CHAPTER THREE

THE SUN'S GALACTIC JOURNEY AND ABSOLUTE TIME

Conventionally viewed, the formation of a solar-type star and planets from a cloud of gases and cosmic dust takes on the order of several hundreds of millions of years. After accretion, an Earth-like planet supposedly takes another one or two thousand million years (1-2 gigayears or => *aeons)* to develop a stable lithosphere, which when formed allows the much slower evolution of a viable biosphere from the materials and energy available at the planetary surface (Oparin). To us, these processes seem too slow and rely too much upon random occurrences to be viable.

However, the processes forming stars and planets and leading to living things may proceed much more rapidly. Our cosmogony employs electrical cavities, charges and forces to accomplish change. These produce changes which are much more powerful and are highly selective.

Electrical force, as measurable by the repulsion between two electrons, compares with the apparent gravitational attraction of the same two electrons in the ratio of 10 36 to 1.[20] Conventional models of cosmic processes employ almost exclusively the trivially weak force termed gravity to produce and govern the Universe.

Electricity is a greater sculptor of change because it operates more

[20] Incidentally, the Universe, conventionally asserted to be held together by gravity, is said to be 10^{26} meters in radius; the atom, admittedly bound by electricity, has a radius of 10^{-10} meters. These radii are curiously in the ratio of 10^{36} to 1.

variably within a given cosmic setting. A simple lightning bolt can cause extensive surface damage, liberating megajoules of energy within a few meters of surviving observers. Only thousandths of a second are involved in the event. Yet, too, an undisturbed geological surface may be the setting for a large number of biological mutations provoked by a radiation storm of cosmic origin.

What "gravity" is supposed to accomplish in aeons, electricity could quickly accomplish before the eyes of the earthly observer. Driven by the powerful motivator, electricity, quantavolution becomes not only possible - but also essential. Furthermore an understanding of electricity's role provides a powerful new and *unified* explanation of most observable phenomena.

If the evidence cited in Chapter One has permitted us to proceed, viewing the developing Solar System as Solaria Binaria, and similarly, if in Chapter Two we end up viewing stars, and in particular, the Sun as an electric phenomenon, then we can hope to inquire about the time scale over which the Solar Binary developed. To be more specific, may we have a stellar binary which develops over a short interval through some of the most significant phases of the history of the Solar System ?

To tackle the problem of chronology we shall, as we have done before, look to the skies for the crucial clues. We must, in so doing, introduce a seemingly radical conception, one which we feel can be defended with the evidence to follow. We assert, in line with the past chapter, that stars take their properties less from the material which they contain and more from the electrical difference between the cavity, which creates the star, and the surrounding medium of electrified space (see => *space infra-charge)*.

Translated into more common astronomical language, the luminosity of the star depends upon its galactic environment rather than upon the amount of material which it contains (see behind and to Technical Note B). The conventional notion that the more luminous the star, the more massive it is, was induced by Eddington from the analysis of a small sample of binary stars. As we interpret the same data, the more luminous the star, the more it transacts with its companion, and so the companion completes its orbit more rapidly (see Technical Note D). Unfortunately Eddington's Mass-Luminosity relationship is well established in astronomical formalism, so that today stars are assigned masses as soon as their luminosities are estimated.

There is a problem inherent in Eddington's method of massing the binaries. He calls upon "gravitational force" and nothing else to bring about motion within the binary system. The problem is compounded when luminosities are introduced as a way to measure mass in non-binary systems. Luminosity can only be known where the distance to the star can be measured. Star distances are computed using the annual parallax produced by viewing the displacement, as the Earth orbits the Sun, of any nearby star against the background of very distant stars. The parallax measurement involves measuring the minute angle at the apex of an isosceles triangle whose base is the diameter of the Earth's orbit about the Sun.[21] Parallax angles are very small; the closest star, Alpha Centauri, is only displaced through 1.52 => *arc seconds* over the year. This parallax, the largest, was not measured until 1839 (Baker, R. H., p. 317) Parallaxes are difficult to measure and they cannot be determined for stars farther from Earth than 652 => *light-years*. Such a small distance encompasses only one thousandth of the sphere of stars under close observation by astronomers. Thus the majority of reported star distances and luminosities are derived by theory rather than measurement. Of the twenty first-magnitude stars (the apparently brightest stars in the sky) only five are closer than 26 light years, the next five take us to 84 light-years; the next seven to 217 light years; and the last five to the measurement limit. In this sample are six supergiant stars; the parallax of one of these stars is only an estimate, two of the others are at the extreme limit, the last three are between 171 and 192 light-years distant. None of the most luminous supergiant stars are in this sample; thus all luminosities given for such stars are estimates! Even where parallax is measured, the measurement is rarely precise; uncertainties of 25% and larger are common, leading to luminosities which are most likely erroneous in the order of at least 56% (about half a magnitude unit). Near the measuring limit the possible deviations grow immensely, often exceeding considerably the number measured.

