives the gravitational potential for Newton's internal gravity.

$$a = \frac{4\pi G\rho r}{3} \quad \rightarrow \quad V = \frac{4\pi G\rho r^2}{3} \tag{3}$$

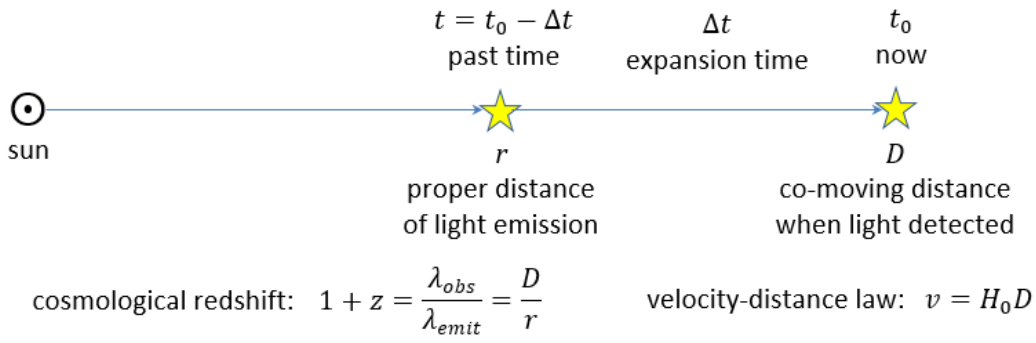
The gravitational potential of internal gravity increases in strength with distance, which means that gravitational time dilation and gravitational redshift also increase with distance. This is the opposite of the gravitational potential of external gravity, which decreases in strength as distance increases ($V = GM/r$). It is theoretically possible that the law of internal gravity might explain Hubble's redshift-distance relation.

5. Alternative Explanations for Galactic Redshifts in Two Expanding Models

This possibility is considered in a secular scientific paper I published last October, titled *A Static Universe Explanation for the Redshift-Distance Relation as an Effect of Gravitational Time Dilation*. [10] This 2021 paper demonstrates that the gravitational redshift caused by the internal form of gravity can explain Hubble's discovery in a static universe. Some key points from this paper are touched upon in what follows.

The first section of this paper gives a brief overview of the space expansion explanation for the redshift-distance relation.

Figure 5: **Galactic Redshifts in the Friedmann Expanding Model**



It requires time for the light emitted by a galaxy to reach us. During this travel time of light, the galaxy continues to recede from the proper distance *r,* where it emitted light, to a so-called co-moving distance *D,* where it is now when we detect its light. Cosmological redshift is determined by the ratio of the co-moving distance over the proper distance D/r, which is called the scale factor. The scale factor is how much the metrical unit used to measure distance has increased between the time of emission and the time of detection. It is this "metric expansion" of space which causes the wavelength λ (Greek letter *lambda*) of light to increase in size from the time it was emitted λ_{emit} to the time when it is observed λ_{obs}.

The receding velocity of the galaxy at the current time is given by the velocity-distance law and equals the Hubble constant multiplied by the co-moving distance. $v = H_0 D$ This law is formally derived from Friedmann's solution to Einstein's gravitational field equations.

$$H^2 = \frac{8\pi G\rho}{3} - \frac{kc^2}{a^2}$$

This is the defining equation for Friedmann's expanding model. It includes a "*k*-term" which quantifies the degree and type of spacetime curvature in the universe. In Friedmann's model the curvature of spacetime can result in "open," "closed" or "flat" universes. In the singular case where there is no spacetime curvature, space is "flat" and the value of the *k*-term equals zero. This term can be dropped from the Friedmann equation, since it has been determined over the last few decades that space is "flat;" that is, it is like the un-curved space of Euclidean geometry. A 2018 determination by the Planck satellite found the universe has no significant spacetime curvature. [11] Eliminating this term from the Friedmann equation leaves what is called the critical density equation.

$$H_0^2 = \frac{8\pi G\rho}{3} \qquad (4)$$

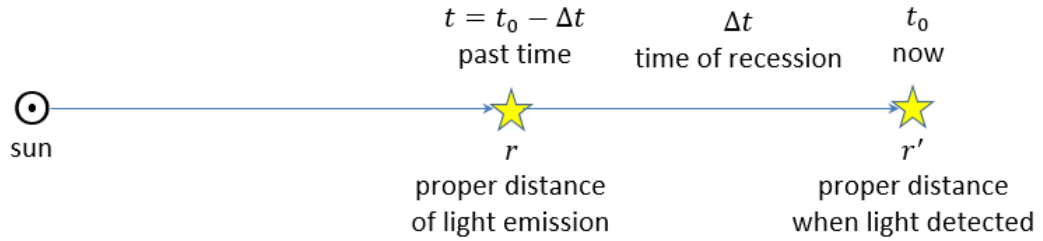
In this remarkable equation, the square of the Hubble constant H_0^2 equals a constant, which includes Newton's gravitational constant G, multiplied by the uniform mass density ρ of the universe. Conceptually, the square of the Hubble constant represents the energy of space expansion, which was initiated by some big bang event. The right hand side of the equation represents the energy of space contraction caused by Einstein's gravity. The critical density equation gives a total energy of zero for the system; i.e. the energies of expansion and contraction are equal, so the universe continues to expand until it reaches a state of stasis. A recently determined value of the Hubble constant is 73 kilometers per second per megaparsec ($73\ \mathrm{km/s/Mpc}$). For this value, the critical density equation gives a uniform mass density of $1 \times 10^{-26}\ \mathrm{kg/m^3}$, which is equivalent to six hydrogen atoms per cubic meter.

Although it is not mentioned in this paper, the book appears to support Einstein's postulate of a uniform mass density on large cosmic scales. A Mighty Messenger says the temperature of space is not absolute zero, because matter responds to "gravity presence and action" and "Practically speaking, space is not empty." (42:4.6) He goes on to say that the most nearly empty space in Nebadon contains about "one hundred ultimatons—the equivalent of one electron—in each cubic inch." This is equivalent to 33 hydrogen atoms per cubic meter. It seems reasonable that the emptiest space found within our region of the Milky Way galaxy has a mass density that is about 5.5 times greater than the mass density on intergalactic scales.

The second section of the paper reviews an alternative "Newtonian expanding model" proposed by Edward A. Milne in 1934. Milne accepted Einstein's postulate of a uniform mass density in the universe. He also accepted Einstein's special theory of relativity and the idea of a big bang. But he doubted the reality of space expansion, arguing it is an unnecessary hypothesis in any case. A central premise of his paper is: "Moving particles in a static space will give the

same observable phenomena as stationary particles in 'expanding' space." [12] This is the basic idea behind his alternative explanation for the redshift-distance relation. He demonstrates that a big bang event can be treated as an explosion of matter *in* static Euclidean space, instead of as a metric expansion *of* space in which matter is carried along by space.

Figure 6: **Galactic Redshifts in Milne's Newtonian Expanding Model**



Doppler redshift: $1 + z = \frac{\lambda_{obs}}{\lambda_{emit}} = 1 + \frac{v}{c}$ velocity-distance law: $v = H_0 r$

In Milne's model galactic redshifts are Doppler redshifts, and these occur at the moment light is emitted by a receding galaxy at a proper distance *r*. Unlike cosmological redshift, there is no change in the wavelength of light during the time it takes for the light to reach us. Doppler redshift equals the receding velocity of a galaxy divided by the speed of light. $z = v/c$ The velocity-distance law gives the velocity of a galaxy at that moment in the past when its light was emitted, not its velocity now. $v = H_0 r$ Rearranging the Doppler redshift equation $v = cz$ and substituting for v in the velocity-distance law gives Hubble's redshift-distance relation.

$$cz = H_0 r \quad \rightarrow \quad \frac{z}{r} = \frac{H_0}{c} \tag{5}$$

The Newtonian expanding model can explain the redshift-distance relation as Doppler redshifts, supporting Milne's assertion that space expansion is not necessary to explain this relation. Milne demonstrates the theoretical equivalence of his model with the Friedmann model by deriving Friedmann's equation from Newtonian theory. What follows is a very brief version of this derivation which only touches on a few of its key points.

In the classical equation for a gravitational system, the total energy (*E*) of the system is conserved and equals the kinetic energy (*KE*) plus the potential energy (*PE*) of the system.

$$E = KE + PE \quad \rightarrow \quad E = \frac{1}{2}mv^2 - \frac{GMm}{r}$$

There is no curved space in Milne's model. The equivalent of "flat" space in the Friedmann model occurs in Milne's model when the total energy of the system equals zero ($E = 0$). When this is the case, the kinetic energy of a galaxy's receding velocity at a distance r equals its gravitational potential energy at the same distance, and matter expansion continues until a state of stasis is reached. Simplifying and rearranging gives the gravitational potential in Milne's model.

$$\frac{1}{2}mv^2 = \frac{GMm}{r} \quad \rightarrow \quad v^2 = \frac{2GM}{r} \tag{6}$$

The square of the receding velocity of a galaxy equals twice the gravitational potential. Equation (6) is identical to the classical equation for escape velocity. By Newton's shell theorem, the mass for this potential equals the uniform mass density ρ multiplied by the volume of a sphere of radius *r*. Substituting $\rho(4/3)\pi r^3$ for M in the above equation (6):

$$v^2 = \frac{2G\rho((4/3)\pi r^3)}{r} \quad \rightarrow \quad v^2 = \frac{8\pi G\rho r^2}{3} \tag{7}$$

Equation (7) is the internal form of the gravitational potential equation in Milne's model. It equals twice the gravitational potential for internal gravity given in equation (3), since it is based on the escape velocity (eq. 6). Squaring the velocity-distance relation in the Milne model $v = H_0 r$ and substituting $H_0^2 r^2$ for v^2 in equation (7) reproduces the critical density equation (4).

$$H_0^2 r^2 = \frac{8\pi G\rho r^2}{3} \quad \rightarrow \quad H_0^2 = \frac{8\pi G\rho}{3}$$

Milne's derivation of Friedmann's equation shows that Newton's theory of gravity describes the same relation between the Hubble constant and uniform mass density as Friedmann's solution of Einstein's field equations. It demonstrates that Newton's theory can be legitimately applied on very large cosmic scales.

Subsequent analyses of his work have validated this "Newtonian derivation" of the Friedmann equation. [13] A 1965 paper by C. Callan, R. H. Dicke, and P. J. E. Peebles concluded the Milne model is sufficient for "a completely correct discussion of the dynamics of expansion in a region where both general relativity and Newtonian mechanics are equally valid." [14] General relativity and Newtonian gravity are equally valid in the region of a weak gravitational field, where velocities are much less than the speed of light. The extent of the region in which the Milne model and the expanding model give very similar predictions extends out to several billion light-years. [15]

6. Explaining Galactic Redshifts in a Static Model

The third section of the paper shows that the gravitational potential of Newton's internal form of gravity can explain the redshift-distance relation in a static universe of Euclidean space.

Gravitational potential is measured in units of velocity squared, but this does not necessarily mean that a body in a gravitational system has a velocity. For instance, a body at rest on the surface of a non-rotating planet has a gravitational potential but no velocity. In this case, velocity squared represents an *energy density* that is equal to the gravitational potential energy of a body divided by its mass $v^2 = PE/m$; energy density is energy per unit mass. This idea of energy density is consistent with Einstein's equation for the equivalence of energy and mass $E = mc^2$. The speed of light squared equals the total possible work energy divided by the rest mass $c^2 = E/m$. The mass is at rest and not moving at the velocity of light; c^2 represents the energy density which is equal to the total work energy per unit mass.

