A NEW APPROACH TO THE ORGANIZATION OF THE COSMOS

A GRAPHICAL COSMOLOGY

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Cosmology, in the broadest sense of the word, is that branch of learning which treats the cosmos as an ordered system. The name is derived from two Greek words, the first meaning "order", "harmony" and the "world", while the second ~~meaning~~ means "word", "discorse". Cosmology is the framework of concepts and relations which man erects, in satisfaction of some emotional or intellectual drive for the purpose of bringing descriptive order into the world as a whole. As such, it is confined to a DESCRIPTION of the salient features of the observed universe in terms of dimensional space, time and matter.

The cosmologies that have been presented at ~~various times~~ different eras in history, inevitably reflect the physical and intellectual environment of the era, including above all the interest and culture of that particular society. Any attempt to bring order into the cosmos as a whole requires the adhering to these lines by which man has already brought order into the portion with which he is most familiar. Any new cosmology will accordingly reflect the scientific, philosophical or socialogical predilections of the individual and his group. In keeping with this viewpoint and the fact that man for sometime has been immersed in an era characterised by scientific research, this expanded concept will use as its foundations the latest astrophysical and IGY data.

The development of a cosmological model which avoids some of the limitations of the well known works of Lemait-Eddington[1], the

Einstein-De Sitter model[2], or the steady state theory of H. Bondi[3], has been accomplished by GRAPHICALLY plotting a series of star systems which are keyed to the latest optical and radio astronomy data. The information gathered on the Milky Way Galaxy as well as other Stellar systems during the last ten years with the largest light gathering telescopes, the Schmidt cameras and the radio telescopes, provide new data which will be used in an attempt to explain some of the unique arrangements of the cosmos. The most unique and important optical and radio telescope data will be first discussed, to provide the logic of the concept for this cosmology.

<u>Galaxy Organization - Based on Optical Data</u>

The Milky Way Galaxy of which our solar system is considered to be a part, is conceived by the astronomers to be similar to the Andromeda Galaxy, shown in Fig. 1. The Milky Way Galaxy and the Andromeda Galaxy are classified as spiral galaxies. The Andromeda Galaxy features individual arms of stellar dust, hydrogen and suns which appear to move with uniform rigidity around the center of the galaxy.[4 pg. 65] The Milky Way Galaxy also exhibits these dust and hydrogen gas armlike arrangements and is presently considered to be circular, with a diameter of approx. 100,000 light years[5]. As this presentation progresses a model will develop giving much different dimensions to the galaxy and an envelope shape which is elipsodial. An analysis of the details of the Milky Way Galaxy, based on optical data will first be made.

Both optical and radio telescope data agree with considerable accuracy on the features of the Milky Way Galaxy. A moasic picture of the Northern Milky Way taken with the Schmidt Camera is shown in Fig. 2, which sweeps out a view of the sky around the galactic equator ($b = 0^{o}$) between the galactic longitudes $l = 310^{o}$ through $l = 0$ to $l = 210^{o}$. The most dense region of stars in the sky is in the direction of the Star Cloud of Sagattarious, $l \simeq 327.5^{o}$ and $b = 0^{o}$.

An enlargement of this area is Fig. 3, showing the density of stars. Astronomers pretty much agree that this is the direction to the galactic center[6], and that our sun moves in a clockwise direction around a distant center some 27,500 light years away. (This is the direction of motion when viewed from the Galactic North Pole). Because of inter-stellar dust and hydrogen clouds occuring at 4 to 5000 light years (L.Y.) from our sun, the actual center cannot be optically seen but must be calculated, based on our solar systems motion. The distance calculated from optical data is in agreement with radio data[5].