The famous => *Hertzsprung-Russell diagram,* the Rosetta Stone of modern astronomy, plots stellar luminosities against surface temperatures, determined from the star's spectrum. Since the spectrum is often difficult to classify, placement of the star on the diagram is not always easy (Baker, R. H., p. 342). To circumvent that difficulty astronomers now rely upon color indices in place of spectrum classes.[22] Such measurements are even more strongly theory dependent than the former in terms of their

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[21] In practice, the parallax is half of the annual angular displacement of the star, and the base of the triangle, now right-angled, is one astronomical unit.

[22] The color index is determined by measuring the brightness of the star through two or more colored filters and comparing the intensities obtained with calculated laboratory profiles of intensity versus wave-lengths for various temperatures.

applicability to stellar emissions (see Wyse, p. 49), but they are more quantitatively formulated and therefore they lead to an unjustified sense of satisfaction with the computed result of the stellar condition. For our purposes they offer no help.

What we would say about the classification of stars is the following. In going from stars whose surface temperature appears to be high, to those which appear cooler, there is a gradation of the lines present in the stellar spectra. The hotter stars show absorption produced by helium atoms. As we look at progressively cooler stars the helium lines decline and abruptly hydrogen lines appear, increase in intensity, and slowly decline. As the hydrogen declines, the lines of the metals and metal ions increase in intensity through the solar type stars; they dominate in stars slightly cooler than the Sun, only to be surpassed in the coolest stars by band spectra produced by various simple molecules, notably hydrides and oxides. In some of the coolest stars compounds of carbon are prominent. Although astronomers may continue to seek a more precise classification for stars, we are content to employ the traditional spectral types for the present study.

Besides the Hertzsprung-Russell diagram that is used to classify the stars, astronomers have also divided the stars into populations according to their location within the Galaxy.

Some striking results were obtained:

1. The most luminous and apparently hottest stars are found within gaseous clouds containing much cosmic dust. These stars are confined in clumps to a thin plate that forms the equator of the Galaxy. Similar stars define the highly visible spiral arms seen in other galaxies.
2. Bright, cooler stars like Sirius are located near the equator of the Galaxy but are not confined to the galactic arms.
3. The disc of the Galaxy is populated with moderately hot stars (with 5000 to 8000 K surface temperatures); these stars resemble the Sun and populate the arms, the spaces between the arms, and make up part of the stars that occupy the central core of the Galaxy. These disc stars are the most numerous group of stars observed.
4. The disc of the Galaxy is enveloped in an ovoid shell of red giant stars whose spectra show fewer metals than stars of comparable type in the disc population. That these stars are mostly giant stars

is usually explained by claiming that the smaller stars in the population are not likely seen because of distance from the Earth. It is possible that the latter are absent. Most of what is known about these stars is from the study of giant stars within star clusters and intrinsically varying giant stars - where the star's luminosity varies in some characteristic way over an interval of days to months.

5. The Galaxy itself is embedded in a halo of cooler stars. Most of what is known of the galactic halo is deduced from a study of a few nearby small stars and 120 globular star clusters which surround the core of the Galaxy. One of these globular clusters, Messier 13 in the constellation of Hercules, has been described as a "celestial chrysanthemum" (Baker, R. H., p. 451). The number of stars in this cluster cannot be counted; but estimates around 500 000 are made. Averaging this number of stars over the volume of the cluster (not precisely known) it would seem as if the stars are about two light-years apart, much closer than the stars near the Sun. Some small halo stars are observed passing through the disc stars in the Sun's vicinity. Barnard's star is an example.