If the receding velocities of galaxies *are apparent and not real*, Milne's expanding model becomes a static model, and the velocity squared in Milne's gravitational potential equation (7) represents an energy density, instead of a velocity. In Newtonian theory the energy density of a gravitational potential is equivalent to a centripetal acceleration multiplied by a radial distance $V = v^2 = ar$. Making this substitution for v^2 in equation (7) shows that the centripetal acceleration acting on a distant galaxy is directly proportional to its distance.

$$v^2 = \frac{8\pi G\rho r^2}{3} \quad \rightarrow \quad a = \frac{8\pi G\rho r}{3} \tag{8}$$

The centripetal acceleration of cosmic (absolute) gravity is twice that of Newton's internal form of gravity, since it is derived from the energy density that is equal to the total possible gravitational potential. Redshift z is defined as the ratio of velocity over the speed of light $z = v/c$. Squaring this equation and rearranging, $v^2 = c^2z^2$. Substituting c^2z^2 for velocity squared in the equation for total gravitational potential (7), rearranging, and taking the square root of both sides gives the static model equation for gravitational redshift at a distance r and also the redshift-distance relation.

$$c^2z^2 = \frac{8\pi G\rho r^2}{3} \quad \rightarrow \quad z = \sqrt{\frac{8\pi G\rho r^2}{3c^2}} \quad \text{or} \quad \frac{z}{r} = \sqrt{\frac{8\pi G\rho}{3c^2}} = \frac{H_0}{c} \tag{9}$$

The gravitational redshift caused by internal (absolute) gravity equals the square root of the ratio of Milne's gravitational potential (eq. 7) divided by the square of the speed of light. The term under this first radical sign is the internal form of the term in general relativity which determines the degree of gravitational time dilation (see next paragraph). Time dilation increases as the distance *r* increases. The redshift over the distance equals the square root of the right hand side of the critical density equation (4) divided by the square of the speed of light. Since $H_0 = \sqrt{8\pi G\rho/3}$, the ratio of redshift over distance equals the Hubble constant over the speed of light, which explains the linear redshift-distance relation. This is the same relation $z/r = H_0/c$ found in Milne's expanding model (eq. 5), but it is derived from static gravitational potential instead of from velocity induced Doppler redshift.

Gravitational redshift is an effect of gravitational time dilation, which is described by a static solution to Einstein's field equations found by Karl Schwarzschild in 1916. In Schwarzschild's equation the external form of gravitational potential divided by the speed of light squared $(2GM/rc^2)$ is the term which determines the degree of gravitational time dilation. Under the internal law of gravity, the ratio of dilated time t at a distance r over the un-dilated time t_0 minus one equals the gravitational redshift.

$$\frac{t}{t_0} - 1 = z = \sqrt{\frac{8\pi G\rho r^2}{3c^2}} \tag{10}$$

It follows from the first equality in this expansion of equation (9) that gravitational time dilation is directly proportional to cosmic (gravitational) redshift, as shown in equation (11).

$$t = t_0(1 + z) \tag{11}$$

The linear increase in time dilation with redshift means the universe has a temporal structure. Proceeding outward there are concentric shells of uniformly dilated time, in which the degree of time dilation increases with redshift. This is an extraordinary conclusion. What is even more surprising is that equation (11) is predicted by the expanding model; there is a linear relation between cosmic time dilation and cosmological redshift. Both are explained by the motion of space expansion.

This time dilation was predicted as early as 1939. [16] It was first empirically verified about 20 years ago from the light curves of Type Ia supernovae. These light curves plot the rise and fall of the luminosity of these supernovae over time, which is on the order of about a month. It has been confirmed that the light curve of a supernova at a redshift of z has a duration that is $(1 + z)$ times longer than that of a nearby supernova. [17] [18] The duration of the supernova explosion is longer, because time dilation causes all physical processes to slow down relative to our frame of reference. Space expansion causes a kinetic time dilation that is proportional to cosmological redshift. In the static model gravitational potential causes a static time dilation that is proportional to cosmic redshift.

The redshift-distance relation is considered the primary body of evidence supporting the hypothesis of space expansion. This evidence is equally supportive of gravitational time dilation and redshift. The highly uniform temperature of the cosmic microwave background (CMB) radiation discovered in 1964 is considered a secondary body of evidence which supports the hypothesis of space expansion. The static model can also explain this phenomenon.

In the expanding model, all of the CMB radiation was supposedly emitted about 380,000 years after the big bang, when the universe was filled with an opaque ionized plasma which had a temperature of $3{,}000$ °K, due to the kinetic motion of subatomic particles. Hydrogen atoms formed at this temperature, and the CMB radiation was emitted. This thermal radiation has since cooled to 2.725 °K as a result of space expansion. This change in temperature is described by a linear redshift-CMB-temperature relation.

$$T = T_0(1 + z) \tag{12}$$

The CMB radiation at a redshift z is older and therefore its temperature T is warmer than the observed temperature of $T_0 = 2.725$ °K by a factor of $(1 + z)$. This relation between redshift and CMB temperature has been empirically confirmed. The temperature of the CMB radiation at a redshift can be indirectly measured by the atomic fine-structure energy levels this thermal radiation excites: The CMB radiation field increases these energy levels from their ground-states in a predictable way. The fine-structure energy levels of different atomic elements associated with high

redshift objects ($z \geq \sim 2$) show the CMB temperatures at these redshifts are consistent with the prediction of $T = T_0(1 + z)$. [19][20][21]

The static model predicts exactly the same redshift-CMB-temperature relation (eq. 12). In the static model the CMB temperature of 2.725 °K is highly uniform everywhere in the universe and is constant over time. (In the expanding model it is continuously decreasing over time.) It is caused by the kinetic motion of particles, which have a uniform mass density of 10^{-26} kg/m^3. (*cf.* 42:4.6) Despite the continuous origin of this thermal radiation at different distances, the observed temperature is highly uniform due to three relativity effects of the gravitational potential of internal (absolute) gravity – relativistic time, mass, and temperature. These are incorporated in an expansion of equation (10).

$$1 + z = \frac{t}{t_0} = \frac{m}{m_0} = \frac{T}{T_0} = 1 + \sqrt{\frac{8\pi G\rho r^2}{3c^2}} \qquad (13)$$

This 2021 paper demonstrates that the relativity effects of the gravitational potential of internal (absolute) gravity can explain the redshift-distance relation and the uniform temperature of the CMB radiation. This establishes the static model as a credible alternative to both the Friedmann and Milne expanding models.

7. The Angular Velocity Constant for the Revolving Model

The paper on the static model ends at this point; it does not address what type of motion the Hubble constant represents in this model. In the Friedmann and Milne expanding models it represents a linear velocity. Its dimensions resolve to one divided by a unit of time t.

$$H_0 \; units = \frac{v}{d} = \frac{(d/t)}{d} = \frac{1}{t}$$

This linear velocity constant gives the rate of universal recession from a location due to space expansion. There is no space expansion in the static model. Still, the redshift-distance relation in this model is given by the ratio of the Hubble constant divided by the speed of light (eq. 9). $z/r = H_0/c$ The only possible universal motion relative to a location in a static universe is a circular motion.

The dimensions of one per unit time $(1/t)$ are equivalent to the dimensions for angular velocity ω (Greek letter *omega*), which has units of radians per unit time (rad/t). One radian is the ratio of a circular arc with a length equal to the radius of a circle over the radius of the circle. This makes the radian a dimensionless unit, so radians over time resolves to one over units of time. In the expanding model the Hubble constant is a universal linear velocity constant. In the static model it is a universal angular velocity constant. For $H_0 = 73$ km/s/Mpc the equivalent angular velocity constant is $\omega_0 = 2.37 \times 10^{-18}$ rad/sec. This change from a linear to an angular velocity constant changes the static model into a *revolving* static model.

This change to an angular velocity constant necessarily follows from the fact that the static model is governed by the directly proportional force of internal (absolute) gravity (eq. 8). The force of absolute gravity is described by Hooke's law $F = kr$, and this force law results in simple harmonic motion (SHM). This is a specific type of periodic motion which has a constant frequency that is determined by the force constant *k.* This constant equals mass *m* multiplied by the square of an angular velocity constant. $k = m\omega_0^2$ In the potential energy equation for SHM, the constant *k* can be replace by $m\omega_0^2$.

$$PE = \frac{1}{2}kr^2 \quad \rightarrow \quad PE = \frac{1}{2}m\omega_0^2 r^2$$

Dividing both sides of this potential energy equation by mass *m* gives the potential – the energy density – for a system in simple harmonic motion which is either in linear oscillation or angular rotation.

$$\frac{PE}{m} = \frac{1}{2}\frac{m\omega_0^2 r^2}{m} \quad \rightarrow \quad v^2 = \frac{1}{2}\omega_0^2 r^2 \qquad (14)$$

The energy density of SHM at *r* is equal to the energy density of the gravitational potential for internal gravity at *r* given by equation (3).

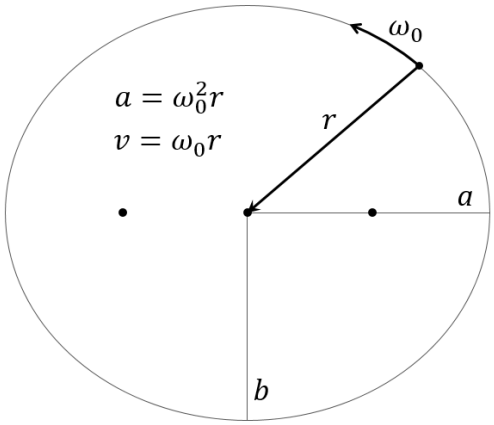
$$v^2 = \frac{4\pi G\rho r^2}{3} \qquad (3)$$

Since the energy densities are equal, the right hand sides of these two equations (3 & 14) can be set equal to each other and after rearranging:

$$\frac{1}{2}\omega_0^2 r^2 = \frac{4\pi G\rho r^2}{3} \quad \rightarrow \quad \omega_0^2 = \frac{8\pi G\rho}{3} \qquad (15)$$

The angular velocity constant squared equals the right hand side of the critical density equation (4). This equals the square of the Hubble constant, which proves that $\omega_0^2 = H_0^2$. This also demonstrates that the SHM of the revolving model is consistent with the critical density equation, which can be derived from it.

Figure 7: **Equations of Motion in the Revolving Model**



The equations of motion in the revolving model are determined by the angular velocity constant ω_0. All orbits around Paradise are elliptical (11:8.2) and follow "the exact gigantic outlines of Paradise," (15:4.1) which is the pattern ellipse. The Paradise ellipse has a semi-major axis (a) of 7 units and a semi-minor axis (b) of 6 units. (11:2.2) This gives it two foci at ± 3.61 units from the center on the major axis. Paradise is essentially flat with a depth of 0.6 units (one-tenth the east-west diameter).

These elliptical orbits are governed by absolute (internal) gravity, which is proportional to the distance from Paradise. This type of central force is directed toward the geometric center of an ellipse, as proven by Newton in Book I, Proposition 10. The direction of the force of absolute gravity must be towards Paradise to be consistent with epochal revelation.

> The Father is always to be found at this central location. Did he move, universal pandemonium would be precipitated, for there converge in him at this residential center the universal lines of gravity from the ends of creation. (11:1.4)

The question can be raised if there is another type of gravity besides a directly proportional one which can act in this way. The definitive answer is no. In 1873 the French mathematician Joseph Bertrand developed an analytic proof, known as Bertrand's theorem, which considers all possible types of central force which can produce stable periodic orbits. He demonstrates conclusively that there are only two types which can produce these orbits: One that varies inversely with the square of the distance and one that varies directly with the distance. Since 'the universal lines of gravity from the ends of creation' converge at Paradise, absolute gravity can only be a directly proportional central force.

The directly proportional force of absolute gravity causes SHM which is governed by an angular velocity constant. The basic equations of motion for the SHM of the revolving model are determined by ω_0.

