8

The Cosmic World

The Solar System

In the previous chapter we spoke of creation by reference to the smallest particles from which matter is assembled. Now we turn to the cosmic scene and examine the question of creation of the sun and its planets.

It is conventional to begin with a hypothesis. There was a beginning when the sun was formed by accretion of cosmic dust. Gravity brought the matter together and it nucleated to form the sun. The great mystery is how it all started and another mystery is how the planets formed once the sun became established. The unified physical account presented in our previous chapters gives us a new starting point for addressing these issues, because it has provided a phenomenological account of the nature of gravitation. Gravitation has become dependent upon the structured nature of the vacuum medium. This allows us to contemplate an analogy elsewhere in physics, one, indeed, from which the primary inspiration for the author's development of this whole theory sprang. The analogy arises in the state of ferromagnetism.

The electric interactions between atoms in a crystal can, under certain circumstances prevalent in just a few materials, generate forces we associate with ferromagnetism. The law of electrodynamic interaction developed in Chapter 1 finds application in the author's interpretation of ferromagnetism.* It is the same law as that used to explain gravitational force in this work. Furthermore, we have seen that the gravitational force depends upon the parallel motion of the graviton system, a condition which depends upon ordered motion associated with the lattice structure of the space medium. Random motion in a disordered lattice would suppress the gravitational action.

* H. Aspden, *Physics without Einstein*, Sabberton, Southampton, England, p. 48 (1969).

The analogy applies exactly within the ferromagnet. Ferromagnetism vanishes at the Curie temperature when the thermal condition of the crystal lattice is sufficient to upset the interaction forces and upset the critical energy balance favouring ferromagnetism. Logically, therefore, if there was a beginning when cosmic dust began to nucleate to form the sun, then that beginning might have been an event when the space lattice changed from a state of disorder to one of order. Gravitation then appeared, to form the astronomical objects we see today. Conversely, one day we might expect something to trigger the onset of disorder and gravitation may vanish, causing the sun to disintegrate and disperse its matter. Eventually order would be restored and we would begin a new cycle of creation.

This may seem to be mere speculation, but it is speculation with better foundation that the usual nebular hypothesis of creation. The reason is that, because gravitation suddenly appears, a special phenomenon will occur, which could not be foreseen in a system in which gravitation has always existed but matter is created gradually and then nucleated.

Dispersed matter spread over a vast region of space could be expected to contain at least some heavy positive ions and a corresponding number of negative electrons of relatively small mass. The mutual gravitational action of a gas containing such asymmetry in the distribution of charge and mass would cause an initial sun to form with a positive charge Q given by $G^{\frac{1}{2}}M$, M being its mass and G the constant of gravitation. The reason for this is that the mutual gravitational force between two heavy ions causes them to accelerate towards one another at a much higher rate than that operative between two electrons. It only needs a very small degree of ionization to ensure this build-up of central positive charge. The formula is derived in Appendix I.

Eventually, of course, the electrons will arrive to cancel the positive charge and assure the electrical neutrality of the body formed. In the meantime, these electrical effects are all that is necessary to set the character and principally the rotation of the newly formed sun. Also the eventual electrical neutralization by the inflow of electrons induces the creation of the planets.

In explaining these processes, the question of planetary creation will be addressed first. The source of the sun's initial angular momentum (denoted X) will be explained in the next section. Since angular momentum is conserved in the solar system, the value of X is that we measure today as the total angular momentum of the sun's rotation and the planets in orbit. Let R denote the radius of the sun in its primordial form. Given Q, R and X, we can write the following equation:

$$kQ^2/R^2 = X^2/mR^3 \tag{212}$$

where k is a factor introduced for reasons which will become apparent as we proceed, and m is a mass quantity other than M.

The equation relates the Coulomb interaction between the core charge $+Q$ and the balancing charge $-Q$ on the assumption that the latter charge is held at the surface of the system and associated with matter of mass m which has absorbed all the angular momentum X. k is a factor which qualifies these assumptions. The expression X^2/mR^3 is merely the centrifugal force of the mass m.

R. A. Lyttleton* in his book *Mysteries of the Solar System* has explained how magnetic forces exerted within a system of charge by its rotation and self-gravitation will force angular momentum outwards. Thus the transfer of the angular momentum X to a concentrated surface zone is understandable. In a sense this can be thought of as a phenomenon similar to the gyromagnetic reaction already discussed. The reaction angular momentum of the field absorbs angular momentum from the centre of the body and the primary balance of angular momentum is driven to the outer periphery of the rotating system, all as a result of the diamagnetic screening effects within the electrical core.

Once the equation (212) is established, the body is primed to create its satellite system. All that has to happen is for the Q charges to neutralize by slow discharge and as this happens the satellite matter of mass m will leave the main body. It will take up an eventual orbital position governed by gravitational balance between $M-m$ and m and the orbital centrifugal forces of m.