In summary:

- the most interactive stars and gas clouds form clumps which are the galactic arms

- around the arms is a disc of less interactive stars

- enveloping the disc are variously shaped ovoids and halos alleged to be progressively more "metal deficient" stars.

It has been proposed that the stars of the different populations of the Galaxy follow orbits about the galactic core which are characteristic of the population. Supposedly the arm stars have the most circular orbits; the disc stars follow slightly elliptical paths. Some are deemed to move inclined slightly to the galactic plane, like the asteroid orbits of the Solar System. The halo stars move in strongly elliptical orbits with random inclinations to the galactic arms, like the comet orbits of the Solar System. As they pass through the Sun's locality the halo stars betray their presence by large annual displacements compared to the disc stars.

All of the stars in the Galaxy are in motion. Since there is no standard of rest all we can detect is the motion of one star relative to another. Two streams of stars are observed moving past the Sun parallel to the Milky

Way (the arms of the Galaxy). The two streams move oppositely at a relative speed of 40 km/s, the outer stream moving towards Orion, the inner one to Scutum. These motions apparently reflect differences in the motion of consecutive galactic arm segments in the Galaxy. The stars in the Sun's "arm" we assume move with the Sun at 275 km/s [23] towards the constellation of Lyra near Cygnus, which is a motion away from the stars of Puppis.

Looking only at the net motion of stars close to the Sun we detect the drift of the Sun within its arm of the Galaxy. This analysis reveals a motion of 20 km/s towards the constellation of Hercules (away from the constellation of Canis Major)(Mihalas and Routly, p103).

Neither of the Sun's motions is precise but they should suffice for our purpose. The Sun's motion within its arm carries it four astronomical units per year. It takes nearly 22 500 years for the Sun to drift one light-year from its present position. But, when the galactic revolution motion is considered, the Sun is moving up to fourteen times as fast. In the extreme only 1107 years are required to displace the Sun one light-year, so in ten thousand years the Sun moves nine light-years, and in one million years it travels about 904 light years.

If our hypothesis is correct and the stars derive their properties from the space in which they are embedded, then a look at the stars presently in the Sun's wake will tell us how the Sun appeared in ages past. Unfortunately the path of the Sun over the last million years, within which we believe Solaria Binaria developed and collapsed, is not wholly within measured space. Luminosity assumptions need to be made during the first two-thirds of the binary's lifetime.

The Sun's total motion now is directed away from a point within the constellation of Right Carina (the solar antapex) at 8.4 hours Right Ascension and declination -62º.[24]

This antapex was determined by Strömberg using the radial velocities of globular star-clusters (Menzel *et al.).* In his sample, the Sun's drift and the Galaxy's revolution combine to produce a net motion of 286 km/s away from the antapex.

For star systems close to the Sun, adjacent stars are about 10.3 light-

[23] We choose this value from a list of several, spread between 167 ± 30 km/s and 300 ± 25 km/s, the values obtained using different samples of celestial objects (Mihalas and Routly). The choice can never be free of theoretical bias, nor of indeterminate bulk velocities possessed by the sample objects. Here, the choice is a compromise between accepted values for the galactic rotation (Menzel et al.) and the higher value derived from measurements within the Local Group of Galaxies (Mihalas and Routly).

[24] Negative declinations indicate coordinates south of the celestial equator.

years apart, each thus occupying a sphere containing 578 cubic light years of space (Allen, 1963, p237). Given such a low star density, a rather large volume must be examined around and along the Sun's wake to ensure that some stars are included. We have constructed, therefore, a cylinder thirteen and one-quarter light years in radius about the Sun's path. Moving for ten thousand years through this cylinder the Sun will "encounter" about 5000 cubic light-years of space. In such a volume there would reside about nine stars or star systems at the average local star density. Over the sixty-five light year swath through space covered by the *Gliese Star Catalogue* there are only fifteen star systems. It appears that along the Sun's path, the actual star density is only twenty seven percent of that expected. The Sun entered the region included within the Gliese catalogue about 74 000 years ago. Within that volume, our analytical sample of stars is reasonably complete . Beyond it, many of the stars located along the cylinder do not have published parallaxes and so they cannot be located in time; they cannot be used in the analysis.

The region of space which includes those stars which now occupy the space once passed through by the Sun on its galactic voyage is represented on a star map by a cone centered on the solar antapex [25].