1. Centripetal acceleration is a function of distance. $a = \omega_0^2 r$
2. Orbital velocity is a function of distance. $v = \omega_0 r$
3. Orbital position and distance as a function of time t:
    a) $x = a \cdot \cos \omega_0 t$
    b) $y = b \cdot \sin \omega_0 t$
    c) $r = \sqrt{x^2 + y^2}$
4. Orbital period is a function of angular velocity. $T = 2\pi/\omega_0$

Under SHM all orbits have the same period of revolution, regardless of the distance from the geometric center of the orbit. For an angular velocity constant of $\omega_0 = 2.37 \text{ x } 10^{-18}$ rad/s, all orbits around Paradise have the same period of revolution of 84.2 billion years.

The idea of a revolving universe gleaned from certain key ideas in *The Urantia Book* can be developed into a scientific model based upon well-established physical theory and knowledge. This model can explain the redshift-distance relation and the highly uniform CMB temperature as credibly as the expanding model can. Actually, it should be considered more credible, since Newton proves that internal (absolute) gravity is a universal law, while the reality of space

expansion is still unconfirmed. Since both models can explain these primary and secondary bodies of data, determining which model is correct depends upon how well each can explain other types of observational evidence.

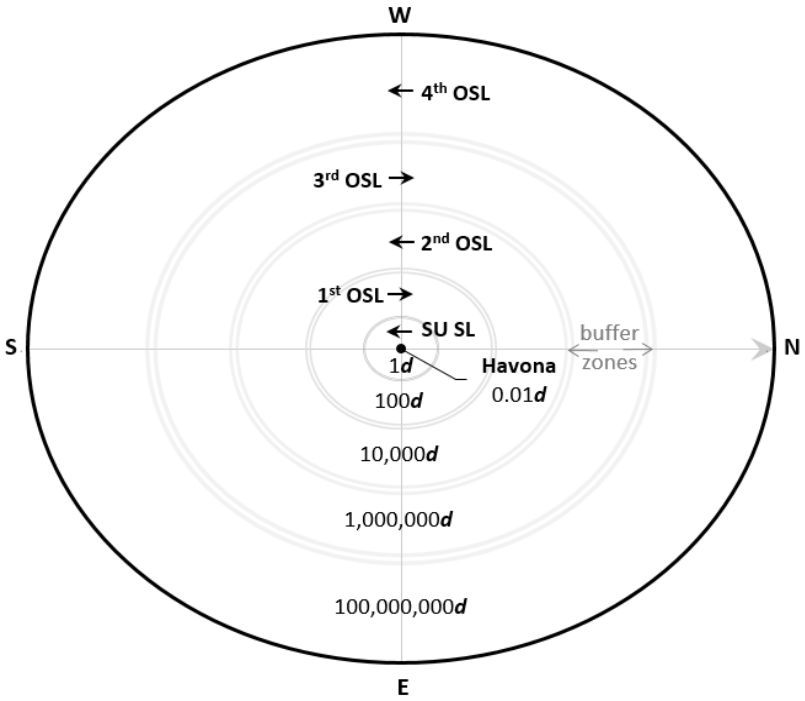
The revolving model predicts a rate of rotation ω_0 for the universe. Since neighboring space levels revolve in opposite directions, this rotation is potentially detectable. The expanding model makes no such prediction. However, this angular velocity appears to be too small to measure currently (0.016 mas/year or 4.3×10^{-9} degrees/year).

The book describes concentrically arranged concentrations of galaxies on a universal plane. The dynamic of universal gravitational revolution can explain the planar organization of matter on large cosmic scales, because this dynamic occurs relative to a universal axis. The vector of the angular momentum of a rotating mass is along the axis of its rotation and "… gravity always acts preferentially in the plane perpendicular to the mass …" (11:8.9) On the other hand, space expansion causes the universal dispersion of matter from every point in every direction. This dynamic cannot result in the planar organization of matter on large cosmic scales.

The 2019 paper on *The Law of Absolute Gravity* identifies two large planar structures which are consistent with the superuniverse and first outer space levels. [7] These are briefly reviewed here and a third much larger planar structure is identified.

8. Identifying the Superuniverse Space Level

Figure 8: **Gravitational Plane of the Master Universe**

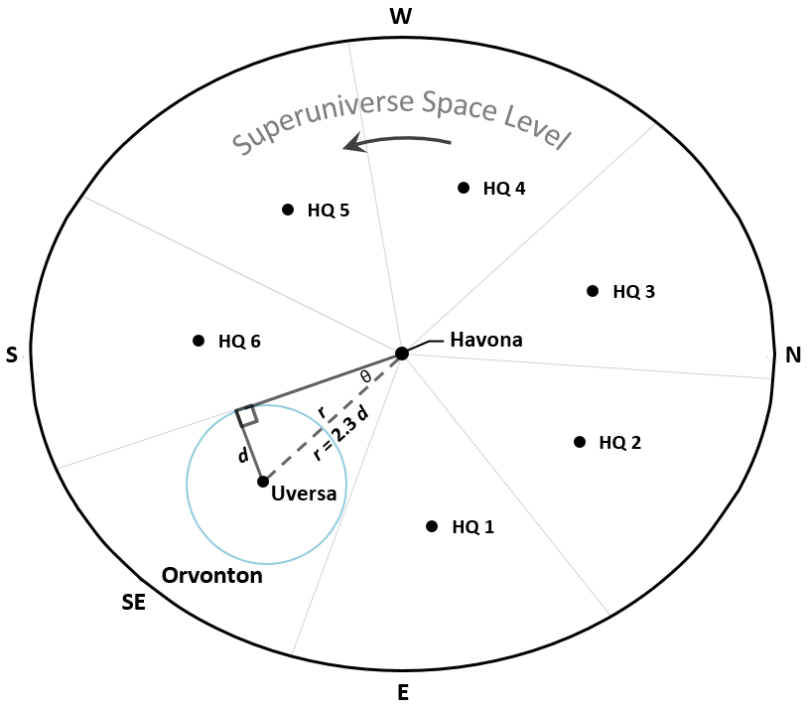


There are six elliptical space levels centered on the Isle of Paradise. These are concentrically arranged on the gravitational plane of the master universe. (12:1.4-9) These space levels are not shown to scale in figure 8, because each space level is 100 times larger than the one it encompasses. This is an inference based on the width of the buffer zones (12:1.14-15) between space levels. Absolute direction and orientation in the master universe are determined by Paradise, which is longer in the north-south direction than it is in the east-west direction.

> These differences in dimensions, taken in connection with its stationary status and the greater out-pressure of force-energy at the north end of the Isle, make it possible to establish absolute direction in the master universe. (11:2.3)

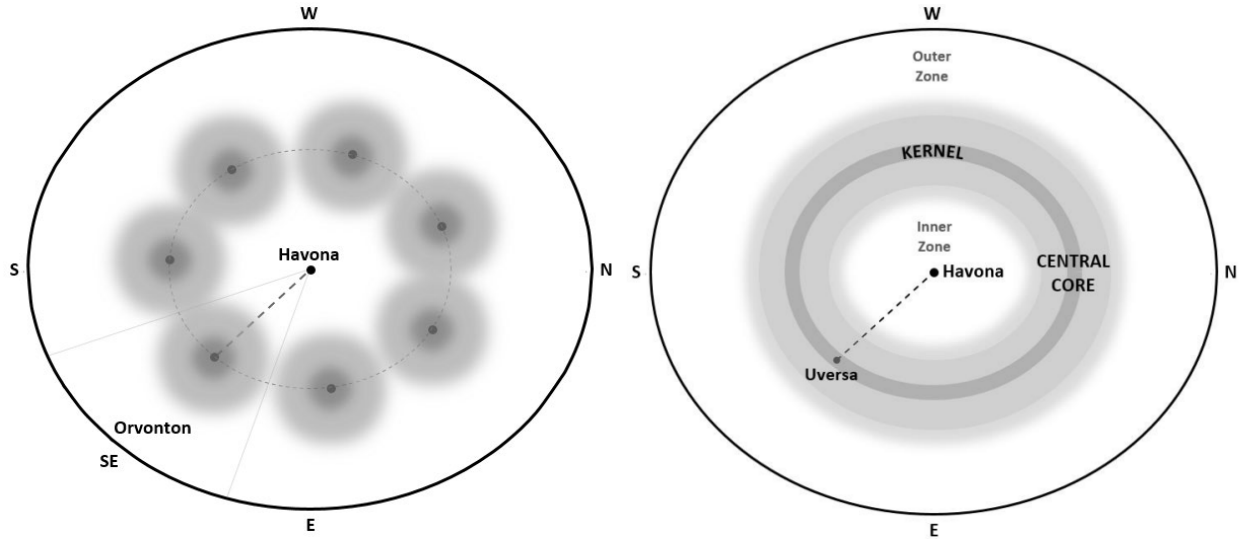
Figure 8 is a polar view looking down at the surface of upper Paradise with Paradise north pointing to the right.

Figure 9: **The Chart of the Superuniverse Space Level**



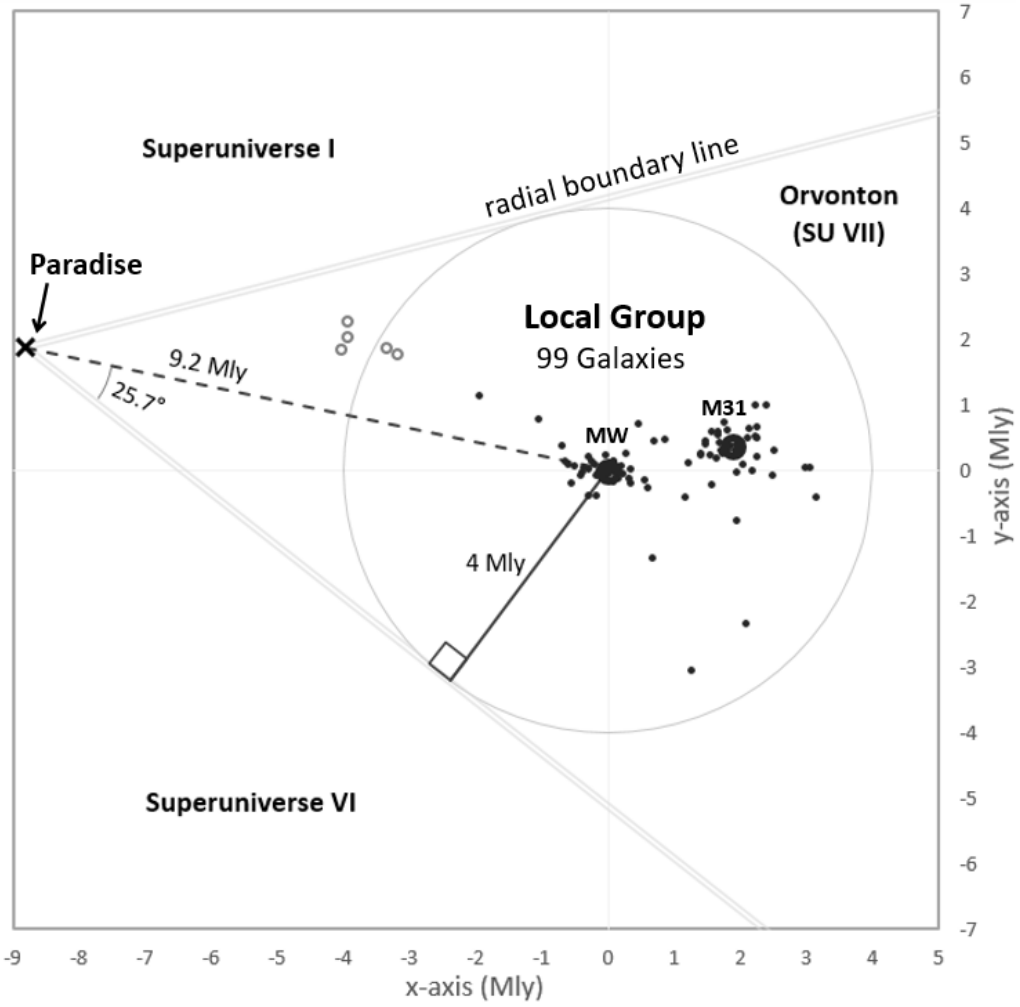
The elliptical superuniverse space level is "divided into seven stupendous segments" arranged around Paradise, as shown in figure 9. (15:0.2) Uversa is the headquarters world of our superuniverse of Orvonton and is located near the center of its wedge-like "space segment." (15:7.1) Uversa is more than 200,000 but less than 250,000 light-years from us. (32:2.11) Based on the geometry of our space level, the distance *r* from Uversa to Paradise is 2.3 times the shortest distance d from Uversa to the radial boundary line of the space segment of Orvonton. ($r = d/\sin\theta = 2.3d;$ for $\theta = 25.7°$)

Figure 10: **Density of Galaxies around the HQ Worlds Forms a Central Core**



The galaxies in Orvonton orbit Uversa (15:3.13) and the same pattern should hold in the other six superuniverses. (Figure 10) These seven concentrations of galaxies around the headquarters worlds form a dense elliptical ring of galaxies, which can be referred to as the *central core*. The region between the outer borders of the central core and the superuniverse space level can be referred to as the *outer zone*. The region inside the inner border of the central core can be referred to as the *inner zone*.