This is all rather simple and it lends itself to immediate verification because we can develop a formula for m/M which can be checked with observation. Note that $GM^2=Q^2$ and write M as $4\pi\rho_m R^3/3$, where ρ_m is the mass density of the parent body. Replace X by $2MR^2w/5$, the formula for a uniformly dense sphere of mass M and radius R rotating at angular velocity w. Then (212) can become:

$$m/M = 3w^2/25\pi\rho_m Gk \tag{213}$$

* R. A. Lyttleton, *Mysteries of the Solar System*, Clarendon Press, Oxford, p. 34, 1968.

Now apply this to the sun, noting that the initial angular velocity w of the sun is found by summing the present angular momentum of the solar system and computing w from the above expression for X. This is shown in Appendix II to make w a little greater than $8\ 10^{-5}$ rad/s. G is $6{\cdot}67\ 10^{-8}$ cgs units and ρ_m of the sun, assuming its present value still applies, is 1·4 gm/cc. We then find that if $k=2$ the planet/sun mass ratio given by (213) is 1/764. The observed value of this mass ratio is 1/745.

Next, let us check this same formula with the Earth's own satellite, the moon. The Earth has a ρ_m value of 5·5 gm/cc and w of the initial Earth before the moon was ejected was, according to Lyttleton,* 5·5 hours per revolution or $3{\cdot}2\ 10^{-4}$ rad/s. This is easily verified by adding the moon's angular momentum in orbit around the Earth to that possessed by the Earth today. In this case we find that if $k=1$ we obtain from (213) a value of m/M of 1/83. The observed moon/Earth mass ratio is 1/81.

It follows that we have a viable theory of creation of our planetary system if only we can explain why $k=2$ for the sun and $k=1$ for the Earth. This is a vital clue to the understanding of the cosmic medium and the source of the sun's initial angular momentum. We find that we need to explore the field energy properties of the space medium of our earlier chapters, but on a cosmic scale.

Cosmic Space

Gravitation has been shown to be an electrodynamic action involving the graviton system of the space medium. The interaction energy associated with this action had two aspects. Firstly, there was a mere deployment of electric field energy between the interacting charge system and the space displacement system. This involved the Neumann potential. Secondly, and governed by this deployment according to the Neumann potential, there was a related amount of energy supplied to the kinetic reaction. This is a kind of thermal energy, generally known as magnetic field energy.

As might be expected, therefore, when matter comes together under gravitational attraction the loss of gravitational potential results in kinetic energy which we assume generates heat and is dispersed. Our observations relate only to the cause, the mysterious force of gravitation, and the ultimate effect, the creation of heat. What happens in

* R. A. Lyttleton, *Science Journal*, 5, 53 (1969).

the intervening stages is not normally considered. It seems probable that if gravitation is a process arising from the involvement of the structured vacuum medium, then the kinetic energy could, in an intermediate stage, be energy associated with motion of that medium. We can then contemplate two kinds of motion, the thermal agitation of the lattice particles and the ordered rotary motion of a whole vast region of the lattice. The disturbances caused by matter are unlikely to affect the universal energy content of the ordered harmonious motion of the space medium depicted in Fig. 22, at least as far as matter acting on matter is concerned. In our next chapter we will see some interesting consequences of gravitational interaction between matter and the lattice of the space medium.

Here, then, is another clue. The energy available from the gravitational accretion of matter forming the sun did not go directly into heat. It passed through a phase in which it sustained the kinetic energy of a body of space itself, as if the space medium associated with this accreting matter were able to move to absorb this energy. The photon unit of our earlier discussions demonstrated the scope for bodily rotation of space within an enveloping non-rotating space. The question posed then is the source of the angular momentum. Now this we have in abundance because the whole C-frame and G-frame system of space, as depicted in Fig. 22 possesses angular momentum on a vast scale. The problem is how to tap this source. It is here that we find the electrical action of the temporary charge Q of the initial sun performs a key role.

In Chapter 2 we saw that a charge would cause displacement of the space lattice, effectively transferring Coulomb energy to the corresponding Coulomb form of charge displacement in the space medium. The charge Q must cause such a displacement in the whole region filled by the accreting solar substance. This system has a special property. It is spherically symmetrical and the displacement is, or rather tends to be, radial from the centre of the system. As electric potential it always tends to minimize and degenerate into kinetic energy. This is not usually possible in an ordered system because it would mean contravening Newton's Third Law of Motion and introducing unidirectional linear momentum. It becomes possible in such a system in the presence of a radial field extending over a large range, because we can have rotation by borrowing angular momentum from the fund of angular momentum of the space medium. Thus the Coulomb energy of the charge Q can find its way into the kinetic energy of rotation of the space medium, transiently, pending the neutralization by $-Q$, and so fix a rotation which is shared by the sun itself. Eventually, much of this kinetic energy is returned as the neutralization process occurs. Some finds its way into normal thermal energy of matter and is dispersed. Perhaps the major part goes into the galactic motion of the sun. However, a small amount is probably retained and sustains the rotation of the space medium within the present sun.