The base of the cone in the present includes stars over one half of the sky. As time progresses backwards the frustum of the cone projected upon the sky diminishes in area (Figure 3). The frustum of the cone 3 500 years ago is a circle 76° in radius, encompassing stars from Orion's belt across the South Celestial Pole to the Scorpion's tail. Moving back twenty thousand years shortens the radius to 36°, thereby including the region from the feet of the Greater Dog to the Centaur's right foot. The area has only a 13.5° radius sixty thousand years ago; it shrinks to less than a 3° circle after three hundred thousand years.

Through recent time the Sun's trail is very close to a straight line projected towards the antapex. It is shown in Figure 4 and the stars included are listed in Table 1.

The stars occupying the space inhabited by the Sun through the current era (the Period of Solaria)[26] and during the time of the Late Quantavolutions, to be discussed in part Two of this book, are in this sample. Here, we find the nearest star system, the Alpha Centauri triple. The largest star is very similar to the Sun (Dole, p. 112).

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[25] Because of galactic rotation the cone is bent slightly. Over one million years the path bends eastwards by a shade less than one degree , corresponding to a sideward displacement of 15 light years.

[26] See ahead to Table 6 (p. 124) for a summary of the periods during Solaria Binaria's lifetime.

Figure 3
Stars Around the Sun's Antapex

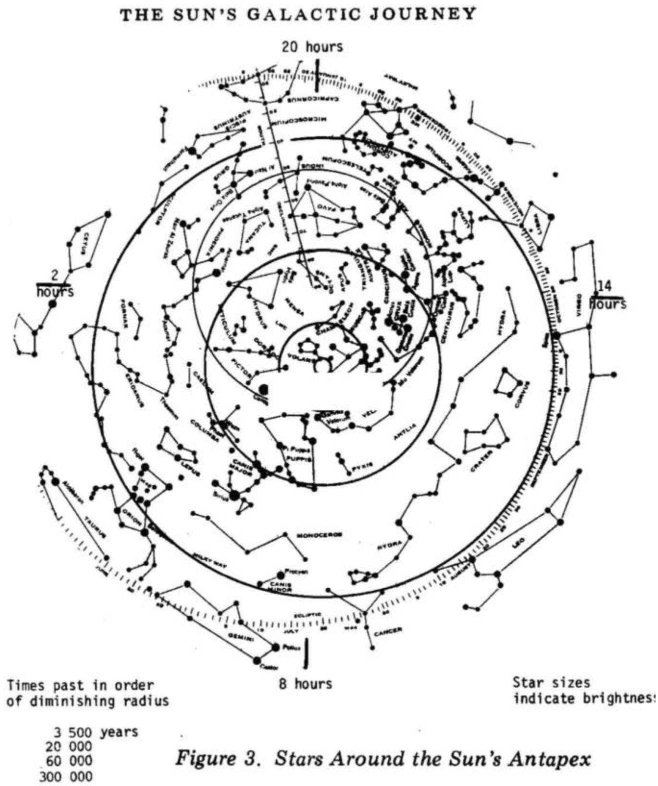
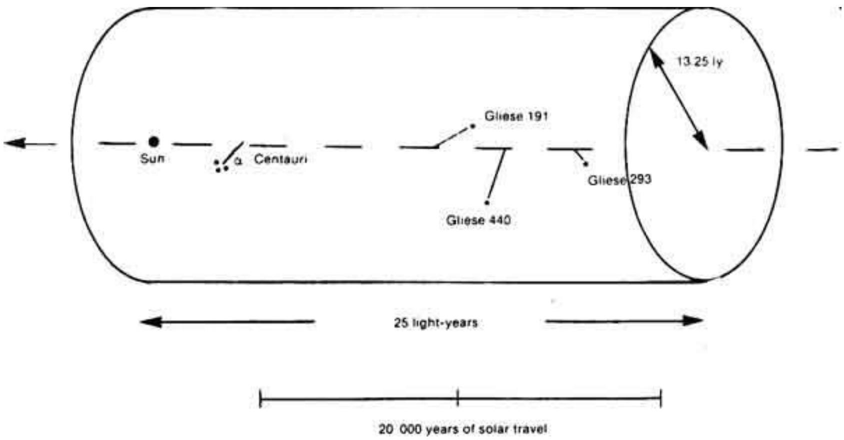


Figure 3. Stars Around the Sun's Antapex

The Sun's path traced backwards through the stars of the Galaxy passes through a cylinder of space whose axis stretches from the center of the Sun through the point on the celestial sphere with coordinates 8.4 hours of right ascension and -62º of declination. The edge of this cylinder, chosen to have a radius of 13.25 light years, is represented for different eras by the series of circles converging onto the solar antapex.