Figure 11: **The Local Group of Galaxies is the Central Portion of Orvonton**

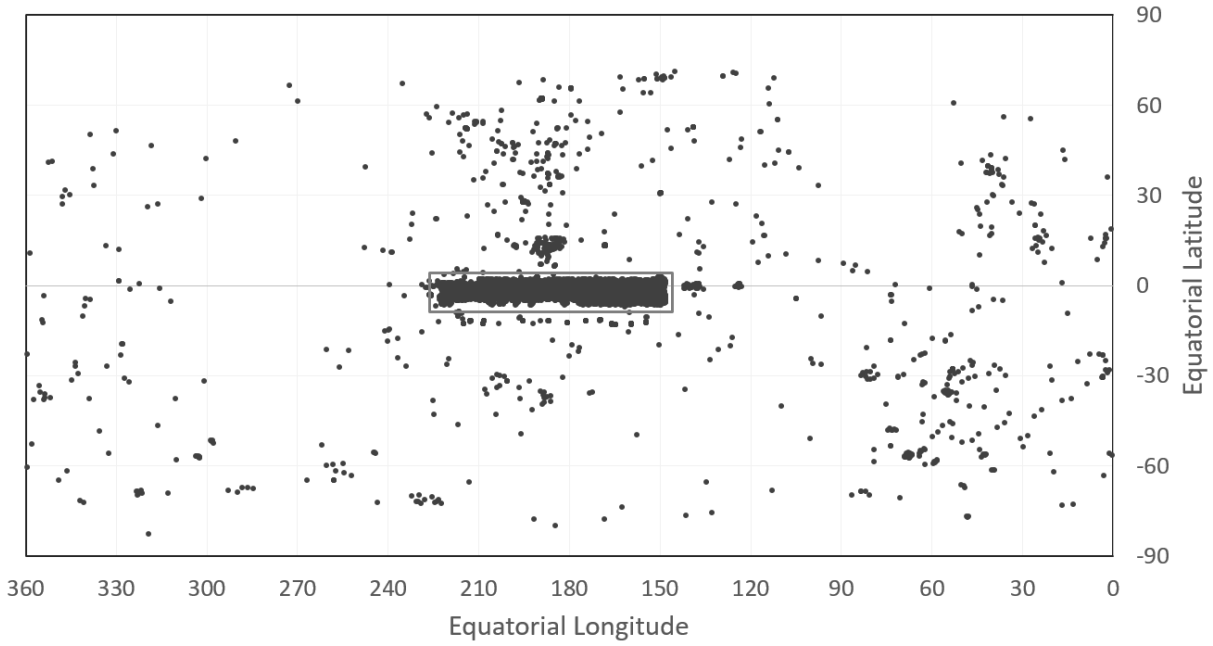


The Milky Way (MW) is a member of a cluster of galaxies called the Local Group. It was first recognized by Hubble in 1936, who identified eleven galaxies as members. [6] As of June 2019, a total of 99 galaxies have been identified as definite members of this group. These member galaxies are listed in the Appendix to *The Law of Absolute Gravity*. [7] Over the course of almost a century, it has been confirmed that this cluster of galaxies is bound together by gravity and moves together as a whole unit; wherever the Milky Way goes all of the other Local Group galaxies go.

The Milky Way is at/near the center of Orvonton: "The vast Milky Way starry system represents the central nucleus of Orvonton." (15:3.1) Everything in Orvonton revolves around Uversa and the Milky Way, (15:3.13) so it must all be gravitationally bound to the Milky Way, 'the central nucleus of Orvonton.' Since the galaxies in the Local Group are gravitationally bound to the Milky Way, which revolves with Uversa around Paradise, (15:3.14) these galaxies must also revolve around Paradise. Therefore, the Local Group of galaxies must be the central part of the superuniverse of Orvonton. This conclusion is consistent with the statement, "Of the ten major divisions of Orvonton, eight have been roughly identified by Urantian astronomers." (15:3.4) The date given for this statement of 1934 (31:10.22) is near 1936 when Hubble published his finding that there are at least eleven galaxies in the Local Group.

The Local Group has a radius of $\sim 4 \pm 0.5$ million light-years (Mly), although there are estimates as large 5 Mly and as small as 3.5 Mly. Assuming the 4 Mly radius of the Local Group is the shortest distance from Uversa to Orvonton's radial boundary line, the distance from Uversa to Paradise should be 2.3 times this or 9.2 Mly, based on the revealed chart of the grand universe. The distance to the farthest border of the superuniverse space level should then be about 27.6 Mly. So, the galaxies in the other six superuniverses should be found within about 32 Mly of us.

Figure 12: **All-Sky Chart Showing Galaxies at Distances Between 5 and 32 Mly**



A 2018 query of NASA's Extragalactic Database for all galaxies which are more than 5 Mly and less than 32 Mly distant returned 5,162 galaxies. More than two-thirds or 3,705 galaxies are concentrated in a belt 75 degrees of longitude in length which runs along the celestial equator. These galaxies were identified by the 2-degree Field Galactic Redshift Survey conducted between 1997 and 2002. The box outlining this belt is the 2dF survey window.

Figure 13: **Polar View of 3,705 2dF Galaxies**

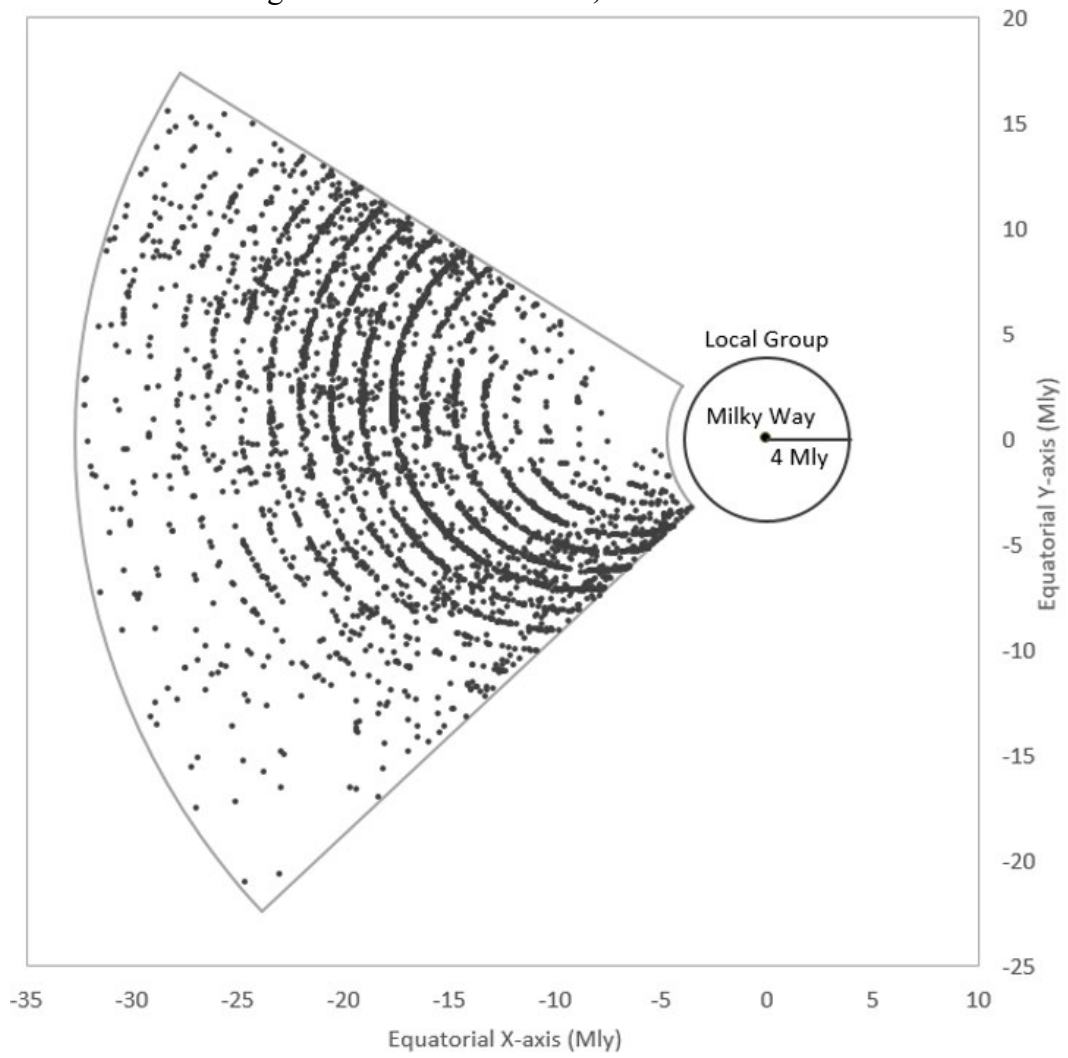


Figure 13 is a polar view of these 3,705 galaxies plotted on the equatorial plane which shows them spread out in a fan-like pattern. The outline of the 2dF survey area on the equatorial plane is shown out to 32 Mly.

Any concentration of galaxies in the survey area will become apparent, if those galaxies where the galactic density is below some minimum are filtered out. Plotting only those galaxies where the density is above some minimum should reveal the central core, where the galactic density is greater. Filtering out those galaxies where the density is lower can be compared to taking an x-ray of the data; the resulting 'photographic negative' shows where the density of matter is greater and 'blocks' more of the 'x-rays.'