This account lends itself to analysis and, once again, we can take comfort from the very pertinent numerical results which emerge.

Write ρ_0 as the mass density of the lattice system of space which is set in bodily rotation on a large scale. We assume spherical symmetry to permit such rotation without collision with surrounding lattice. Then, taking R now as the radius of such a sphere, the kinetic energy of this rotating space is given by:

$$(1/5)(4\pi R^3/3)\rho_0 w^2 R^2 \tag{214}$$

w is now the angular velocity of this space region.

It is coextensive with a region in which the charge Q is dispersed uniformly and cancelled by displacement generating a uniform space charge of opposite polarity and density σ'. Thus, the electric energy can be calculated as:

$$(3/5)(4\pi R^3/3)^2(\sigma')^2/R \tag{215}$$

We would like these to be equal to signify the possibility that the electric energy may have transferred to kinetic form, assuming that we can find a way of justifying such an action. This would give:

$$\rho_0 w^2 = 4\pi(\sigma')^2 \tag{216}$$

Now we search for such an action. We imagine that the space rotation is about an axis parallel with the universal direction of the spin vector Ω of the space medium. Consider a lattice particle of charge q describing its orbit of radius r at this angular velocity Ω, with its centre carried at speed wR about the remote central axis of the rotating space region. This is illustrated in Fig. 38.

The lattice particle is held in synchronism with all the surrounding particles in the non-rotating space environment as well as with those elsewhere in the rotating region. This puts a constraint on the particles due to their motion about the remote axis. They are displaced in a radial sense in a plane at right angles to this axis, the displacement being inwards or outwards according to the direction of rotation of the space region.

Inspection of Fig. 38 will show that when the two motions are compounded the radius of the particle orbit must vary between

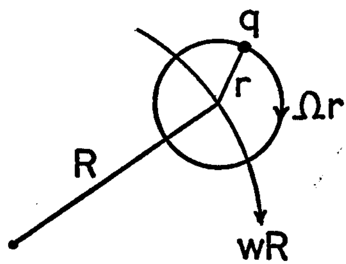

Fig. 38

$r(1+wR/\Omega r)$ and $r(1-wR/\Omega r)$ for the condition of synchronous motion to apply. In effect, the particle is moving at a steady speed in orbit about a new centre radially displaced from the remote axis through a distance wR/Ω. This corresponds to an induction of charge of density σ' given by incrementing the radius of a disc of charge density σ by this amount wR/Ω:

$$\pi(\sigma')R^2 = \pi\sigma[(R+wR/\Omega)^2 - R^2] \tag{217}$$

From this:

$$\sigma' = 2\delta w/\Omega \tag{218}$$

The value of σ is, of course, the charge density of the continuum, apart from a change of sign. We know from (132) and the preamble just before (132) at the beginning of Chapter 6 that:

$$m\Omega^2 = 8\pi\sigma q \tag{219}$$

where m is the mass of a lattice particle. As a mass density this becomes $m(\sigma/q)$, which is $8\pi(\sigma/\Omega)^2$ from (219). It is then of interest to see that if we double this, taking account of the equal mass density of the G-frame system, and equate the result to ρ_0, we obtain from (218):

$$\rho_0 w^2 = 4\pi(\sigma')^2 \tag{220}$$

This is the equation (216).

What this means is that the electric energy given by (215) can be converted into the kinetic energy given by (214) by the development of rotation which induces charge displacement owing to the synchronizing constraints, this latter charge displacement replacing the normal direct field displacement but deriving its energy from the pooled energy of the Ω spin of the space medium generally.

The formula (220) gives us immediately a value for w determined by the other parameters of the creation process. We know that σ' is $G^{\frac{1}{2}}\rho_m$. Thus:

$$w = \rho_m(4\pi G/\rho_o)^{\frac{1}{2}} \tag{221}$$

This is independent of R.

Thus a whole expanse of the space medium begins to rotate at this angular velocity w, determined by the mass density ρ_m of the accreting matter. Electrical effects are balanced. The system goes faster and faster as it shrinks in size to the compacted form of a solid body or a gaseous body in equilibrium under its own pressure. The value of w at that time determines how fast the body rotates when created. The value of ρ_o needs some adjustment for this involvement of ρ_m, but we neglect this in applying formula (221), because our theory tells us that ρ_o is appreciably higher than the normal mass density associated with matter. Indeed, we will now calculate ρ_o using the data for w and ρ_m presented above in calculating the masses of the satellite systems of the sun and Earth.