Moving approximately 15^{o} along the galactic equator in the direction of $l = 345^{o}$, it is seen that there is suddenly a void of stars above the galactic plane, though it is very dense below the galactic equator. This is the beginning of what is known as the Great Rift in the Milky Way, a condition that is existing, the cause of which is not understood. This sparsely star populated Rift continues on thru the region $l = 18^{o}$, Altair, enlarged in Fig. 4. (This Rift condition, will be later answered by this hypothesis). Continuing on in Fig. 2 to $l = 40^{o}$, in the vicinity of Cygnus, it becomes apparent that the number of stars below the galactic equator diminishes drastically, while the density at and above the equator is greater. Fig. 5 is an enlargement of the area above the galactic equator. Though it can be seen that the region is closely packed with stars, between $b = 0^{o}$ and $b = + 8^{o}$ there is no comparison with the star density found at the Sagattarious region of Fig. 3. This comparison of star densities, indicates we have moved away from the center of the galaxy, plus the fact that for some reason the dense clustering remains above the galactic equator. Distance measurements of many of the stars 400 L.Y. and more below the equator, indicate they are far distant and may be considered extra-galactic. Why the greatest star density is located between $b = 0^{o}$ and $b = + 8^{o}$, for the region $l = 30^{o}$ to 180^{o} is a peculiarity of the Milky Way for which there is presently no answer. Part of the answer may lie in the fact that our Sun and its solar system is believed to be below the galactic equator, estimated by the Russian astronomers[7] to be 200 L. Y. below the equator.

Moving along in Fig. 2 to l = 90°, b =- 20°, there is found the Andromeda galaxy, Fig. 1, which is now calculated to be 1,500,000 L.Y. away. This is considered the nearest galaxy to our Milky Way galaxy. In this direction Shapley[10] has found there are few stars more than 5000 L.Y. away, and between this distance and the Andromeda Galaxy there is virtually a void with little matter.

Turning now to galactic longitudes l = 140° to l = 180° at b =- 15° are two well known regions Tarus and Orion respectively. Enlargements of these regions are Fig. 6 of the Crab Nebula and Fig. 7 and Fig. 8 of the Orion and Horsehead Nebula respectively. The Crab Nebula Fig. 6, is the result of what is believed to have been a supernovia explosion on 1052 A. D., which is expanding at a rate of 70,000,000 miles per day[5]. This nebula is estimated to be 4100 L.Y. away, and is presently considered by the astronomers to be part of our galaxy. (It will be shown in this hypothesis that it is a near member to the Galaxy, but that it is actually outside the peripheral of the Milky Way galaxy). The Orion and Horsehead Nebula, Figs. 7 & 8 are estimated[6] at distances of 1500 L. Y. and are part of the Galaxy. Even though both of these photographs are in infra red light, they still appear as extremely hot nebulosities. Actually these are patches of neutral hydrogen that have been ionized by ultraviolet radiation from "O" and "B" stars. Stromgren[6] has shown that "O" stars can ionize all hydrogen within a distance of 500 L. Y., while "B" stars will ionize to a distance of 100 L. Y. This region of the sky is very rich in both types of stars. Also from radio data Fig. 9 it is found that the temp. of this hydrogen varies from 40° K. to 70° K. (-360°F.), consequently it is not a source of great thermal heat that would affect any planetary bodies in the immediate vicinity.

From $l = 90^{\circ}$ to $l = 190^{\circ}$, at $b = 0^{\circ}$, is a region called the "Zone of Avoidance" for optical observations. This is due to large quanities of stella dust, occuring 3500 to 6000 L. Y. away. This dust cloud makes a great arc thru this region, between $b = -8^{\circ}$ to $b = +5^{\circ}$, apparently forming an outer peripheral to our galaxy. Figs. 6, 7 & 8 show 2 very important features, first that this region is very sparsely populated with stars compared with Fig. 3 and is, therefore, opposite the center of our galaxy and at the edge. Second, since our sun is only 1500 L. Y. from this region, we are located near the outer edge of the Milky Way Galaxy.

Moving in the direction of $l = 240^{\circ}$, Carina, it is seen by the enlargement of Fig. 10 that the star density has again increased considerably, similar to the Cygnus region in Fig. 5. The star density has increased below the galactic equator again, starting around $l = 200^{\circ}$ and remaining more dense below the equator thru $l = 270^{\circ}$. This is a reversal of conditions between $l = 40^{\circ}$ to 180°. The reason why must be evident from this hypothesis.

Looking at Fig. 2, in the direction of the Galactic center, a curious but important feature is readily noted between $l = 305^{\circ}$ & 325°. In this region it is found that star density above the galactic plane does not readily drop off as in other areas of the sky but instead large groups of stars are found as high as 40° above the galactic equator. RR lyre & F stars[6] in this area are found to have extreme elleptic orbits moving in directions both above and below the galactic plane and at angles varying from parallel to the equator to right angles to the equator. Several of these stars are moving at extremely high velocities and with orbits calculated to carry them 40,000 L. Y.[6] above the galactic plane. A galactic model which will permit this phenomena for this particular location must of course be provided by this hypothesis.

