8. Cosmic Theory

Geomagnetism

The discovery of the pole-seeking properties of the lodestone antedates the discovery of the phenomenon of gravitation. It is quite remarkable that the great progress of physical science in the past hundred years has not been marked by a wholly acceptable account of these two fundamental properties of the earth. In this work, new comprehensive explanations for gravitation and ferromagnetism have been presented, but to meet the challenge of the lodestone we now need to understand geomagnetism. Even though ferromagnetism can be explained, whether by Heisenberg's theory or the author's theory in Chapter 3, we have no explanation of the earth's magnetism. It is true that there is a theory of hydromagnetism, but this has hardly been accepted. Large astronomical bodies rotating at significant speeds all exhibit intrinsic magnetism. Some, the sun is an example, exhibit a magnetic moment which reverses direction from time to time. Such behaviour is hardly accountable for in terms of hydromagnetism. Hydromagnetism has been reviewed in detail by Elsasser (1955, 1956).

It is of interest to see whether the theory introduced in the foregoing pages can offer a better explanation. There is some encouragement to believe that it may, because there is the immediate question of what happens to the Hypothesis of Universal Time if the "clock", meaning the cyclic motion of the lattice particles, is rotating, as with the earth. Clearly, as the earth rotates, the space–time within the earth rotates as well. The particle lattice rotates as a whole and so does the continuum. Thus, there is basically a balance of charge in motion. The gravitons, electrons and energy medium do not have to share this earthly rotation, any more than they share the linear motion of the space–time lattice. These latter space–time constituents define the inertial frame of reference. Apart from this, the lattice particles do have to rotate at their universal angular velocity Ω to keep in register with the harmonious motion of all space. Now, how can the particles within the earth's aether do this if the whole lattice which they form has to rotate with the earth? The answer to this is simple. To keep in register they have to undergo a slight radial displacement. This will be understood by reference to Fig. 8.1.

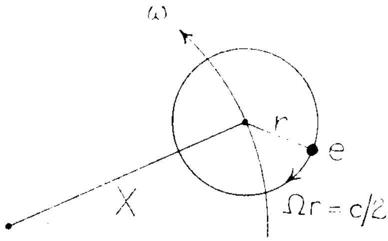

Fig. 8.1

Imagine a particle to be describing its regular orbit at a distance X from the centre of the earth as it moves with the earth about the earth's axis of rotation. The axes of the two motions are deemed to be parallel. Then, compounding the two components of particle velocity, we find that, as the particle rotates, its orbital speed in its space–time orbit varies between $c/2+\omega X$ and $c/2-\omega X$, where ω is the angular velocity of the earth. For constant angular velocity of the particle relative to the inertial frame, a condition we associate with the harmonious motion or in-register state of the particles, the variation of the above speed has to be accompanied by a proportional variation of the radius of the particle orbit. The radius is found by dividing the orbital speed by the angular velocity $c/2r$. Thus, the radius varies betwen $r(1+2\omega X/c)$ and $r(1-2\omega X/c)$. It follows that the whole orbit of the particle behaves as if its radius remains unchanged but its centre has been displaced radially with respect to the axis of the earth by an amount δX of $2\omega Xr/c$. This means that the effect of the charge e is changed as if the charge were simply displaced by this amount.

Now, although the charge continuum and the lattice particles are aether rotating with the earth, there is good reason for believing that there are unbound particles moving through the earth and compensating its linear momentum effects of its space–time due to its motion about the sun. This was implicit in the explanation of the perihelion anomaly in Chapter 5. Thus, we are free to expect that the electrostatic effects of the charge displacement can be wholly balanced by an appropriate distribution of these free charges. The electrical balance is assured, but the magnetic effects of the displaced charge will not be balanced. The free particles are not moving with the earth as it rotates. They move through the earth to compensate the motion of the earth in its orbit around the sun. This means that there will be some magnetic effect set up due to the rotation of the space–time in the earth.

We will calculate the magnetic moment of this displaced charge. The change in magnetic moment due to one displaced particle is $\frac{1}{2}(e/c)\delta(\omega X^2)$ or $e\omega X\delta X/c$. Since δX has been evaluated as $2\omega Xr/c$, the elemental magnetic moment arising from a single particle is $2e\omega^2X^2r/c^2$. Since R may denote the radius of the earth's aether, following the same argument as we used in Chapter 5 for perihelion anomalies, and since there are $1/d^3$ particles per unit volume of the earth's aether, the magnetic moment of the earth should be:

$$\frac{16\pi}{15}erR^5\omega^2/d^3c^2 \qquad (8.1)$$

This derivation has involved integrating the function in X over the whole volume of the earth's aether.