(221) as applied to the sun gives ρ_o as 257 gm/cc and as applied to the Earth gives ρ_o as 248 gm/cc. These results are gratifyingly of the same order. However, better than this, there is general agreement with the absolute derivation of ρ_o from the main theory. We know that ρ_o is given by:

$$\rho_o = 2m/d^3 \tag{222}$$

As we saw in Chapter 6 from (155) the mass m is 0·0408 times the mass of the electron, or 3·72 10^{-29} gm. The value of r/d was about 0·3029 with r as $1/4\pi$ of the Compton wave-length. Thus d is 6·37 10^{-11} cm. From (222) ρ_o is 288 gm/cc.

It is evident from this that, given the basic theoretical constants of the space medium determined in this work, we can, from (221) and (213), account for the angular momentum and satellite/mother-body mass ratio of planetary systems. The only parameter needed is the mass density of the matter which accretes to form the mother body. There is but one proviso. This arises from the perplexing problem of the factor k in (213). Why should k be 2 for the formation of the sun's satellites and 1 for the formation of the Earth's satellite?

Is this a measure of the uncertainty in the analysis, a 50% factor, or is there some special design in Nature's fabric?

The answer appears once we consider the domain concept of space.

Space Domains

We have used an analogy with ferromagnetism in the introduction to this chapter. This analogy will now be extended to the concept that space has two forms. Our basic space medium was found to have lattice particles immersed in a continuum of charge of opposite polarity. It had a C-frame and a G-frame rotating in the same sense. Thus it involved asymmetry of two kinds, an electrical asymmetry and an angular momentum asymmetry. The need for universal balance suggests that there may be other domains in space within which the lattice particles have the opposite polarities and the continuum also has its charge reversed. Also the direction of the angular momentum vector linked to the parameter Ω could change from one domain to the next. In the universe overall there could be balance, that is no net angular momentum and as many anti-lattice particles as lattice particles. A vacuum of space and anti-space domains is suggested.

Potentially each star, or pair of stars if binary, is a candidate for its own space domain. There is unlikely to be any gravitational action between matter in separate space domains. Hence gravitational interaction between stars would seem to be precluded on this model. This is not so, because, although stars formed in different domains may be de-coupled gravitationally at the time they were formed, they migrate across domain boundaries and they are gravitationally coupled when sharing the same domain. A loosely-connected gravitational action can then be envisaged as an average effect acting only between nearby stars. It is as if they are coupled by a chain subjected to sporadic jerks so that some links are disconnected at any given moment. Such a chain can, nevertheless, convey forces, especially if each link has the inertia of a star.

The need for such domains is soon apparent when we trace the source of the angular momentum needed to create a star. Now, as was explained by reference to equations (97) and (98) in the chapter on quantum mechanics, an energy E fed to the space medium involves an angular momentum addition of E/Ω and half the energy goes into kinetic energy locally. Conversely, if the space medium yields an energy E as gravitational energy it loses angular momentum E/Ω and kinetic energy $\frac{1}{2}E$. This angular momentum is assumed to go to the star.

On this basis we can write the gravitational potential of a lattice particle of mass m as:

$$\Phi m = \Omega H_{m} \qquad (223)$$

where H_m is the angular momentum released by each unit cell of the space lattice. This is an angular momentum of $\Phi m/\Omega$ per mass m or $\frac{1}{2}\Phi\rho_0/\Omega$ per cc. Φ is the gravitational potential of a star of mass M distant R from the region under study. Thus the total angular momentum of the star becomes:

$$(AM) = \int_0^D \tfrac{1}{2}(GM/R)\rho_0(4\pi R^2)(1/\Omega)dR \qquad (224)$$

This supposes that the domain is spherical and of radius D. The result is:

$$(AM) = \pi GMD^2\rho_0/\Omega \qquad (225)$$

D is given by:

$$D^2 = S\Omega/\pi G\rho_0 \qquad (226)$$

where S is the parameter angular momentum/mass of the star.

Now from (221) we can show that for any star this parameter S is simply related to mass/radius. This does not vary much between stars. The sun is typical and reliable as an estimate of the order of magnitude of this quantity S. For the sun the angular momentum is about $3{\cdot}2\ 10^{50}$ cgs units (at creation) and M is $2\ 10^{33}$. Thus, from (226) with G as $6{\cdot}67\ 10^{-8}$ cgs and Ω as $7{\cdot}8\ 10^{20}\ s^{-1}$, as known from the quantum mechanical chapter, we find a value of D dependent upon ρ_0. This mass density ρ_0 has just been shown to be 288 gm/cc. Accordingly, D becomes $4{\cdot}6\ 10^{20}$ cm or 480 light years.