Figure 14: **Polar View of 2,341 Galaxies – Density Filter of at least 85 gal/Mpc^3**

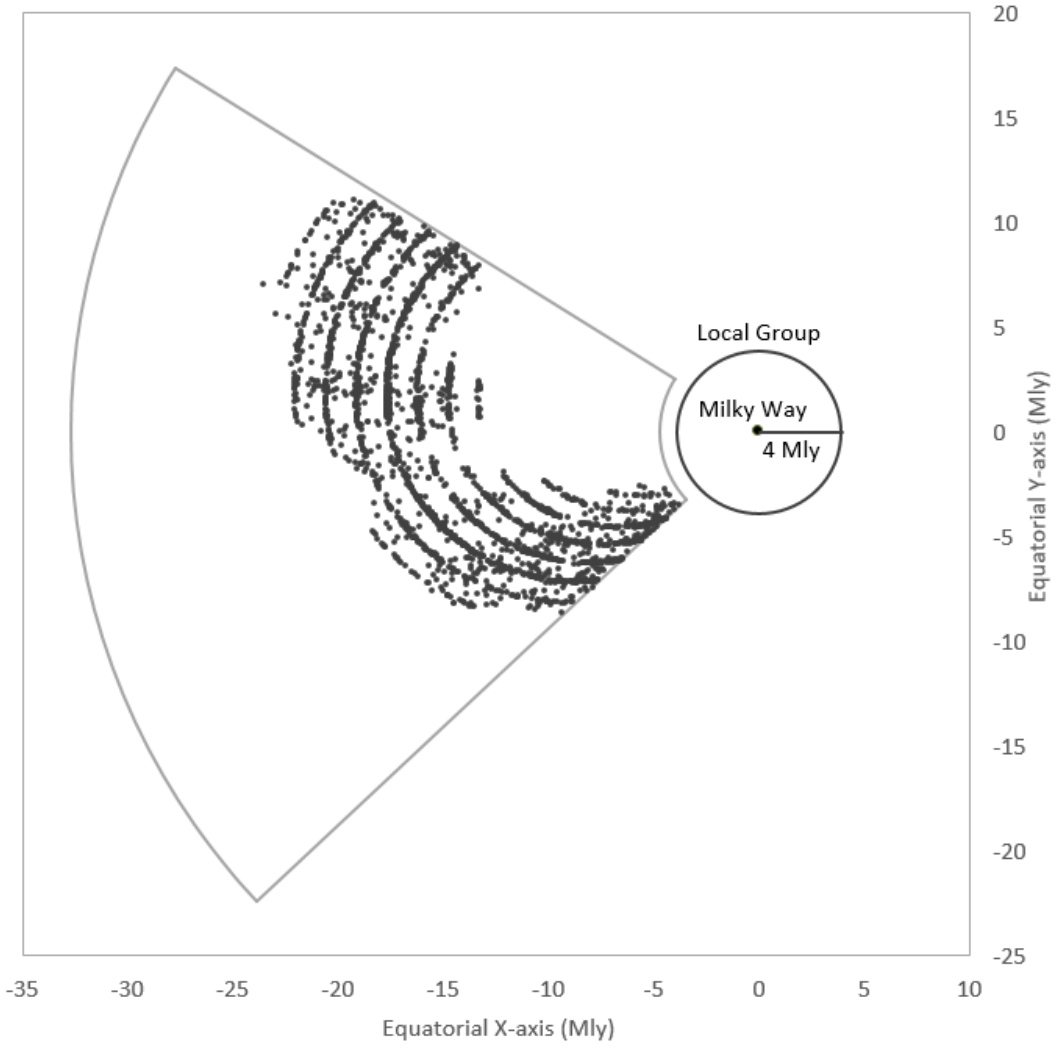
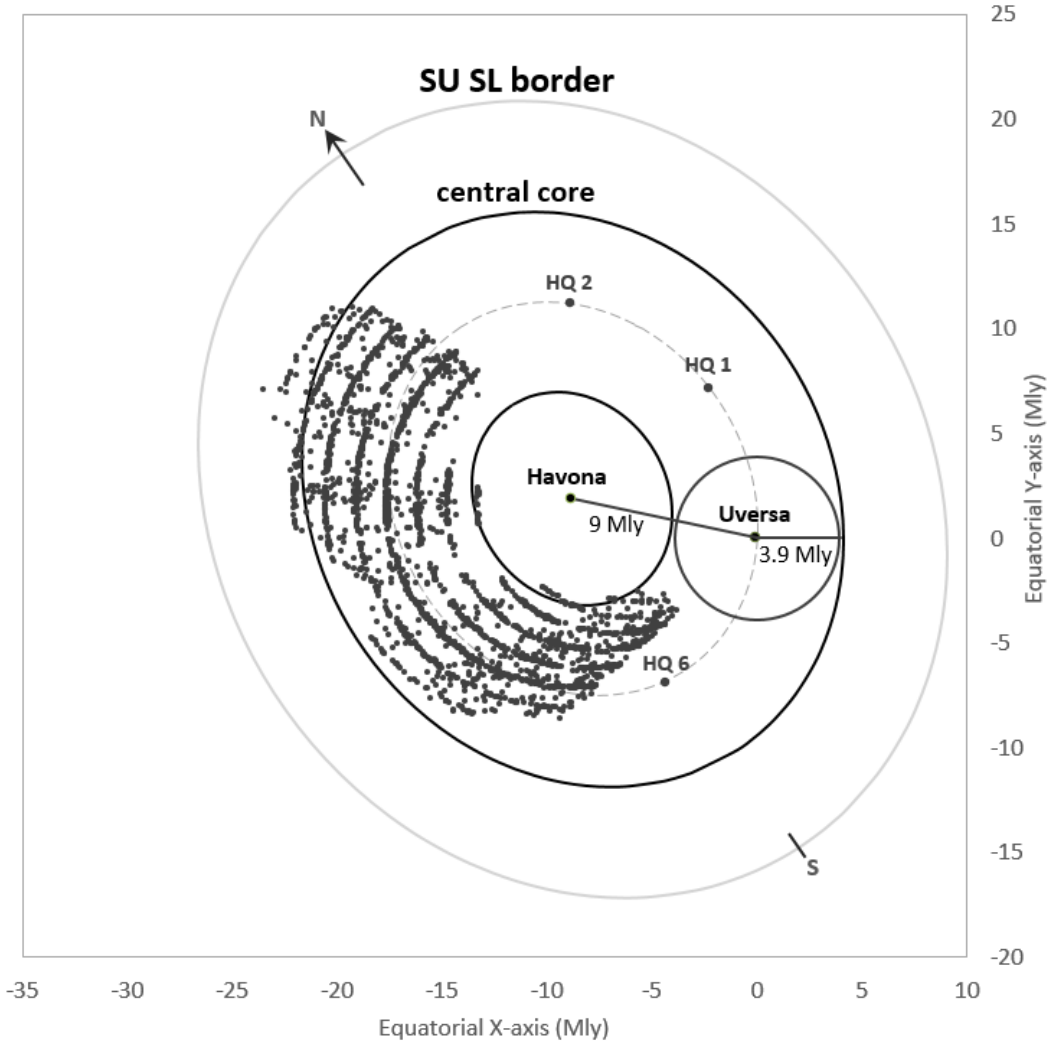


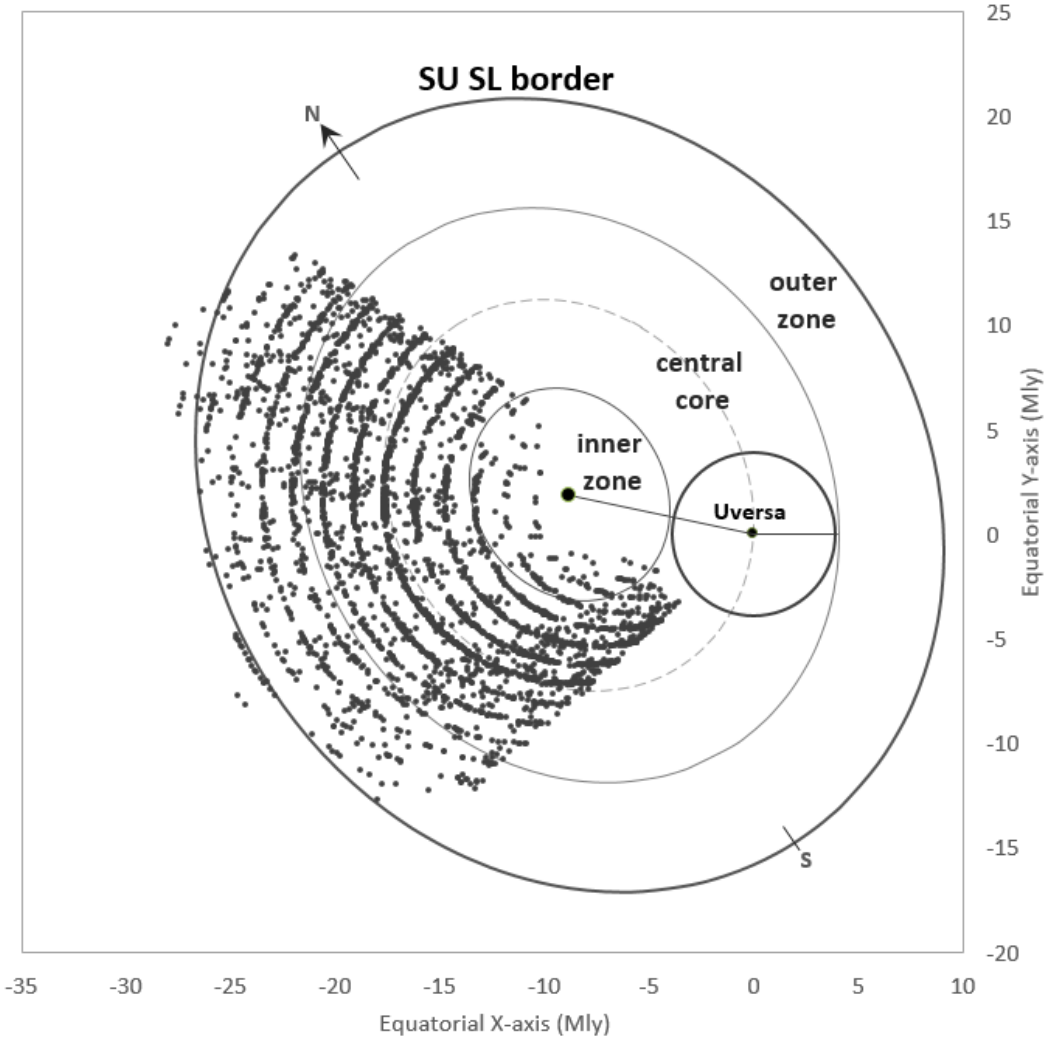
Figure 14 is a plot of only those galaxies where the galactic density is at least 85 galaxies per cubic megaparsec. It shows a dense concentration of galaxies forming an arc-like structure to the left of the Local Group. The dynamic relationship between this region of higher galactic density and the Local Group becomes apparent when this plot is compared to a chart of the grand universe.

Figure 15: **The Central Core of the Superuniverse Space Level: 85 gal/Mpc^3**



Overlaying the chart of the grand universe scaled to a shortest radius of 3.9 Mly for Orvonton shows a good fit between this arc of galaxies and the central core of the superuniverse space level. The center of this ring-like elliptical structure is 9 Mly from us, which is consistent with the 9.2 Mly to Paradise expected. The density of galaxies within this ring is about nine times greater than the average density within 32 Mly. The good fit of this cosmic structure with the central core of the superuniverse space level is relatively conclusive proof of its existence.

Figure 16: **The Outer Border of the Superuniverse Space Level: 20 gal/Mpc^3**

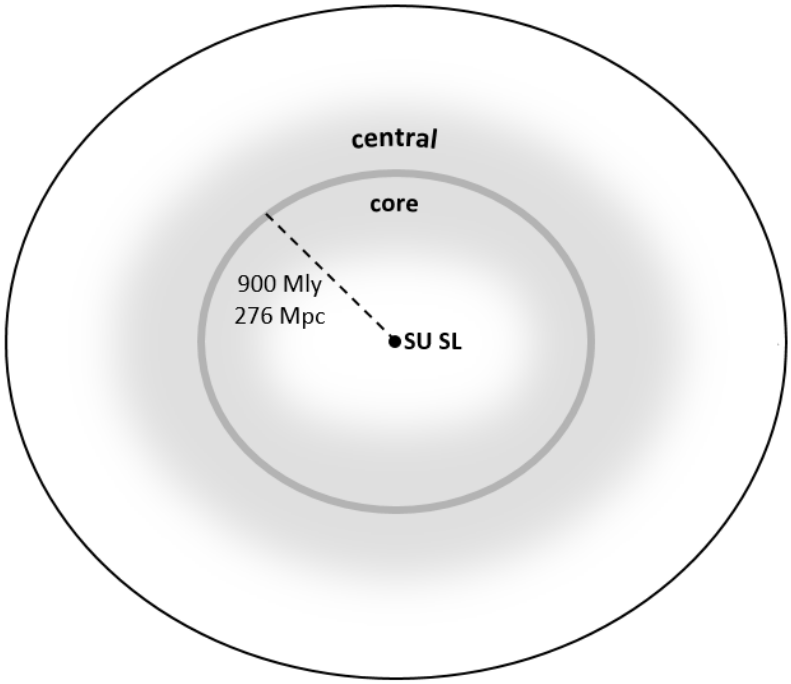


Lowering the minimum galactic density from 85 to 20 gal/Mpc^3 produces the plot in figure 16. An overlay of the chart of the grand universe shows a good fit between this plot and the elliptical outer border of the superuniverse space level. The density in the outer zone increases from 20 gal/Mpc^3 at the superuniverse border to 85 gal/Mpc^3 at the outer border of the central core. The density in the inner zone decreases from 85 gal/Mpc^3 at the inner border of the central core to 20 gal/Mpc^3 moving inward towards Paradise. These complementary density gradients prove the existence of the elliptical ring of galaxies which is the central core beyond a reasonable doubt. Consequently, the location of the Isle of Paradise can be identified with a reasonably high degree of confidence.