The expression can be evaluated quite readily. From (4.1), er is the Bohr Magneton, known from experiment to be $9{\cdot}27\ 10^{-21}$ cgs units. From (6.58), we know that r/d is 0·30292. This tells us that d is $6{\cdot}37\ 10^{-11}$ cm, since e is known to be $4{\cdot}8\ 10^{-10}$ esu. We know c. It is $3\ 10^{10}$ cm/sec. For the earth ω is $7{\cdot}26\ 10^{-5}$ rad/sec. The radius of the earth is $6{\cdot}378\ 10^8$ cm, but since the earth's aether evidently terminates somewhat above the earth's surface, say in the ionosphere, we could round R off at $6{\cdot}45\ 10^8$ cm. This puts the earth's aether boundary 72 km above the earth's surface, at the locality of the lower ionosphere layer. These data give an estimate of the geomagnetic moment, since, from (8.1), our theory suggests that it is $7{\cdot}9\ 10^{25}$ cgs units. In fact, the measured geomagnetic moment is $8{\cdot}06\ 10^{25}$. Again we have excellent results. Of course, it is not exact. We have made some assumptions and these need rectifying. Firstly, it has been assumed that the earth's axis is parallel with that of the motion of space–time. The earth's axis rotates itself. It changes direction by precessing about a mean direction over a long period of time. The earth's axis tends to be tilted relative to a reference direction normal to the plane of the earth's motion about the sun. Thus, one has to accept that there is some angular displacement between the axis of space–time and that of the earth. If θ is this angle of tilt and it is the angle measured relative to the perpendicular to the orbit, θ is $23{\cdot}5°$. This will reduce the estimate of the geomagnetic moment given by (8.1) in proportion to the factor cos $23{\cdot}5°$. This is $0{\cdot}917$. Then, if we also use the uppermost ionosphere layer as the boundary of the earth's aether, which is 250 km above the earth's surface, the geomagnetic moment becomes $8{\cdot}25\ 10^{25}$ cgs units. Clearly, one correction reduces the original estimate, which was slightly low, and the other more than compensates. It seems that if the successive ionosphere layers represent different boundaries of slip of the earth's aether relative to the aether surrounding the earth, then the geomagnetic field can be explained exactly.

There is also the question of whether the field will be of the right form. The magnetic moment might be correct, but will the shape of the field match that measured? Will the seat of the magnetic moment match that observed? This has been discussed elsewhere by the author (1966), but it is important to note here that the earth's magnetic moment comprises the quantity deduced in (8.1) and a quantity in the opposite direction which is exactly double and so gives the same numerical result when combined. This is because we are talking about charge which is *displaced*, but only displaced *in effect*. The result is that there is an effective charge density distributed throughout the earth due to this displacement and the balance of this charge is found at the ionosphere layers. This balance is opposite in sign and will generate its own magnetic moment. In fact, the magnetic moment of a charge at the surface of the ionosphere, as displaced from the volume enclosed, will be opposite and exactly double that calculated above. The total magnitude therefore remains unchanged. Note that the radial displacement of charge is from the axis about which the earth rotates. It is not radial from the earth's centre. For this reason, the effective radius of gyration of the earth's distributed charge is $1/\sqrt{2}$ times the radius of the earth's aether. Remember that although there is magnetic moment, the electric field effects of this charge displacement are not apparent because there are free lattice particles in motion along set paths through the earth, due to the translational velocity of the earth in its orbit about the sun. These charges do effectively compensate the electric field. They do not compensate the magnetic field because they do not share the earth's rotation. This is the whole basis of the account of the anomalous perihelion problem, as explained in Chapter 5.