We may expect the space domains to be measured in hundreds of light years from this account. Note that the domain boundary limits on the integration are necessary in (226). Otherwise the angular momentum fed to the star would be infinite. It increases as D^2. If, on the other hand, we say that the domain extends far enough to include numerous stars in proportion to D^3 then the angular momentum increases in proportion to D^5 and the angular momentum per star is still proportional to D^2. There must then be domains bounded in the manner indicated.

Today we find stars clustered together in regions, as if the gravitational effects between adjacent stars have brought them in closer proximity than at creation. There are several stars close enough to the sun to lie within the single domain just discussed. Such speculation, however, runs contrary to the popular idea of the expansion of the universe, and we will not develop this theme. Instead, we will adhere to the domain theory now developed and consider events as the star crosses a domain boundary.

We know that during the transit there is a breakdown of gravitational action across the boundary. This we will discuss later from the viewpoint of events on Earth as our Earth is affected by the corresponding phenomenon. The main point is the balance of the charge Q. Until the primordial sun forms its satellites it rotates with its full initial angular velocity. Thus Q is preserved in the core in balance with the radial displacement effect discussed by reference to Fig. 38. The charge $-Q$ has settled at the periphery of the sun and is kept there by the balance of charge in the space medium. Note that the radial displacement of lattice charge in space creates the uniform charge distribution within the rotating space medium but it also leaves a shell of charge at the surface. The state of electrical balance is that shown in Fig. 39.

A key issue is whether the material substance of the body has a larger radius or a smaller radius than the rotating space region. We have assumed them to be coextensive but they may not be quite coextensive. Much will depend upon whether the body developed its form in good time before the arrival of negative charge. If it developed in stages then the space region could well be of smaller radius and the body thereby inclined to shed a higher proportion of its mass as a satellite.

Therefore, in Fig. 39, both alternatives are shown. The full circle depicts the form of the body and the broken circle depicts the form of the space region. There is charge balance in both of the upper figures.

Now let us see what happens when the whole system finds itself on the other side of a space domain boundary. This is shown for both systems in the lower part of Fig. 39. The space charges have reversed because the rotation of the space medium has retained its inertial effects. We presume that the direction of the spin vector Ω

is much the same between adjacent domains. There is now a complete unbalance of charge. Magnetic effects due to rotation will appear and transfer angular momentum to outer regions and the matter charge $-Q$ will be set in centrifugal balance with the Coulomb interaction. In one case, however, where the matter charge $-Q$ is within the space boundary, the Coulomb interaction is

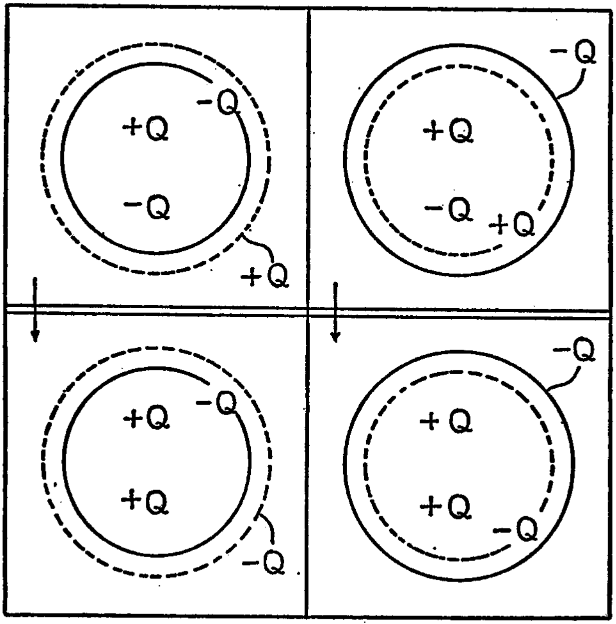

Fig. 39

$2Q^2/R^2$, whereas in the other case, where the matter charge $-Q$ is located outside the space boundary, the Coulomb interaction is Q^2/R^2. It all depends upon whether the $-Q$ charge at the space boundary is effective in producing any force on the matter charge. Thus the factor k in (213) will be 2 for the sun and 1 for the Earth, under these circumstances. No doubt the matter shed by the Earth in forming the moon resulted in the Earth's space boundary settling outside the eventual form of the Earth.