Based on optical data Oort[6] has constructed a star density model of the galaxy[8] shown in Fig. 11., which is a cross section of the galactic plane taken through the sun, to the center of the galaxy. It is to be noted from Fig. 11 that when looking toward the center of the galaxy for approx. 7000 L. Y. the star density is considered only 0.446 of what it is in the vicinity of the sun. The galaxy by this model would have only approx. 3000 L. Y. thickness. At this point, Oort believes there develops an elliptic halo phenomena, which is two times as dense in stars as is found in the immediate vicinity of the sun. This elliptic region bulges out to give a thickness of only 11,000 L. Y. at the galactic center. This analysis, as pictured in Fig. 11 gives an extremely thin section to our galaxy, especially when it is believed to be 100,000 L. Y. in diameter. Other estimates[5] give a thickness of the halo region at the center of 20,000 L. Y., or a ratio of thickness to diameter of 1/5. This is more in proportion to the values obtained for other galaxies, such as NGC 891 in Fig. 12. In studying galaxy NGC 891 it is difficult to determine whether the bulged out nucleous is the result of a high concentration of stars, or if it is a ionization halo resulting from a highly ionized region of hydrogen surrounding a dense cluster of stars. It is also not improbable to conside that after a galaxy age exceeds 10^8 years, that the resedue material at the center is capable of ionizing all dust in the center region. Shapley[8] has found for the Milky Way Galaxy, cluster type variablestars between $l = 300^\circ$ & 290°, up to $b=60^\circ$, or 50,000 L. Y. Between $l=20^\circ$ through $l=0^\circ$ to 350°, $b=-60^\circ$ to distances of 30,000 L. Y.

Globular Clusters

Another important odity of the Milky Way Galaxy is that almost 1/3 of all known globular clusters are to be found in the directions of the galaxtic' center, an area covering only 2% of the sky. Fig. 13 shows 30 of the clusters. A globular cluster is a densely packed spherical group of stars varying from[6] 10,000 to 1,000,000 members as indicated in Fig. 14.

Even though these are large groups of stars they do not appear to interfere with the dynamics of the Milky Way galaxy, or to exhibit the same dynamical motions. That this region of space (actually within the confines of the galaxy), will house these clusters, without any interference is an important point to be answered in this hypothesis.

Near the Milky Way Galaxy there is also to be found the two star Clouds of Magellan, which are located[5 & 6, 8] approx. 40,000 and 60,000 L. Y. below the galactic plane in the direction of $1 = 92^\circ$ & 140°, with $b =- 98^\circ$. These two immense irregular clouds have their own dynamic motion independent of the Milky Way galaxy. In fact they appear to be moving away from our sun. In this hypothesis it will be shown why they can be located in this particular region of the sky and why they do not cause any interference.

Spiral Arm Structure

It was mentioned earlier that the Milky Way Galaxy is believed to have Spiral arms. Based on optical data there is considered to exist 3 arms. In the direction of the galactic center there is thought[6 (Pg. 240)] to origonate the Sagittarious spiral arm, though this region is extremely complex and data is very confusing. This arm is believed to run between $1 = 310^\circ$ & 330°, starting approx. 30,000 L. Y. from the sun. Its width is approx. 3000 L.Y. and runs past our sun, missing it by 1500 L. Y. (when viewed in the direction $1 = 240^\circ$). This arm swings a large arc, running on for another 3000 L. Y. before terminating between $1 = 200^\circ$ and 180°. (Optical variation of this spiral structure concept is extremely poor, consequently very little was done along these lines until data from the radio telescopes became available.) The results of 21 cm. research to be discussed shortly, provides data which gives a much clearer understanding to this arm concept. Morgan, Sharples and Osterbroch[6 (pg. 239)] with the aid of the Greenstein-Henney camera, have established what is believed to be 2 additional spiral arms. The Orion arm, also sweeping out a large arc, is observed starting at $l = 40^{\circ}$ and terminating at $l = 180^{\circ}$ to 190°. Our sun is placed close to the inner edge, toward the galactic center, of this arm, which has been traced over a distance of 12,000 L.Y. and believed to be 1200 L.Y. wide. Morgan estimates that the sun is not at the edge but 100 to 200 L.Y. inside the Orion Arm. Morgan believes there to be a second arm, the Perseum Arm, starting nearer the galactic center (about 7000 L. Y. from the sun) and running between galactic longitudes $l = 70^{\circ}$ to 140°. The width and length of this second arm appears to be the same as the first Orion arm, but the density of emission nebulosity seems to be less.