Jupiter

It is reasonable to ask if we can explain the magnetic moments of other planets. The problem is the provision of adequate data. We need to know the magnetic moment of a large planet spinning at a high rate. Otherwise the magnetic fields produced are too small to be measured. For a large planet, the estimate of the magnetic field may also be indirect. It may depend upon other theory and this could be defective. For example, consider the planet Jupiter. A problem confronting radio astronomers is the nature of radio emission by Jupiter. Whereas thermal action can be regarded as the energy source for generating radio emission by stars, the planet Jupiter has a temperature of -143°C and, analysed as a "black-body" radiator, it is found that at a wave-length of 100 cm the actual radiation is 1,000 times stronger than predicted theoretically (see *New Scientist*, March 17, 1966, p. 702). This hardly confirms one's belief in the sources of radio emission by stars. The question is seemingly still an open one. However, looking elsewhere for the explanation, the above article refers to theoretical analysis which attributes the radio emission to "synchrotron emission" produced by electrons moving at highly relativistic speeds close to the velocity of light. On the same analysis the polar magnetic field of Jupiter is believed to be about 60 gauss.

Now, on the author's theory of magnetic moment, as presented above, we see from (8.1) that magnetic moment is proportional to the fifth power of radius and the square of speed of rotation. Jupiter has ten times the radius and 2·4 times the rotation speed of the earth. Since polar field varies inversely as the cube of radius, the polar magnetic field of Jupiter should be about 600 times that of the earth. This is, say, 300 gauss, which is five times that estimated on the basis of Relativistic electron emission. However, the radio emission of Jupiter may not be attributable to electrons assumed to move at ultra-high velocity. Instead, on this theory, it could be due to the reaction effect of electrons responding to provide the reaction energy associated with Jupiter's field. A cyclotron frequency corresponding to an angular velocity of eH/mc does occur and, assuming that this is the source of Jupiter's radio emission, the wave-length will be $10{,}700/H$ cm.

It will be remembered that in discussing the reaction effect of electrons or other charge carriers in the presence of a magnetic field in Chapter 2, the kinetic energy of this reacting charge was deemed to be equal to the magnetic field energy. The operative equation was:

$$\frac{Hev}{c} = \frac{mv^2}{R} \tag{8.2}$$

where e and m apply here to the electron. The angular velocity is the ratio of the velocity v of the electron to the radius R of its orbit when reacting to the field H. This angular velocity is then seen to be eH/mc, as used above.

For Jupiter, if H is 300 gauss the emission frequency will be at a wave-length of 35 cm. If H varies over the disc of Jupiter, decreasing away from the poles, then this wave-length will also vary over a range slightly above 35 cm. Radio emission from Jupiter does appear to be strongest over a range of frequency corresponding to such wave-lengths. Therefore, reacting electrons could well be its cause. However, it is not necessary to expect the electron velocities to be "relativistic". In so far as they can develop motion in harmony they will develop magnetic disturbances and wave radiation. We are not concerned with their emission of energy on this theory.

It is concluded that there is a feasible explanation for the magnetic moment of the planet Jupiter. The account presented explains a rather higher magnetic moment than has been observed indirectly from studies of radio emission. However, it is based upon the same analysis as that used to explain the earth's magnetic moment. Also, it is shown that there is another way of interpreting the indirect evidence of radio emission experiments. Also, this other interpretation adds support to the concepts of space–time on which this work is based and does not involve any assumptions about electrons moving at ultra-high velocities in Jupiter's field.

The Sun

We can next test the theory of magnetic moment of astronomical bodies by applying it to the sun. The sun rotates once every 25 days and has a radius 108 times that of the earth. Its magnetic moment should then be $(108)^5/(25)^2$ that of the earth's magnetic moment, or $1{\cdot}9\ 10^{33}$ cgs units. Estimations of the solar magnetic moment have to take into account sporadic magnetic fields produced in sun spots. A reliable estimate of solar magnetic dipole moment was probably made by Sakurai (1959), who measured it as 5 10^{32} cgs. This is less than predicted, but there has been evidence that the solar magnetic field changes with time. It is believed that in some stars the magnetic field reverses cyclically, in some cases every few days. Thus, though the explanation offered for the solar field is of the right order, it is perplexing to seek to explain the possible reversals. Presumably this variable magnetic moment rules out any question of the magnetism depending upon thermal-electric effects. The theory presented is no worse in this regard than one depending upon magneto-hydrodynamic possibilities. On the other hand, it is at least much better since it gives the right quantitative results. Further, perhaps the reversals can be explained, particularly as the magnetic moment developed on this account is produced by the *difference* between an effect within the rotating system and one at its surface. We will come back to this problem later in this chapter.