9. Identifying the First Outer Space Level

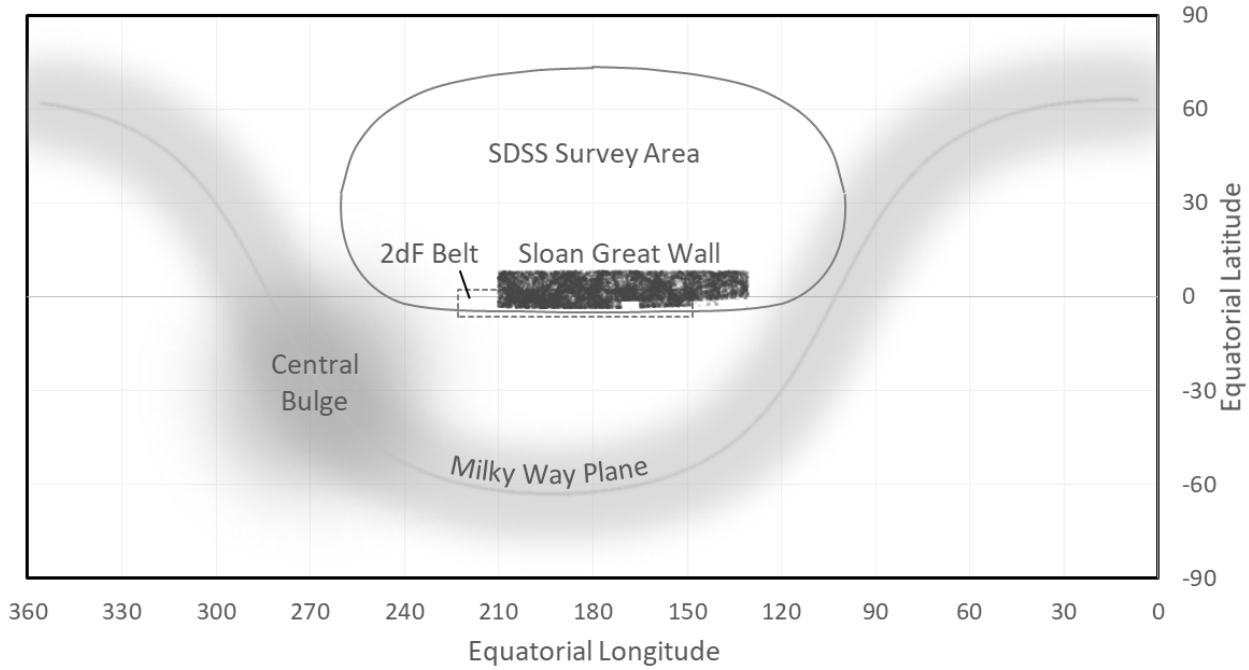
The concentric space levels revolve in alternating directions around Paradise. (11:7.9) There is a buffer zone of "relatively quiet space" (11:7.7) between the superuniverse and first outer space levels that is about half a million light-years wide. (12:1.14) There is another buffer zone of "quiescent space activities" between the first and second outer space levels that is 50 million light-years (Mly) wide, or 100 times wider. (12:1.15) This implies the widths of successive space levels also increase by a factor of 100. Since the radius of the outer border of the superuniverse space level is 18 Mly, the radius of the first outer space level should be about 1.8 billion light-years (Bly).

Figure 17: **Expectations for the First Outer Space Level**



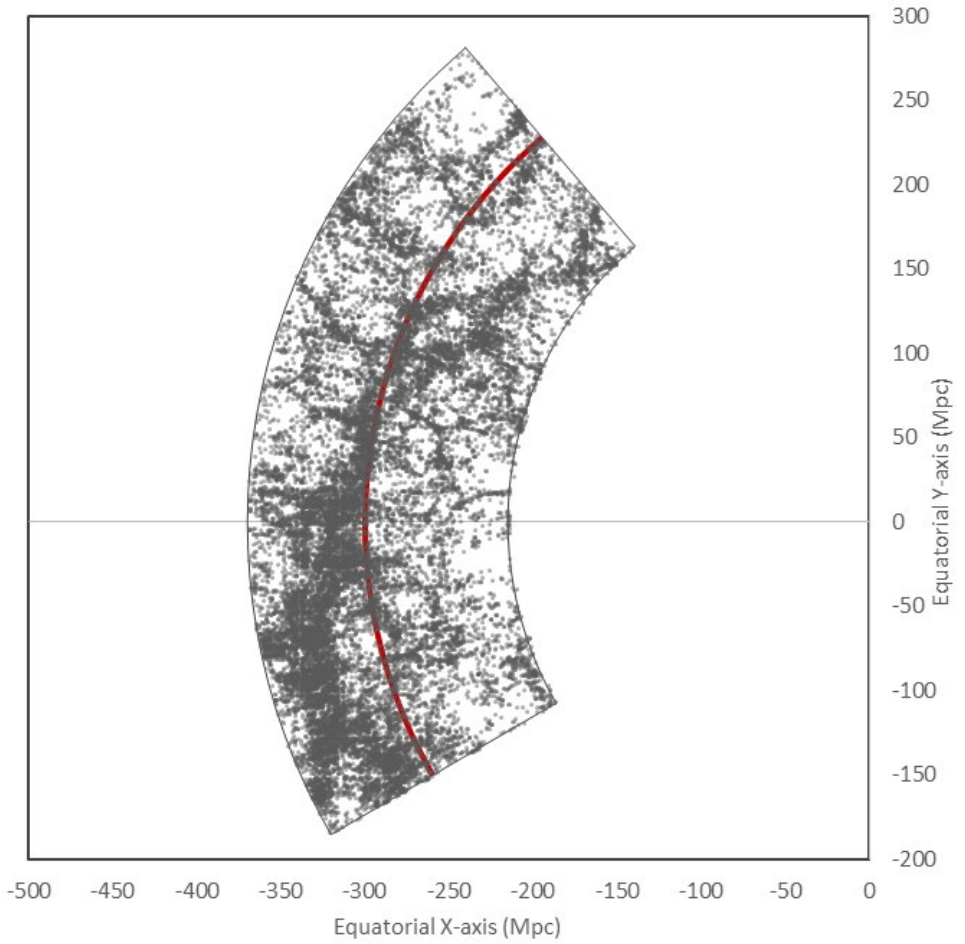
The space levels are the highest level of universe organization and are similar in nature. The ring of galaxies forming the central core of the superuniverse space level is a pattern reflected in the first outer space level. "You may visualize the first outer space level, where untold universes are now in process of formation, as a vast procession of galaxies swinging around Paradise…" (11:7.4) This 'vast procession of galaxies' includes "a continuous belt of cosmic activity encircling the whole of the known, organized, and inhabited creation." (12:1.14) This 'continuous belt' is a "clustering of at least seventy thousand aggregations of matter, each of which is greater than any one of the present superuniverses." (31:10.19) This 'continuous belt' appears to describe the central core of the first outer space level. Based on the pattern established in the superuniverse space level, the distance to the center of this central core should be ~900 Mly.

Figure 18: **All-Sky Map Showing the Sloan Great Wall**



In 2003 J. Richard Gott of Princeton University discovered a belt of galaxies in the Sloan Digital Sky Survey (SDSS) data release of that year. [22] He named this structure the Sloan Great Wall. This very large flat structure, shown in figure 18, is aligned with the equatorial plane like the 2dF ring of galaxies. This is consistent with the expectation for a concentric arrangement of the first outer space level. It is 80° of longitude in length and extends 7-8° above the equatorial plane and 3-4° below it. [23] There are more than 20,000 galaxies in this structure. The plane of the Milky Way is shown; this area of the sky is called the "zone of avoidance" or the "zone of galactic obscuration." The light from the stars in the Milky Way hides galaxies located behind its plane. About 20 percent of the celestial sphere is obscured by the Milky Way.

Figure 19: **Polar View of the Sloan Great Wall**



The Sloan Great Wall begins at a distance of 701 Mly (215 Mpc) and ends at 1207 Mly (370 Mpc) and is ~500 Mly wide. Gott found the median distance for the galaxies in this arc-like structure is 978 Mly (300 Mpc or $z = 0.073$). This is 109 times the distance of 9 Mly from Paradise to Uversa, which is within 10% of the expected distance to the middle of the central core. This structure is 1.4 billion light-years (Bly) long and is the largest structure within several billion light-years. The density of galaxies in its volume is about six times greater than the average density within 2.7 billion light-years (820 Mpc). [24] This density differential is comparable to that between the central core of the superuniverse space level and the region within 32 Mly. The Sloan Great Wall is consistent with the expectations for a segment of the central core of the first outer space level.

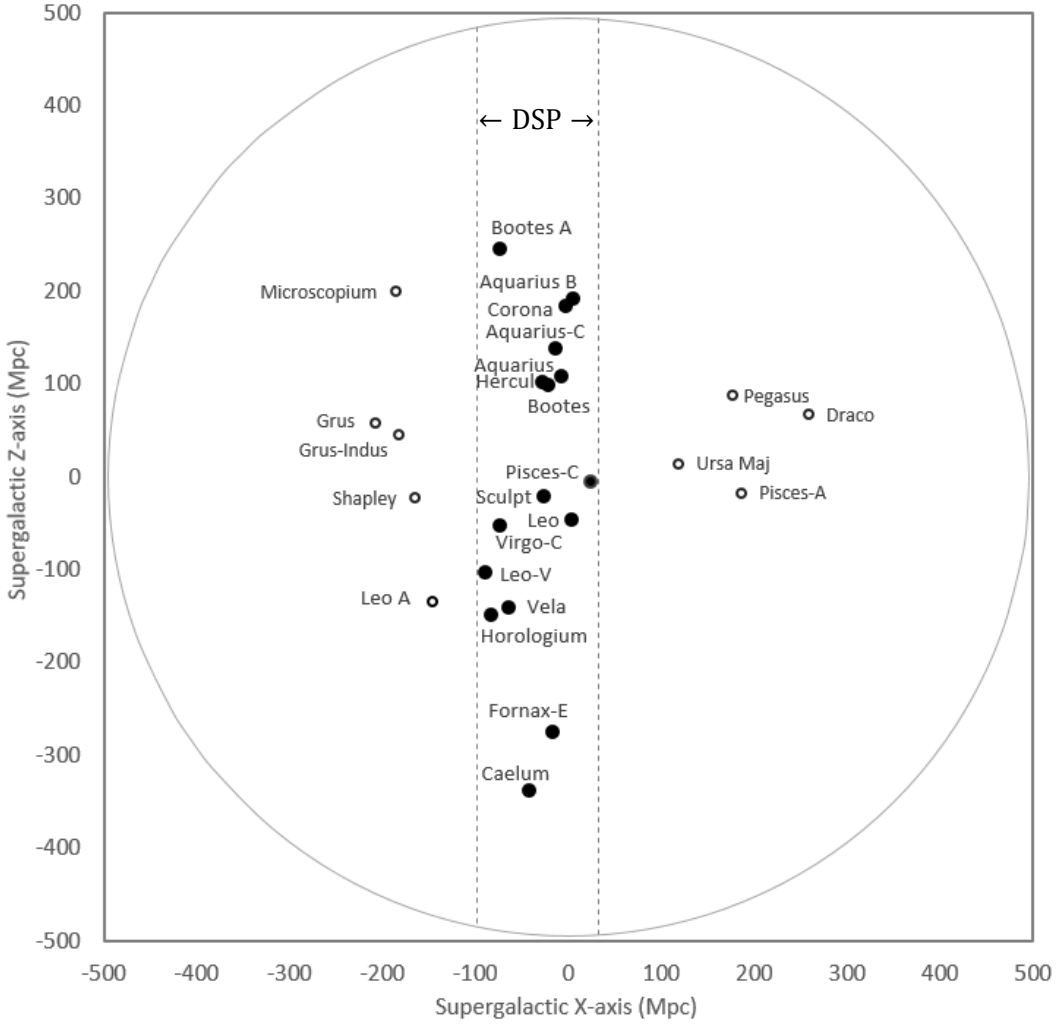
This flat structure is 1.4 billion light-years in length, which makes it too large for the expanding model to explain. This problem is evaded by assuming the Sloan Great Wall is not a genuine physical structure but a chance assembly of very rich galaxy systems. This explanation is something of a stretch, since a dozen superclusters of widely differing sizes have subsequently been identified in the Sloan Great Wall. These superclusters account for about 9,000 of the galaxies in it. [23]