The key assumption made above is that the centrifugal balance between charge and surface matter is established before the system decays by electric discharge. This is very probable when one considers energy deployment. The basic energy is still in the kinetic form of the rotating space medium. The polarity reversal of the space medium in crossing the boundary is not an actual reversal. It is an apparent reversal. The body has moved from one region to another. The synchronizing constraints in each region will assure that energy is available if needed to sustain a transient condition. Thus the $2Q$ charge can exist and will disappear as the space region slows down and enough electrons can move in to assure a balance. Bear in mind that the initial crossing of the boundary would destroy the gravitational field momentarily causing the negative charge in the surface regions to be displaced from the surface of the body. It takes a little time to react to the attraction of the central charge and the centrifugal motion seemingly is established in this interval.

Geomagnetism

Our next question is that of the effects on the Earth of crossing a space domain boundary. We must, even after the many eons since our Earth was created, be crossing these space domain boundaries as the whole solar system progresses on its course through space. It travels at about 390 km/s, as we saw from the opening words in Chapter 3. At this speed it takes 770 years to travel one light year. It would take about 700,000 years to traverse the space domain calculated in the above example. Therefore, every 700,000 or so years we should suddenly experience a violent upset as gravitation relaxes in effect for the few seconds of transit. Also we should find that the polarity reversal of σ' causes a magnetic reversal of the Earth's field.

In this connection we can calculate the magnetic moment produced by the residual charge Q of the Earth today. This charge is positive at the present time. Its polarity is set opposite to that of σ' as induced by the rotation of the space frame with the Earth. Magnetic effects are evidenced by disturbances of the lattice particle system. The charge σ' cannot itself induce a magnetic field because it arises from a displacement of the lattice. Thus it is only the compensating charge Q associated with matter rotating with the frame that can generate a magnetic effect. There is of course a balance charge $-Q$ at the boundary which is part of the system of matter present and this also has to be taken into account. Indeed, it may be shown that the latter charge develops twice the magnetic moment of the distributed core charge. The difference is the same in magnitude as that due to the distributed charge but has the direction we associate with negative charge. It is this double action which causes the field to be similar to that of a dipole at the centre of the Earth.

The earth's magnetic moment is simply $1/2c$ times the electric charge velocity moment, or:

$$(1/2c)(2/5)(4\pi\sigma'/3)R^5w \tag{227}$$

From (218) and the fact that σ is e/d^3:

$$\sigma' = 2ew/\Omega d^3 \tag{228}$$

Then, since Ω is $c/2r$, we put (228) in (227) to find a magnetic moment of:

$$16\pi erR^5w^2/15d^3c^2 \tag{229}$$

In this expression er is the Bohr Magneton, known from experiment to be $9{\cdot}27\ 10^{-21}$ cgs units. d was shown above to be $6{\cdot}37\ 10^{-11}$ cm. For the Earth today w is $7{\cdot}26\ 10^{-5}$ rad/s. c is $3\ 10^{10}$ cm/s.

The resulting value of the geomagnetic moment is very critically dependent upon R, the radius of the space medium rotating with the Earth. Thus, if R is $6{\cdot}45\ 10^8$ cm the magnetic moment is $7{\cdot}86\ 10^{25}$ cgs units. If R is $6{\cdot}50\ 10^8$ cm the magnetic moment is $8{\cdot}17\ 10^{25}$ cgs units. In fact, the radius of the Earth is $6{\cdot}38\ 10^8$ cm and the geomagnetic moment measured is $8{\cdot}06\ 10^{25}$ cgs units.

These are very significant results, which bear out the essential validity of the theory presented. Evidently the Earth's space boundary is about 100 km above the Earth's surface on this theory. There is the question of the direction of the geomagnetic moment and the precession of the poles needs explanation, but we do have here the essential foundations for an understanding of the nature of the geomagnetic field.

It is feasible to think of the Earth's magnetic field reversing at times when the Earth is carried across a space domain boundary. By studying the evidence of the Earth's magnetic field reversals some indication of the existence, the size, and the form of the space domains should become available. We have inferred their approximate size from the theory of the space medium and the hypothesis that the known mass of the sun is typical of stellar mass generally. It remains a mystery as to why space domains of this particular size should form. To probe that question is to seek to understand why the stars have a particular mass and such questions must be deferred at this time. However, we can picture the reversal pattern of the geomagnetic field for a simple domain structure. As each domain has about the same size a simple cubic domain structure seems an appropriate choice. The results will be an approximation only, inasmuch as all stars do not have the same mass/radius parameter. To estimate the degree of approximation let us consider the extreme example of a red giant star in comparison with the sun. Betelgeux is said by Jeans* to be about 40 times as massive as the sun and to occupy 25,000,000 times as much volume. The mass/radius parameter is 0·137 compared with the sun. The value of D given by (226) is 0·37 for this red giant star, compared with the sun's domain radius D at creation. However, a red giant is believed to be the decaying form of a star, rather than the form it may have upon initial creation. Since the majority of stars are similar to the sun we can, therefore, expect a reasonably-representative pattern of magnetic field reversals to emerge from a choice of a simple cubic structured domain system. A reversal period of the order of 700,000 years is to be expected for motion parallel with a main axis of the cubic domain structure. In general, however, a motion will be inclined to such an axis and the planes separating domain boundaries will be crossed more frequently than this.