S. Chandrasekhar and E. Fermi[9], suggest that spiral arms in galaxies may be the seat of magnetic fields in interstellar space whose lines of force run along the spiral arms. A number of lines of evidence, based on the total energy of cosmic rays and on observations of the polarization of starlight due to the scattering by interstellar particles, suggest the possible existance of a magnetic field in interstellar space in our galaxy. An interpretation of the polarization that has received considerable support, suggests that the magnetic lines of force are nearly in the galactic plane, as may be seen from Fig. 15. Chandrasekhar estimates the magnitude of the magnetic field by two methods. First the magnetic field is assumed frozen into the interstellar gas and carried about by its random motions, but is never twisted far out of the galactic plane. If this is so, the magnetic forces largely control the motion, the number S, (ratio of magnetic and inertial forces) $= \mu H^2/4\pi\rho V^2$ must be large, (ρ being the density and V the mean random motion of interstellar gas). Assuming $\rho = 2 \times 10^{-24}$ gm./cm^3, V = 5km/sec., a large S implies that H is large, compared with 2.5×10^{-6} gauss. By refinement of the argument, depending on the estimated deviations of the magnetic field from the galactic plane, the [illegible] value of H is estimated as 7.2 x 10^{-6} gauss.

The second estimate of H is based on magentohydrostatic considerations. The gravitational pull of stars and gas in the spiral arm tends to make the arm collapse into a thin filament. According to / Chandrasekhar gas pressure and turbulent motion are too small to prevent the collapse. They therefore, suggest that the collapse is prevented by lateral magnetic pressure. If m is the mass per unit length of the spiral arm, and R is the radius of its cross section, the gravitational force on gas of density ρ is of the amount $GM\rho/R$ per unit volume; thus a pressure of order $GM\rho$ is required to balance it. Assuming that most of this is supplied by a magnetic field, the field is estimated as 6 x 10^{-6} gauss. A field of this magnitude not only prevents lateral collapse, it also slows down longitudinal gravitational collapse to the point where such collapse become unimportant.

The two estimates of H agree in order of magnitude, but the theory invokes many questions.

1. Where does the field in the spiral arm come from.
2. A spiral arm includes stars as well as interstellar matter, since a magnetic field is virtually unable to affect the motion of stars what is their role in the theory.

As this hypothesis develops it will be shown the importance of these magnetic fields, and their interplay in the formation of numerous star cloud systems.

Rotation

In 1927 Linblad and Oort[6(pg. 120)] gave the first conclusive evidence of galactic rotation as a result of work on O and B star subsystems, when compared with globular cluster motion. More recently Mayall through the study of the radial velocities of 50 globular clusters has determined that the average radial velocity of our sun in reference to globular clusters is approx. 200 km/sec. in the direction of $l = 55^{\circ}$. Thus, it is believed that our sun has a circular orbit around the galactic center which if observed from the N. Galactic pole gives a clockwise direction of rotation. Other data, both from radio observations and dynamical considerations of the Milky Way Galaxy as well as Andromeda, and the Mangelleic clouds indicate that the motion should be from 250 to 270 kilometers/sec., still, however, rotating in the same direction. Spectrographic measurements of stars at the center of neighboring galaxies has led the astronomers to believe that the center of the galaxy may have a rotational velocity of from 30 to 50 km./sec., opposite to the direction our sun is moving. This would give our sun an average velocity of 220 km/sec. in the direction of $l = 55^{\circ}$, at 600,000[5] mph around the center, taking 250 million years to complete an orbit.