Its first companion is 23.5 astronomical units away moving along an elliptical orbit (Menzel *et al.,* p467). This star is slightly cooler and fainter than the Sun. The second companion is located almost two degrees away in the sky. It is over 550 times more distant than the separation of the closer pair. Frequent eruptions superpose bright emission lines on its otherwise faint class M spectrum. It is a flare star; its flaring might be associated with some intermittent transaction with the pair of distant companions. Unfortunately the α-Centauri triple is the only occupant within the space transited by the Sun during the series of quantavolutions preceding the historical period. It gives us no clue to an understanding of that space besides learning that solar-type stars can exist there.

Figure 4
Nearby Stars in the Solar Wake



The sun's path through the space now occupied by the stars listed in Table 1. This space represents the region traversed by the Sun while it quantavoluted from Solaria Binaria into the Solar System we see today.

The three remaining stars are all low-transaction objects. This space we would suspect to hold a lower electric charge density than the space closer to the present. The closest of these three faint stars is located within the zone we believe was occupied by the Sun in the time before the eruptions began which eventually broke up Solaria Binaria. That instability of the recent past may well have been created as the Sun passed between the lower and higher regions of the transaction represented by these six nearby stars. The likelihood is that the Sun, late in the Period of Pangean Stability (Table 6), was less luminous than it is today.

Table 1

STARS BEHIND THE SUN (to 25 000 Years Ago)

Identification of Star	Distance from Sun (in ly)	Years in the Sun's wake (see Fig 3-2)
Alpha Centauri: Triple Star, main sequence components, dwarf "G", "K", and "M" stars; emission lines in the type "M" spectrum	4.3	4 860
Gliese 191: MO main sequence dwarf star	13.0	14 750
Gliese 440: White dwarf start (class A)	16.1	18 200
Gliese 293: White dwarf start (class t-g)	19.2	21 700

Table 2

STARS BEHIND THE SUN (from 25 000 to 75 000 Years Ago)

Time (BP)	Star Name	Type
27 300	Gliese 257	M4 +
33 500	Gliese 341	M0
36 400	Alpha Mensae	G6
47 600	Gliese 269A	K2, Binary
53 500*	Gliese 333	M3
53 500	Gliese 375	M5 +
54 300*	Gliese 391	F3, Subgiant
64 700	Gliese 294A	F8, Triple
68 300	Gliese 298	M
73 800	Alpha Chamaeleonis	F5

Limiting magnitude + 18

* These stars are 25 ly apart, the Sun passes through space at their respective distances at the beginning and end of a 760 year interval.

Extending the Sun's line farther into the past to the limit of the Gliese catalogue (Table 2) we find no stars as luminous as the present Sun until we go back 54 000 years. Then along the path are positioned three stars that exceed the Sun in luminosity. The closest, an F3 subgiant, is five times more luminous; the second, the primary star in a triple system, is only 1.44 times brighter. Its two companions are very faint. The last of the three brighter stars exceeds the Sun's output eight-fold.

At the 75 000 year limit to Table 2 we reach the edge of the reasonably complete star sample. So far there are no conflicts with our theory. Stars of different spectral classes are well separated in space. In fact the cooler and hotter stars seem to be sorted: the class M stars tend to lie above the Sun's route while the class F and G stars are below it.[27]

If our calculated course is correct, the Sun's past behavior, as mirrored in the listed stars' present behavior, would show significant variation in luminosity over the tens of thousands of years represented here. Noteworthy, there are no highly luminous stars thus far along the Sun's trace.

Beyond 65 light-years, the magnitude limit of the available star catalogues containing measured parallaxes limits severely the completeness of the star sample. We can list no stars that are intrinsically fainter than today's Sun (Table 3). The catalogue from which the sample was taken covers only stars whose visual magnitude exceeds 6.25 (Becvar) whereas the Gliese catalogue includes known nearby stars above magnitude 18. Almost all of these stars show some distinguishing characteristic. The majority are binary, another has nebulous spectrum lines. These stars are positioned about the solar antapex in Figure 5. All could reflect plausible conditions for the early stages of Solaria Binaria's Period of Pangean Stability, and possibly also for the earlier Period of Radiant Genesis which followed the binary's creation.