Following this 2019 paper I learned that the Sloan Great Wall is an integral part of a much larger cosmic structure called the Dominant Supercluster Plane, which is 3.2 billion light-years in diameter. This is almost 90% of the predicted diameter of 3.6 billion light-years for the first outer space level (2 x 1.8 Bly).

Superclusters of galaxies are the largest and densest concentrations of matter in the universe. They can be categorized by the number of Abell clusters they contain as poor, rich, and very rich. Very rich superclusters have 8 or more Abell clusters and represent the regions of highest mass density in the universe.

In 1997, six years prior to the discovery of the Sloan Great Wall, M. Einasto of the Tartu Observatory published a catalogue of 220 superclusters located within a distance of 500 Mpc or 1.6 Bly ($z = 0.12$). [25] Only twenty-five of these are very rich superclusters. These are listed in the Appendix.

Figure 20: **Side View of the Dominant Supercluster Plane (DSP)**



When these 25 superclusters were plotted in three dimensions in the supergalactic coordinate system, Einasto found that two-thirds of them, or 16 out of 25, are located in a disk with a thickness

of just 140 Mpc or 456 Mly. These are the solid black dots in figure 20. The 1000 Mpc diameter of this disk is about 7 times greater than its thickness. Einasto called this arrangement the Dominant Supercluster Plane. Investigating the probability of this disk-like concentration of superclusters occurring by random chance, he found this is excluded at the 99% confidence level. This evidence led him to conclude that these 16 very rich superclusters are part of a single structure which continues through the region of the celestial sphere that is obscured by the Milky Way (zone of avoidance; see figure 18).

Figure 21: **Polar View of the Dominant Supercluster Plane**

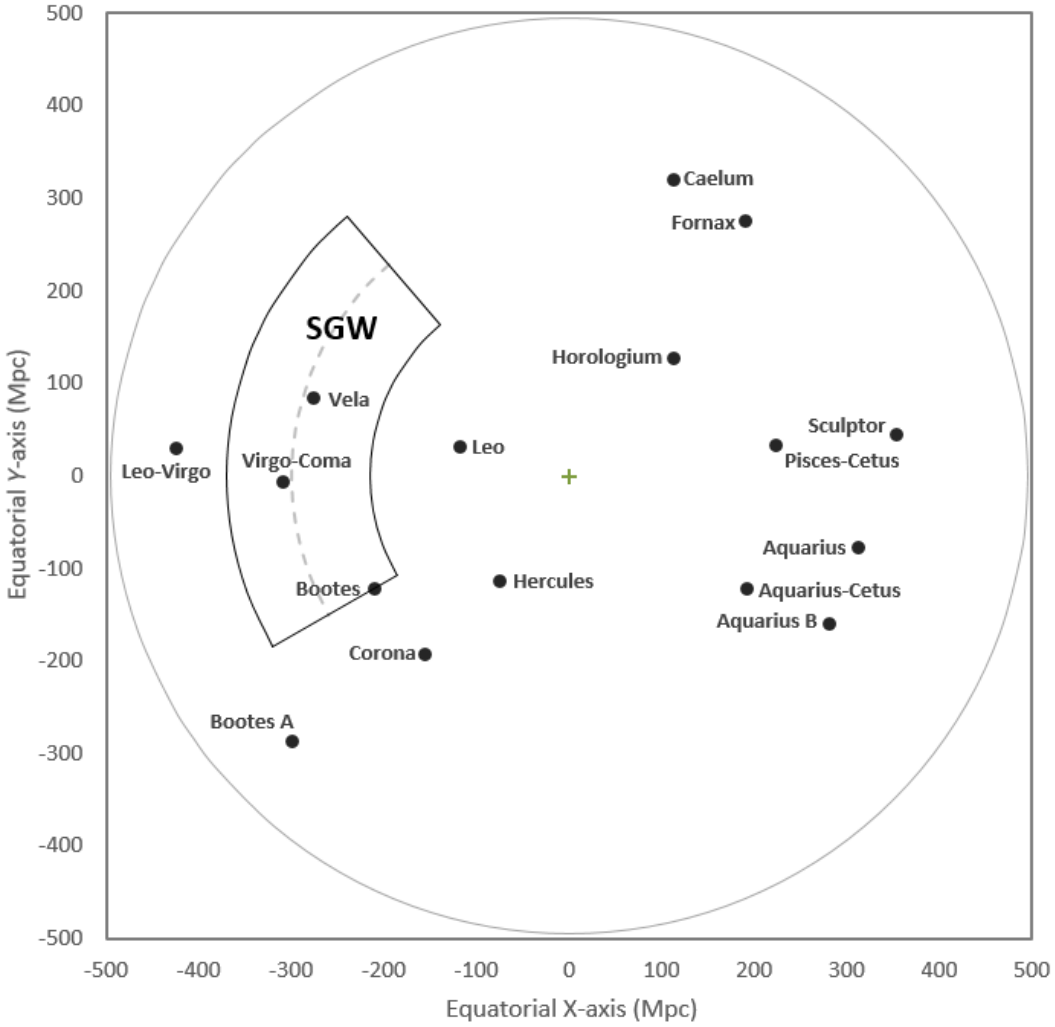
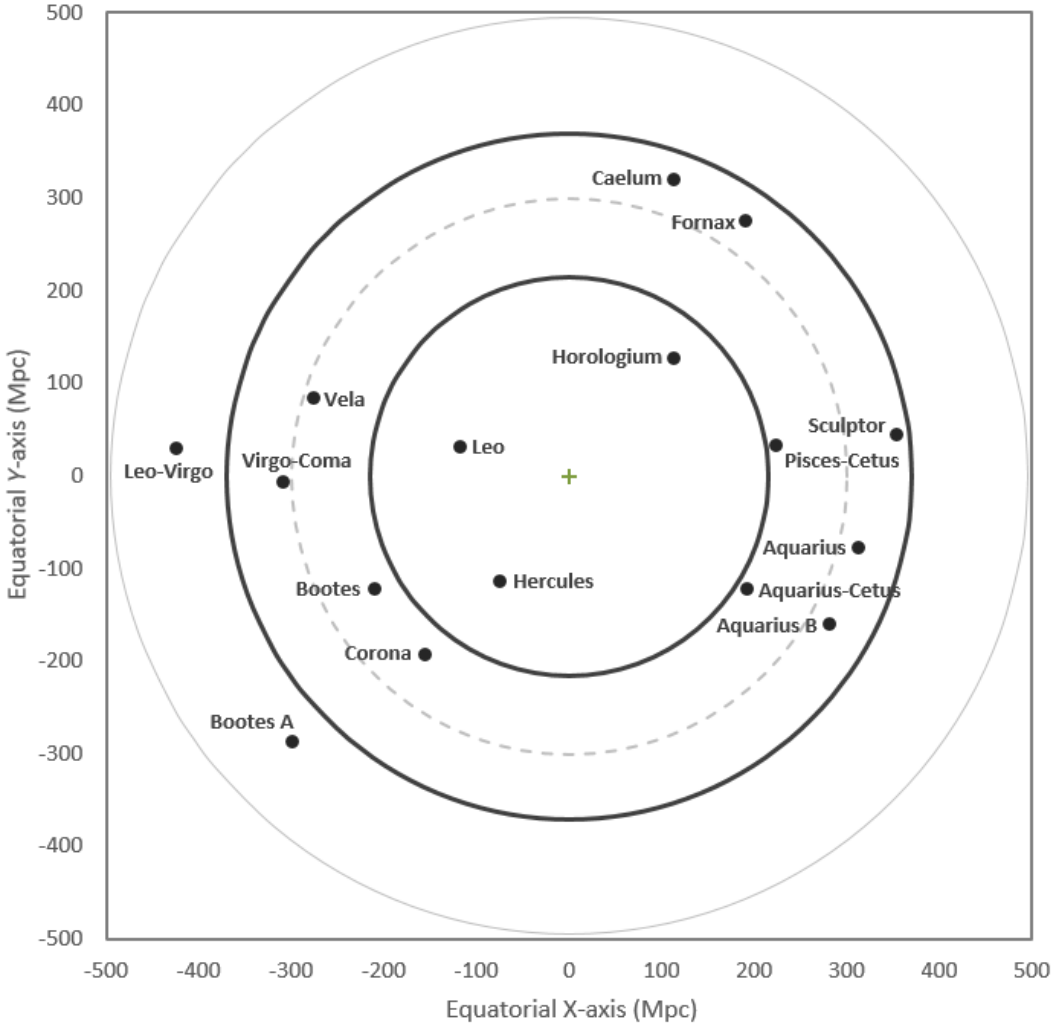


Figure 21 is a polar view of these 16 very rich superclusters plotted on the equatorial plane. The empty areas towards the upper left and lower right are due to the zone of avoidance. This polar view shows that the Sloan Great Wall, which is aligned with the equatorial plane, is part of the Dominant Supercluster Plane. The Sloan Great Wall includes two of these very rich superclusters: the Vela and Virgo-Coma superclusters. The Bootes supercluster is within the region outlined by the Sloan Great Wall on the equatorial plane but a little above it.

The Sloan Great Wall is consistent with an 80° segment of the central core of the first outer space level. So, an extension of its inner and outer boundaries of 215 and 370 Mpc should contain a majority of very rich superclusters within the Dominant Supercluster Plane. In the superuniverse space level at least 2,341 out of 3,705 2dF galaxies or 63% are concentrated in its central core. If this pattern holds, about two-thirds of the very rich superclusters should be within these inner and outer boundaries.

Figure 22: **The Central Core of the First Outer Space Level**



Over 68% of the very rich superclusters in this planar structure (11 out of 16) are contained within a ring formed by the extended inner and outer borders of the Sloan Great Wall. The odds of this occurring by random chance are less than 1 in 1000 ($> 3\sigma$). There is a very high probability that this annular structure has a cause and is not a random occurrence. The density of very rich superclusters within this ring is about two times greater than the average density in the Dominant Supercluster Plane. This ring is consistent with the description of "a continuous belt of cosmic activity encircling the whole of the known, organized, and inhabited creation." (12:1.14) Its concentric arrangement around the 2dF ring of galaxies substantially confirms the existence of the central core of the first outer space level.