In Fig. 40 the hypothetical pattern of reversals due to motion through cubic domain space is shown in a time scale measured in millions of years before the present time. The solar system is imagined to move in a straight line through domain space over this period of time, though it does move in a slight arc owing to the galactic motion. The inclination of the line with the domain cube axes is chosen deliberately to give results which resemble the observed reversal sequence and the time scale has been matched accordingly. The names assigned to the reversals are those used conventionally to designate these events. There is a reasonably close correlation. The interesting result, however, is that such an erratic pattern of events lends itself to decoding in this way. The author believes that this is affirmative support for the domain theory suggested, especially as the size of the domains derived from the empirical data fit is in close accord with that calculated for the sun. Note that the analysis leading to (226) required D to be the radius of a spherical domain. The corresponding cube dimension would be smaller than this. The data in Fig. 40 suggest a domain cube size of about 400,000 years at the

* J. H. Jeans, *The Stars in their Courses*, Cambridge University Press, p. 92 (1931).

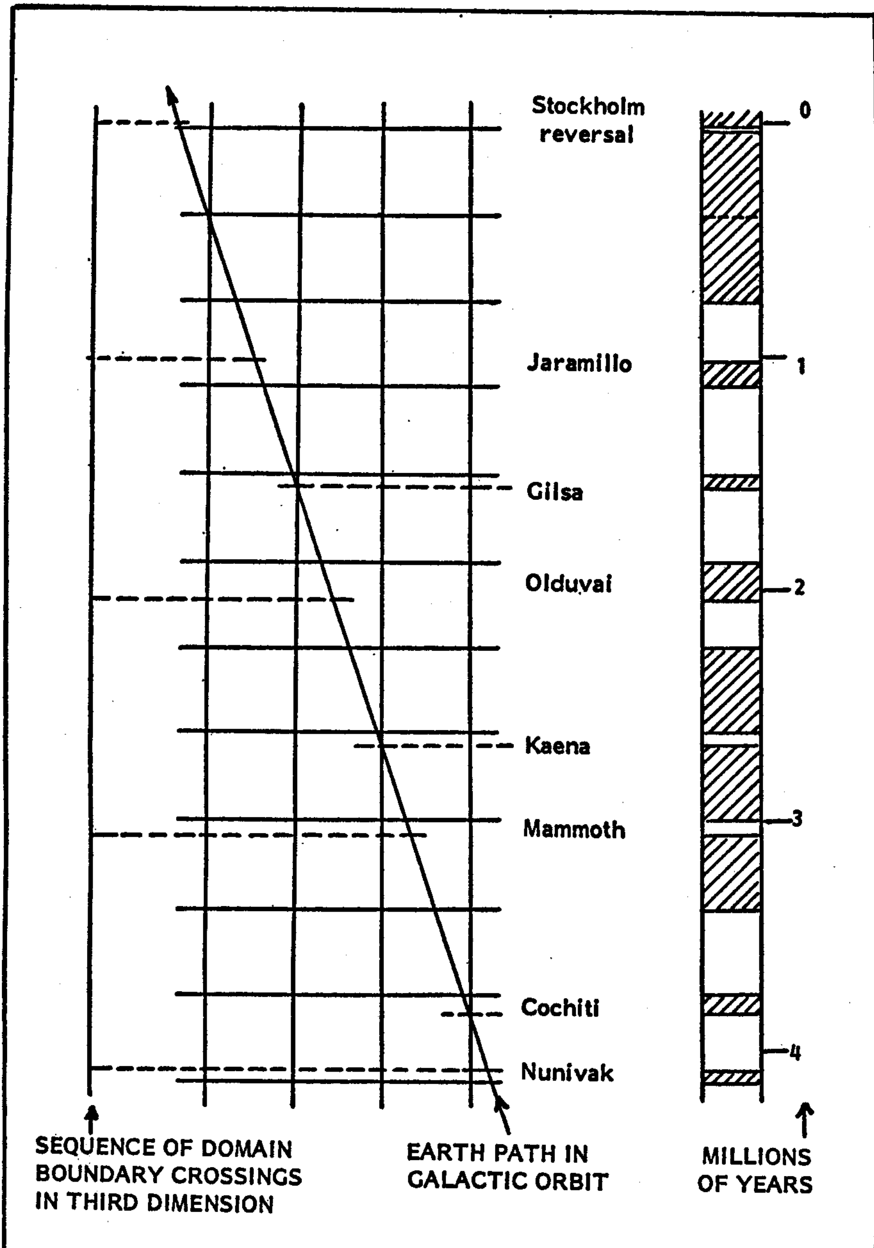
Stockholm reversal
Jaramillo
Gilsa
Olduvai
Kaena
Mammoth
Cochiti
Nunivak
0
1
2
3
4
SEQUENCE OF DOMAIN BOUNDARY CROSSINGS IN THIRD DIMENSION
EARTH PATH IN GALACTIC ORBIT
MILLIONS OF YEARS

Fig. 40

Earth's speed through the space system. At 390 km/s this gives a domain cube size of about 500 light years.