At the limit of our proposed time (about one million years before present) using the Atlas of the Selected Areas (Vehrenberg) we count about 39 stars brighter than magnitude 12.5 in a target zone 40 by 40 arc-minutes adjacent to the Sun's antapex. Unfortunately no distances are given for the stars in this atlas.

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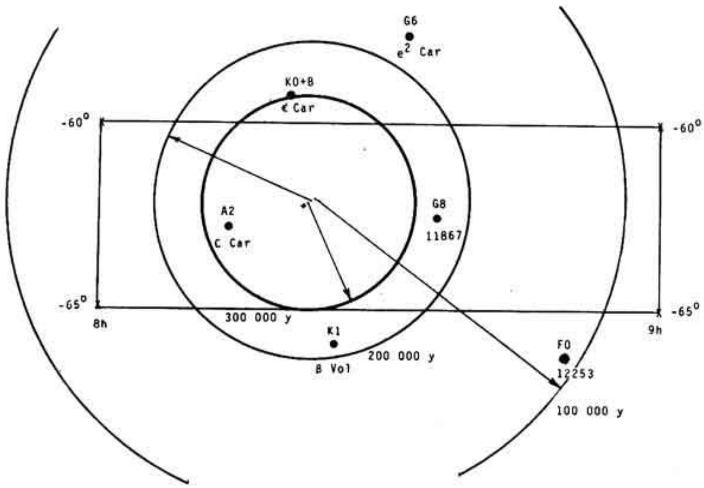
[27] Given a small error in the solar motion (which is uncertain because the Sun's drift velocity, especially in the direction of the Galaxy's rotation, is variously reported with a twenty percent range), its path could be veering somewhat, either upwards or downwards relative to the path we have calculated. If so in this period the Sun might have become significantly brighter, or alternatively, remained much fainter than at present.

Figure 5
The Solar Antapex



Map showing the brightest stars surrounding the solar antapex (see Table 3). The circles represent the described cylinder of space around the Sun at the ages shown. The successive radii are centered upon a slowly displacing point representing the solar antapex. The displacement, seen at this map-scale, occurs because the Sun rapidly orbits about the center of the Galaxy as it slowly moves through the arms of the Galaxy; its path therefore is a curved rather than a straight line.

Table 2
STARS BEHIND THE SUN (over 75 000 years Past)

Time (BP) (in Thousands of years)	Distance (in ly)	Star Name	Spectral Type
124	112	b Volatis	K1
134	121	C Carinae	A2, binary
139	125	GC 12253	F0, nebulous lines
258	233	GC 11867	G8, binary (M=+ 1)
301	326	e Carinae	K0, B; Spectroscopic binary

Limiting magnitude + 6.5 The sample ends at the edge of measured space.

Since our calculated solar target shows no stars the deficiency of the present measurable sample is confirmed. Nevertheless we see that the last listed star, 300 000 years BP along the Sun's run, is a spectroscopic binary whose class B primary is orbited by a class K secondary; a system not unlike our view of the early Solaria Binaria.

In our analysis more distant stars cannot be located in time along the Sun's path. Yet we can place, although uncertainly, several bright blue supergiant stars at locations surrounding the antapex in all directions and at distances corresponding to times between one-half and three million years ago. Several of the stars are components in binary star systems.

Within or on the periphery of this highly transactive region of space, the original Super Sun may have parturitioned to give birth to Solaria Binaria.

Although proof is hardly forthcoming from this analysis, at least evidence disproving the hypothesis is absent. We are encouraged to retain the idea that the behavior of star systems depends, if only in part, upon the celestial charge level of the space through which they pass. It seems as if this electric charge is contained not only by material residing in the space (stars, atoms, and electrons) but also, in part, as a charge embedded in the space itself, what we shall call a space infra-charge. Literally, the space infra-charge means that a vacuum (empty space) contains normally unavailable electric charges (here electrons) which generate the structure of that space and affect the behavior and properties of all matter occupying the space.