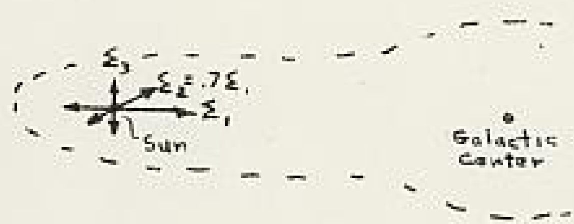
High Velocity Stars and Star Streaming

Most of the stars in the vicinity of the sun (10 L.Y. or less) move with speeds relative to the sun that are not in excess of 30 km./sec[6], however, there are many stars that greatly exceed this velocity. Any star that moves with a speed relative to the sun at 60 km./sec. and over is considered to be a high velocity star. N.G. Roman[6] (pg. 122) has recently published a catalogue of 600 such stars, with an interesting analysis made on stars within 65 L.Y. of our sun. In this study it was found that without exception that the predominant motion of the stars was in directions falling between $l = 150^{\circ}$ & 330°, with the average direction of motion toward $l = 235^{\circ}$. This is just opposite to the direction that our sun is moving. The RR Lyrae are the most striking group of high velocity stars with an average speed to the sun of 130 km./sec. These stars are arranged in a subsystem not quite spherical and having some flattening, being highly concentrated toward the center of the galaxy. The R R Lyrae stars have enlongated orbits somewhat like ellipses and are believed by Martin Schwartzchild to have never been any closer to the galactic center than approx. 10,000 L. Y. Other stars[6(pg.134)] such as F stars have extremely elongated orbits and such high velocities that they are believed to have originated within 5000 L.Y. of the galactic center and moved straight out to our sun position. The reason for the high velocities and diverse directions of motion of these stars, as well as the slower motion and behavior pattern of the millions of other nearby stars, must not only be explained by this hypothesis but there must be given optically measurable directions for many groups and subsystems. A series of sub-star systems will be developed, with the necessary dynamics and force fields, to concur with observable data.

Star Streaming

In 1904 Kapteyn of Holland, first introduced evidence that star motions were not haphazard but subject to general laws. He began his work by studying the proper motion (angular displacements in the sky) of the brighter stars in the sky, by grouping all of those stars moving withing a 15° sector, then all of those moving within a second 15° sector and etc. A diagram was then prepared, similar to Fig. 15, where an arrow is drawn in a particular direction, the length of which is proportion to the number of stars moving in that direction. Then by connecting the ends of the arrows with straight lines, one can see the distribution of proper motion for that section of the sky. If all stars moved perfectly at random, then the sun motion would have an effect of drawing the configuration of Fig. 15 into a circle, then on out into an ellipse, with the long axis pointing away from the direction the sun is moving. Actually this has not been found to be the case, instead when all parts of the sky within the galaxy is studied it is found that there is apparently two pronounced directions in which the stars stream. For stars studied near our sun, the two star stream vertices show two well marked convergent points, that are 180° apart,[6(128)] with one of the vertices lying in the direction of the galactic center. Recent work by Carl Schwarzchild, Vissotys and Lindblad[10] have considerably extended Kapten's work, showing that it is not necessary to think in terms of only 2 star streams, but in terms of all ellipsodial hypothesis. Schwarzschild[11] was able to show that the dispersion of the motions of the stars was not only along the direction of the two true vertices, but also for two mutually perpendicular directions. The greatest dispersion pattern is always along the direction of the two true vertices, while the pattern in the galactic plane but at right angles to the two true vertices has a magnitude of approx. .7. Still somewhat smaller is the magnitude for the pattern which is at right angles to the galactic plane.

Thinking in terms of total galactic star motion, the sketch to the right may help to clarify these motions[11]. E_1 points approx. in the direction of the galactic center, while the smallest streaming, E_3, is at right angles to the galactic plane. Lindblad was the first to show that in the vicinity of the sun, this pattern of the ellipsodial hypothesis was the result of galactic rotation, and provided a major breakthrough in understanding the dynamical behavior of the galaxy. There are still many questions that are unanswered by this hypothesis. In particular there are a number of homogenous groups of stars with elleptic orbits



CROSS SECTION OF GALAXY INDICATING DEGREE OF STAR STREAMING that are inclined to the galactic plane as well as having their main vertices as much as 15° away from the galactic center. This vertex deviation and unsymetrical circular motion will be shown to be clues to a much more complicated and organized elliptic galaxy than now conceived.