The Zodiacal Light

The zodiacal light is a dim glow visible in the night sky in the region of the ecliptic shortly after the sun has set in the evening and shortly before it rises in the morning. It is seen as a cone of light which may rise half way to the zenith and extend at its base along the horizon for an angular distance of normally some 20° to 30° but sometimes as much as 45° each side. Under other conditions the light is evident as a zodiacal band running along the ecliptic normally some 5° to 10° wide but sometimes as much as 20° wide.

Along the zodiacal band at a point directly opposite the sun there is a region where the band is both brighter and wider than at any other point. This brighter region is known as the gegenshein, or counterglow, and is sometimes seen when the band itself is not visible. The nature of this light is still an enigma. One theory stipulates that it is a reflection of light from millions of tiny meteoritic particles, but this puts the source of light well away from the earth's atmosphere and makes it difficult to reconcile some of the characteristics of the phenomenon.

The new ideas presented in this book could provide an answer. Might it be that the slip between the earth's space–time and the surrounding space–time occurring in the ionosphere regions can generate light? On the theory developed, a cubic lattice of space–time rotates within a surrounding cubic lattice. If the slip occurs neatly and is not spread over a region of turbulence, there could be a disturbance of the electromagnetic reference frame as the lattices 'notch along' relative to one another. If there were turbulence, we might have to expect something to go wrong with the laws of physics over this turbulent region. Since there is no evidence of this, one can reasonably expect an electromagnetic disturbance to be produced at the boundary of the earth's space–time. To calculate the frequency of this disturbance is quite simple. Consider Fig. 8.2. At a point A at the boundary of the earth's space–time, positioned over the equator, the lattice structure of the inner and outer space–time systems are in register. The disturbance frequency here is $\omega R/d$, where ω is the earth's

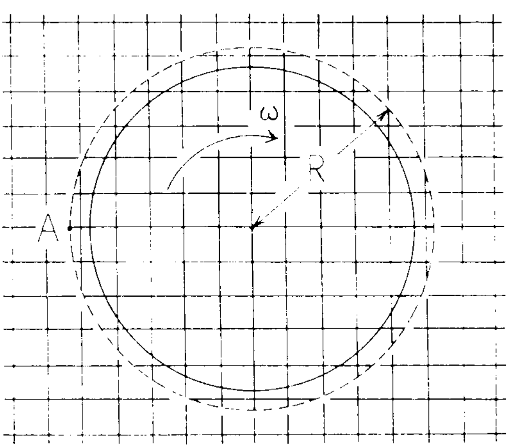

Fig. 8.2

angular velocity, R is the radius of the earth's space–time, and d is the lattice distance parameter. Since ω is $7{\cdot}26\ 10^{-5}$ rad/sec and R is about $6{\cdot}5\ 10^{8}$ cm, we find that the frequency of the boundary ripple is $7{\cdot}4\ 10^{14}$ cycles per second. This corresponds to a wave-length of 4,060 Ångstroms. However, this is an upper limit. When the earth has turned through 45° relative to the surrounding space–time lattice, the ripple action at the boundary will be less, because successive lattice particles are spaced at $\sqrt{2}\,d$. Also, there are factors such as the tilt of the axis of rotation of the earth's space–time, the reduction in frequency if the sky in non-equatorial regions is examined and the possible successive stages of ionosphere slip. Even so, there will be generation of *visible* radiation in the night sky. It is submitted that the above explanation is the answer to the problem of the zodiacal light. The phenomenon has the following features, all of which are consistent with the theory.

1. The visible light frequencies appear to vary in certain regions of the night sky according to different occasions of viewing. This may evidence the interaction of the outer space–time system. The orientation of the lattice of space–time outside the earth system is a factor in determining the frequency of the light generated.
2. The fact that the phenomenon is manifested more in the direction of the ecliptic is consistent with the theory. At positions over the earth where there is high latitude the boundary velocity of the earth's motion is reduced. This means emission of light at lower frequency.
3. The gegenshein phenomenon is more readily explained if the light causing it is generated where it is seen and not reflected from the sun. Assuming that the zodiacal light is generated by the boundary slip process described, it would be more easily seen in the absence of diffused light from the sun, that is, it would be more evident in the region of the gegenshein. Also, however, it would be seen on the horizon owing to the increased intensity resulting from viewing a slip region obliquely.