The expanding model cannot explain any of these very large flat cosmic structures. Space expansion causes a universal dispersion of matter, and this dynamic would prevent anything like them from forming. The existence of these structures refutes the expanding model. On the other hand, the dynamic of gravitational revolution under absolute gravity can explain the existence of these structures.

10. The Paradigm Shift to the Revolving Model

There have been sudden changes in western cosmology in the past. One happened at the start of the 17th century, when the center of the universe shifted from the earth to the sun. Another occurred in the first part of the 20th century, when a galactocentric universe in static Euclidean space was replaced by a centerless universe in expanding space. These paradigm shifts were preceded by the emergence of a new model which could explain what the old model explains. The shift in cosmologic thought occurred after a sufficient amount of new evidence accumulated which the new model could explain but the old model could not.

The old expanding model can explain the phenomena of the redshift-distance relation and the uniform temperature of the CMB radiation. But to do so, it requires the presumption that space expansion is real. And in order to explain the observed flatness of expanding space (the "flatness problem"), it requires the *ad hoc* hypothesis of cosmic inflation. This is an unverifiable hypothesis which was developed in the 1970s and 80s for the specific purpose of saving the big bang model; without it this model is no longer scientifically credible.

A new revolving model can be developed from certain key ideas in *The Urantia Book* which can explain both of these phenomena. This model only relies upon well-established physics, does not require any presumptions, since internal (absolute) gravity is a proven physical law, and does not require *ad hoc* hypotheses to explain things. By the end of the first decade of the 21st century, very large flat cosmic structures were identified which the revolving model can explain but the space expansion mechanism cannot.

With regard to space expansion, a significant amount of data has accumulated from many implementations of half a dozen critical tests designed to determine if it is real. A 2014 analysis of their results by Martin Lopez-Corredoira, mentioned earlier, found that some favor an expanding universe and others a static universe. [5] He provides a table of results for each type of test and concludes, "The first two tests favor expansion, whereas the following four tests get a less *ad hoc* fit with the static solution." His table is recapitulated here with a column added for a *revolving* static universe model.

Cosmological Tests for Expansion of the Universe

Test	*Expanding*	*Static/Revolving*
$T_{CMBR}(z)$	Good fit	Poor fit/Good fit
Time Dilation	Good fit for SNIa	Poor fit/Good fit
Hubble Diagram	Requires introduction of dark energy and/or evolution	Good fit/Good fit
Tolman (SB)	Requires strong SB evolution	Good fit/Good fit
Angular size	Requires too strong evolution of angular sizes	Good fit/Good fit
UV SB limit	Too high UV SB at high z	Within Constraints

The first test is based on the prediction of a redshift-CMB-temperature relation $T = T_0(1 + z)$ in the expanding model. The second test is based on the prediction of a redshift-time-dilation relation $t = t_0(1 + z)$ in this model. The results from these two tests are a good fit for the expanding model. The static Euclidean model considered by Lopez-Corredoira does not explain the results from these two tests and is a poor fit for both. However, a revolving static model governed by internal (absolute) gravity makes these same two predictions (eq. 12 on page 17 and eq. 11 on page 16). These first two critical tests do not distinguish between the expanding and revolving models, since both are good fits for their results. The last four tests are good fits for the static and revolving models without the need for *ad hoc* assumptions. They are poor fits for the expanding model, unless certain *ad hoc* assumptions are made which modify its predictions so that they agree with the empirical results.

The evidence from these critical tests is decisively in favor of the revolving model, since its predictions are a good fit for the results from all of these tests. Based on these critical tests and the relatively recent discovery of very large flat cosmic structures, the balance of the evidence refutes the hypothesis of space expansion. But the evolutionary transition to the revolving model requires something more in the way of theoretical justification. In this day and age, only those cosmological models which are derived from exact solutions to Einstein's field equations are considered seriously. It appears this theoretical justification has already been found. In 1949 the renowned mathematician Kurt Gödel found an exact solution to these field equations which describes a static rotating model of the universe. [26]

In Gödel's solution the universe is a sphere of homogeneous matter which is rotating around a universal center. All particles (galaxies) in the universe have the same angular velocity around this center. This is consistent with the revolving model. The angular velocity in the rotating model is determined by the mass density ρ of the universe in Gödel's equation: $\omega = 2\sqrt{\pi G\rho}$. The angular velocity in the revolving model is also determined by the mass density: $\omega = \sqrt{8\pi G\rho/3}$ (eq. 15). Because space is static in both models, the uniform mass density does not change over time, and the angular velocity is a universal constant in both. Since their circular motion is governed by an angular velocity constant, both models are characterized by simple harmonic motion. The inertia of particles in rotation causes them to recede from the center, which is exactly balanced in Gödel's model by a cosmological constant which acts like a negative pressure directed towards the center. In the revolving model, the centrifugal force of inertial reaction to rotation is exactly balanced by the centripetal acceleration of internal gravity.

In his paper Gödel calculates that the period of universal rotation is 200 billion years, based on a mass density of 10^{-27} kg/m^3. The source of this estimate of mass density is not clear, except that it must be unrelated to the Hubble constant, which is not present in his static model. The mass density calculated from the critical density equation for a Hubble constant of 73 km/s/Mpc is ten times greater at 10^{-26} kg/m^3. If this current value is used in Gödel's equation, the period of rotation is 69 billion years. This is in surprisingly reasonable agreement with the period of 84 billion years calculated in the revolving model, which is only 22 percent longer. This level of agreement in the predicted period of revolution is far too close to be coincidental.

Gödel's static rotating model has no explanation for the redshift-distance relation. As he notes, "it is clear that it yields no redshift for distant objects." Because of this, it has never been considered a realistic model. It's derivation from general relativity does not, however, nullify Newton's law of internal gravity, which always applies in a sphere of homogeneous matter. Gödel's model is, in fact, consistent with internal gravity, since his model is characterized by an angular velocity constant. The directly proportional force of internal gravity provides an alternative explanation for the rotating model. This model can, therefore, explain the redshift-distance relation in terms of the gravitational potential of internal gravity. In Gödel's static solution, Einstein's gravity appears to be equivalent to Newton's internal (absolute) gravity; that is, both can be compared to the force of elastic tension.

The preconditions for a paradigm shift in cosmologic worldview appear to be in place. The transition to the revolving model involves a new understanding of the Hubble constant. The Hubble constant is theoretically determined by the critical density equation, which can be derived from both Einstein's gravity and Newton's internal gravity. The equations of motion in each model are determined by the Hubble constant. This changes from a linear velocity constant H_0 in the expanding model to an angular velocity constant ω_0 in the revolving model. This results in the transformation of linear motions into angular motions.

Expanding Model		*Revolving Model*	
$H_0 = 73$ km/s/Mpc		$\omega_0 = 2.37 \times 10^{-18}$ rad/s	
cosmological redshift:	$z = D/r - 1$	gravitational redshift:	$z = \omega_0 r/c$
expansion velocity:	$v = H_0 D$	orbital velocity:	$v = \omega_0 r$
expansion acceleration:	$a = H_0^2 D$	centripetal acceleration:	$a = \omega_0^2 r$
age of the universe:	age $= 1/H_0$	period of revolution:	$T = 2\pi/\omega_0$

The co-moving distance D in expanding space is replaced by the proper distance r in static space. Cosmological redshift is replaced by gravitational redshift. The receding velocity of space expansion is replaced by the orbital velocity of gravitational revolution. The outward acceleration of space expansion is replaced by the centripetal acceleration of internal (absolute) gravity. The 13.4 billion year old expanding universe $(1/H_0)$ is replaced by a revolving universe in simple harmonic motion which has a period of revolution of 84.2 billion years $(2\pi/\omega_0)$. The *maximum* radius of the expanding universe is 46 billion light-years. The highest measured redshift for a galaxy (HD1 at $z = 13.27$, discovered April 2022) establishes a *minimum* radius for the revolving

universe of 178 billion light-years ($r = cz/\omega_0$). (This is nearly the expected distance of 180 Bly to the outer border of the second outer space level.)

The centerless expanding universe is replaced by a beautiful revolving universe with a center of gravity that is 9 million light-years distant. The beauty of the revolving universe emerges in the revealed truth that the center of absolute gravity is the actual location of the Isle of Paradise, the dwelling place of the Universal Father, "the First Source and Center of all things and beings." (1:0.1) There is a place of absolute spiritual value in the material universe, and this place is the ultimate destination of the mortal ascent to God.

> The discernment of supreme beauty is the discovery and integration of reality: The discernment of the divine goodness in the eternal truth, that is ultimate beauty. (2:7.8)

What appears to be just a dense elliptical ring of galaxies is actually the superuniverse space level in the grand universe, which is the evolutionary domain of Supreme Deity.

> The grand universe is the threefold Deity domain of the Trinity of Supremacy, God the Sevenfold, and the Supreme Being. (0:8.10)

> The Supreme Being is the deity culmination of grand universe evolution—physical evolution around a spirit nucleus and eventual dominance of the spirit nucleus over the encircling and whirling domains of physical evolution. (106:2.1)

The chief pursuit on the worlds of light and life is "the quest for a better understanding and a fuller realization of the comprehensible elements of Deity—truth, beauty, and goodness." (56:10.2) In pursuing the beauty of Deity the inhabitants of these worlds become absorbed in the experiential study of cosmology. In the ideal, cosmology is the pursuit of the divine beauty discernible in God's evolving material creation.

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Appendix – List of 25 Very Rich Superclusters within 500 Mpc by M. Einasto (1997)

In the Dominant Supercluster Plane

	Supercluster Name	Abell Clusters	R.A.	DEC	Mpc	Mly
1	Sculptor (SCL 9)	22	7.3	-30.1	411	1,340
2	Pisces–Cetus (SCL 10)	17	8.6	-20.7	240	782
3	Horologium– Reticulum (SCL 48)	26	48.6	-49.3	262	853
4	Fornax–Eridanus (SCL 53)	12	55.5	-32.4	397	1,296
5	Caelum (SCL 59)	11	70.7	-33.6	408	1,331
6	Vela (SCL 91)	9	162.9	3	290	947
7	Leo (SCL 93)	9	165.2	19.9	132	429
8	Leo–Virgo (SCL 107)	8	175.9	10	433	1,412
9	Virgo–Coma (SCL 111)	16	181.1	10.1	315	1,028
10	Bootes (SCL 138)	12	209.8	25.4	268	876
11	Bootes A (SCL 150)	10	223.6	21.1	444	1,448
12	Corona-Borealis (SCL 158)	8	230.8	29.7	285	929
13	Hercules (SCL 160)	12	236.2	18.5	144	469
14	Aquarius–Cetus (SCL 188)	9	327.6	-13.4	233	760
15	Aquarius B (SCL 193)	8	330.5	-9.9	327	1,068
16	Aquarius (SCL 205)	19	346.1	-20.3	342	1,115
	Outside of the Dominant Supercluster Plane					
17	Pegasus-Pisces (SCL 3)	8	1.40	6.00	375	1,224
18	Pisces-Aries (SCL 30)	8	23.00	17.50	260	849
19	Leo A (SCL 100)	10	173.7	-2.5	392	1,278
20	Ursa Majoris (SCL 109)	8	176.80	54.90	237	773
21	Draco (SCL 114)	16	181.90	64.30	425	1,385
22	Shapley (SCL 124)	34	195.80	-32.80	195	634
23	Microscopium (SCL 174)	10	308.20	-35.00	355	1,157
24	Grus-Indus (SCL 192)	8	329.80	-55.40	295	961
25	Grus (SCL 197)	9	336.40	-51.30	382	1,247