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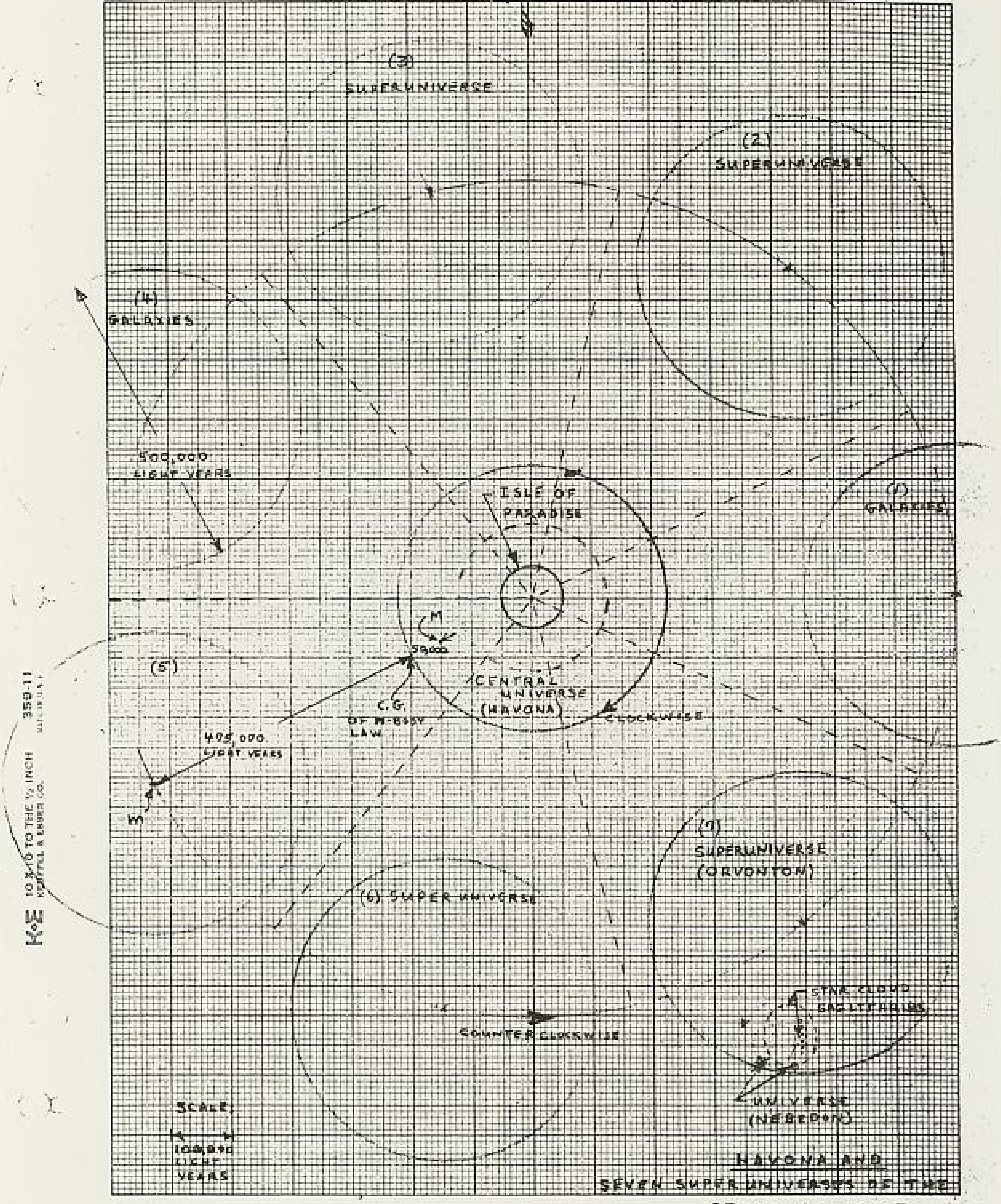