A textbook showing the Earth's magnetic field reversal pattern over the past four million years is one by Tarling and Tarling.* They also comment on the rather perplexing evidence which shows that fossil species have disappeared at times of reversal and new species have appeared shortly thereafter. This implies that the geomagnetic field reversal was accompanied by a rather more traumatic event. Reporting on the documentary evidence of data gleaned from the deep-sea floor of the Indian Ocean, the Science Correspondent of *The Times* wrote in 1972:†

> . . . tiny metallic and glass beads that originated from outer space . . . were fragments from some great cosmic catastrophe that caused molten particles to splash into the atmosphere some 700,000 years ago. The shower of debris coincided with the last reversal of the earth's magnetic field.

The reader will notice that Fig. 40 shows a recent reversal of the geomagnetic field. The above report and the Tarling book both suggest that the last reversal was 700,000 years ago. If this were true then another reversal would be imminent on the time scale used in Fig. 40. However, since these reports were written evidence of a reversal about 12,000 years ago, a very short-lived reversal, has emerged. This fits very well with the empirical evidence in Fig. 40, which shows a near crossing of a cube domain edge, meaning two reversals in rapid succession. The author was unaware of the latest discovery of the reversal when outlining this domain theory at the end of his book *Modern Aether Science*, published early in 1972. The fact that we have had a magnetic reversal in relatively recent times is reassuring if such events are accompanied by cosmic upheavals. One may well wonder whether catastrophic geological events can be traced to this recent period.

On a longer time scale it is interesting to consider the circuital motion of the solar system in its galactic cycle and contemplate the fact that the Earth would cross the domain boundaries at different angles of incidence with a four-fold periodicity per galactic cycle. If

* D. H. Tarling and M. P. Tarling, *Continental Drift*, Bell, London, pp. 52 and 66 (1971).

† P. Wright, 'A Mine of Knowledge from the Sea', *The Times*, London, August 17 (1972).

the gravitational field between matter in the Earth is disturbed when the domain boundaries are traversed, the faster the crossing, the less the disturbance. The crossing will be most rapid when the Earth approaches the boundary in the normal direction. If it approaches a boundary at a low angle it will take much longer to traverse it. Indeed, it seems statistically possible for an approach to be at such a low angle that the Earth could disintegrate on reaching the domain boundary. The probability is very small but it is a consequence of this theory and one might wonder whether the asteroids really originated in a planet broken up in this way.

These ideas are highly speculative but take encouragement from the researches of Steiner.* He has made an extensive study of the possible correlation between geological events and the galactic motion and concluded that the constant of gravitation G may, in some way, depend upon the period in the galactic cycle. The theoretical interpretation of such data is difficult in view of the uncertainties in the present state of cosmological theory, particularly so far as concerns the variation of G. The problem is further confused by the expanding Earth hypothesis which is dependent upon a slowly varying G. Yet Einstein's theory hardly permits G to vary and the author's theory presented in this work requires G to be as constant as the charge-mass ratio of the electron. One feels that if the latter were to change then all other parameters, such as the speed of light and the dimensions of the space lattice and even energy, would change as well. The author therefore favours the supposition that G is constant but only acts between matter within specific domains of space. This renders G effectively dependent upon the position of our planet as far as geological events are concerned and seems to offer scope for relating geological events and galactic motion. However, far more research is needed before these ideas can leave the realm of speculation. Meanwhile, reverting to the statement above that there would be a four-fold periodicity of gravitational upset in the galactic cycle if the space domain ideas hold, the author draws attention to another paper by Steiner† in which he writes:

> If Phanerozoic geological history incorporates any periodicities, they are of the order of 60 or perhaps 70 million years. . . . The galactic periodicity of the solar system is, however, approximately

* J. Steiner, *Jour. Geol. Soc. Australia,* **14,** 99 (1967).
† J. Steiner, 'Geology', p. 89 (1973).

274 million years, representing the length of the cosmic year, or one revolution around the galactic centre.

The author's ideas on space domains and their correlation with geomagnetic field reversals and geological disturbances are also presented in a paper in *Catastrophist Geology*, **2**, 42 (1977).