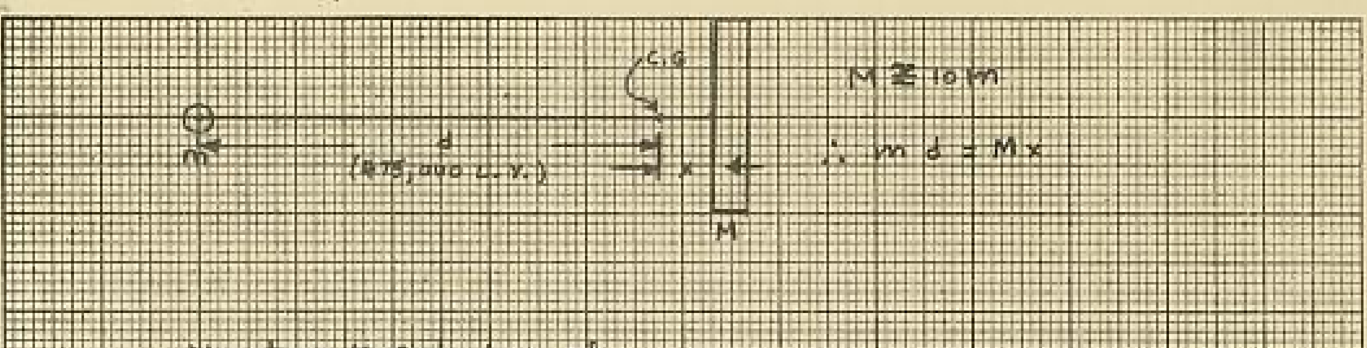
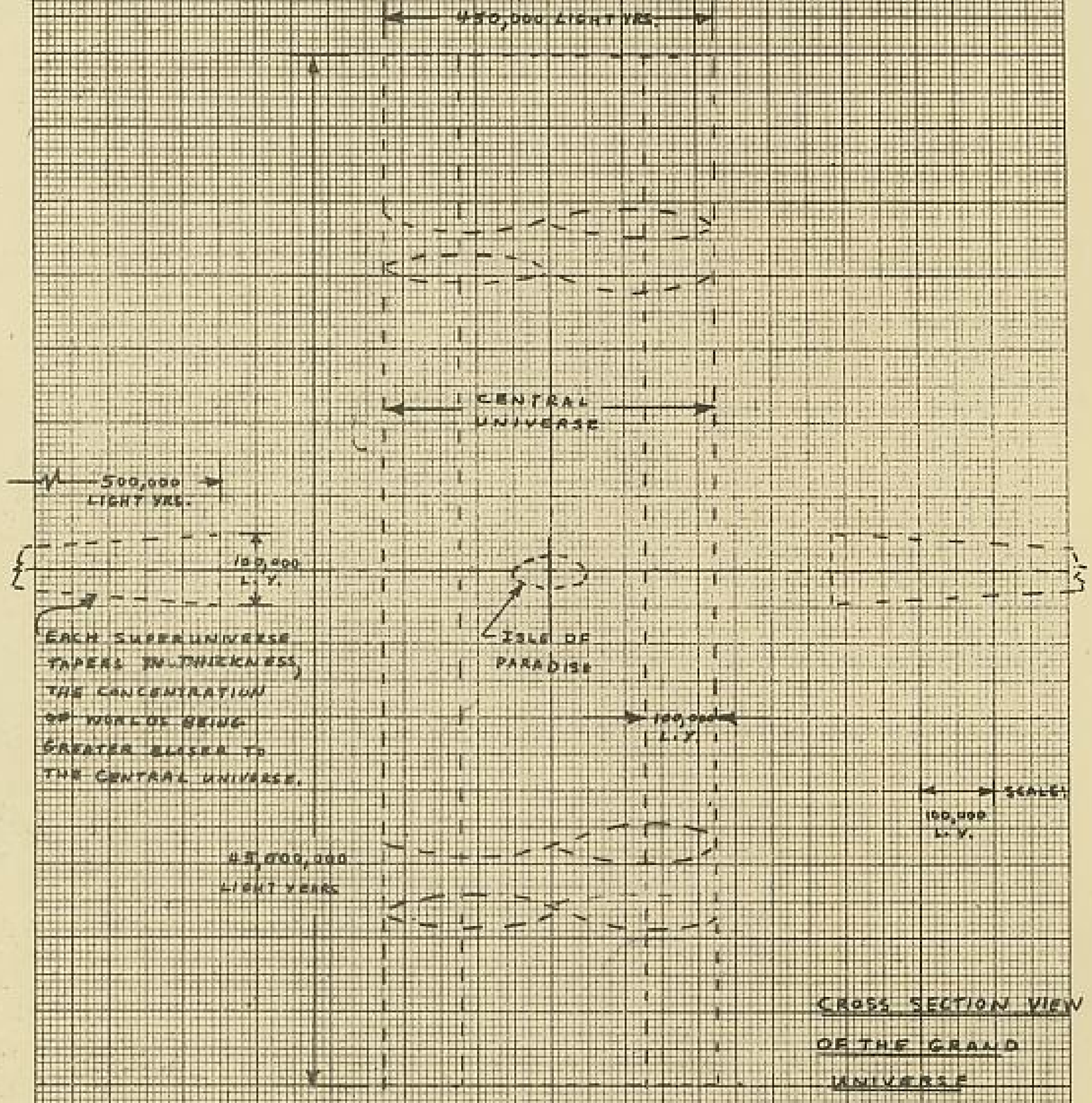


HAVONA AND
SEVEN SUPER UNIVERSES OF THE
GRAND UNIVERSE
FIG. 1



Newtons N-Body Law of Universal Gravitation

Fig. 2



CROSS SECTION VIEW OF THE GRAND UNIVERSE

FIG. 3

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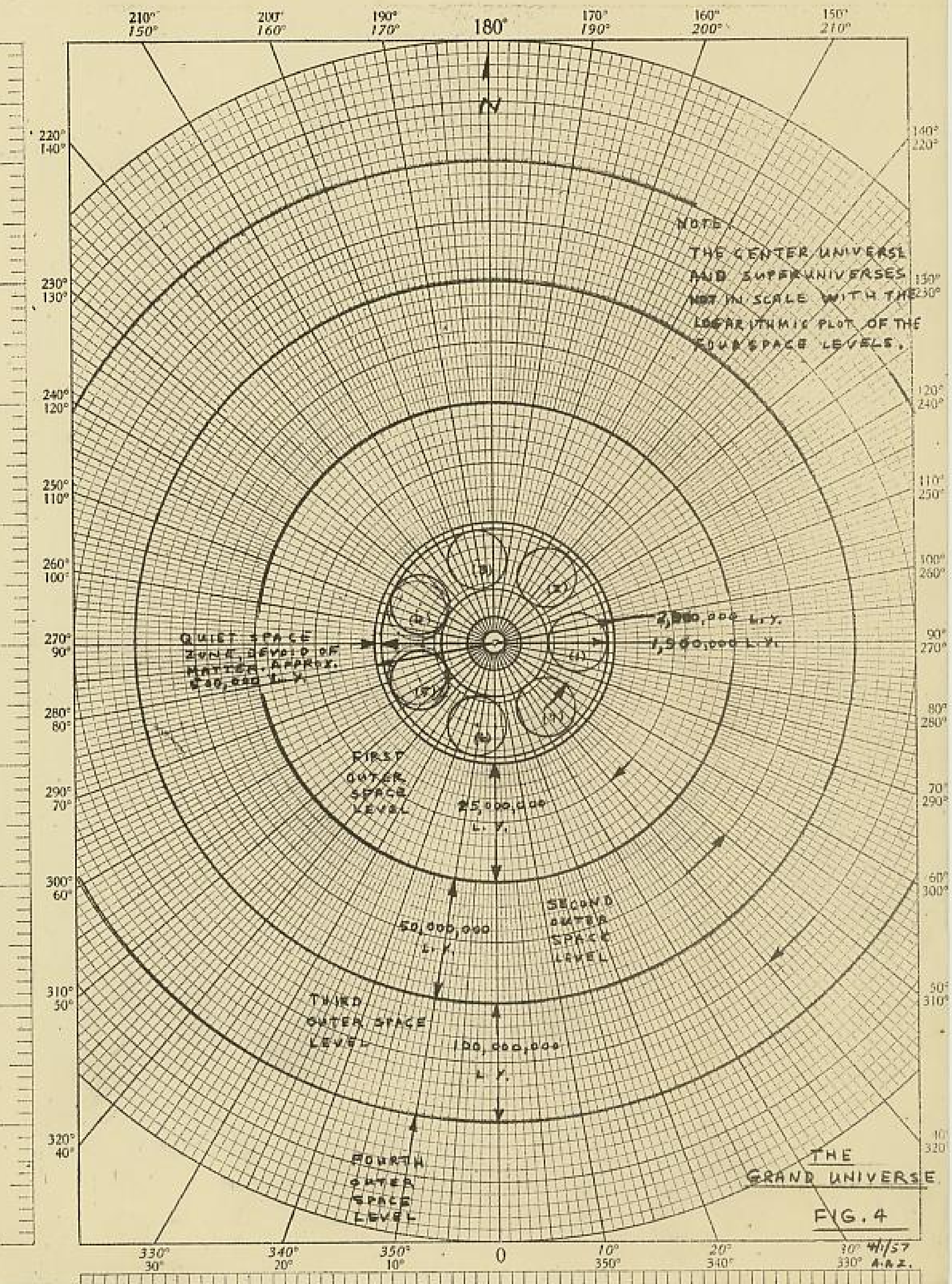
AR-2,



THE GRAND UNIVERSE

FIG. 4