It is of interest to note that the form of light generation suggested here is different from the action of the photon. It is possible, therefore that such light cannot be traced to any original photon quanta. It is possible that its absorption in photon form will occur, because the photon action is concerned with generation and absorption, but not propagation. The result could be that anomalous effects may occur if one thinks in terms of energy conservation and Planck's radiation law. In short, Planck's law need not, and probably does not, apply to radiation in the form of the zodiacal light.

The Solar System

The orbital angular momentum of the planets is almost wholly due to Jupiter (94%) and Saturn (3·8%). In comparison, the sun has negligible orbital angular momentum and an angular momentum due to rotation of less than 1% of that shared by the planets. By recognizing that the space–time in the sun is rotating too and that it has a mass density of 100 times that of the sun, we see the possibility that the sun might have nearly as much angular momentum as the planets. Ideally, these angular momenta should be equal and opposite. This must be the case if the planets came from the sun by some action wholly contained by the matter of the solar system as we know it. Apparently, this is not possible because the sun appears to rotate in the wrong direction. The reader might feel that there is too much speculation involved in arguing that the core of the sun might be rotating in the direction opposite to that observed at its surface. The surface happens to rotate at different angular velocities at different latitudes. Since angular velocity is not constant, it is not impossible to imagine that the hidden core moves at a different angular velocity to its surface. If this can happen, then it may even rotate in the opposite direction. This is speculation, but we need to understand the problem of balance of angular momentum and the alternative is possibly greater speculation. If the planets were ejected as particles of cosmic matter which has been collected in the locality of the planets, it is curious that all this matter should rotate about the sun in the same direction. Unless, of course, it was thrown off the sun in the direction in which the sun rotates at its surface. The reaction effect is in the sun as a whole. If matter is ejected from a near-rigid sun, the sun would have to rotate in the opposite direction to keep the angular momentum balance right. However, on this basis the successive emissions of cosmic matter would tend to be in random direction and the sun would tend to be at rest. Also, the matter might eventually come back to the sun without going into orbit. By having the core of the sun rotating in the opposite direction to its surface, even before any matter is ejected, we have a system which can prevail and increase in its spin as matter forming the planets is thrown off. This idea can be taken much further, with very interesting consequences, but it is beyond the scope of this work and is, undeniably, speculation, though interesting speculation.

For the time being, the reader may prefer to accept the more conventional ideas involving the influence of some star no longer with us. For example, there is the thought that the planets are all that is left of a large star companion to the sun which exploded. When the dust settled, the earth and the other planets were left behind, sharing the angular momentum of the exploded star. On such a theme Hoyle (1950) wrote:

> So this is the sort of thing that happened to the parent of our planets. Calculation tells us a good deal about its state just before the outburst. The collapse must have gone on very far before this

happened. In spite of the enormous amount of material in the companion star, it must have become considerably smaller in volume than the earth. It emitted hard X-rays from its surface into surrounding space. It was so enormously dense that a match-box full of material taken from its central regions would have contained about 1,000,000,000 tons. Its surface rotated with a speed of about 100,000,000 miles an hour. And the time required for its catastrophic outburst was as little as one minute.

Ideas such as this stimulate the imagination. However, the thought of 1,000,000,000 tons of matter being compacted into a match-box is really taking liberties with Newton's discovery of the law of gravity. It is bold assumption to imagine that, whatever gravity is, the constant of gravitation G will, in fact, remain constant under *all* conditions. The ideas about gravitational collapse are all suspect until we can explain the reason behind the constancy of G and the *limitations* on its constancy. The analysis presented in this work has, at least, provided an explanation of the nature of gravitation coupled with an evaluation of G. Thus, we *can* have the boldness and confidence needed to explore what happens in dense matter. We find that space–time has a density itself. It is not going to be compacted by gravitation in matter, because it provides this gravitation. Its disturbance is the phenomenon of gravitation. It is impossible to have matter compacted to a density of the order of 100 gm/cc and still expect G to be constant. Such an idea has no support from experiment and it only comes into modern physics because mathematics allow it and can be applied freely until the physicist discovers the limits to be imposed on the laws formulated. It has to be remembered that so much of theoretical astrophysics is founded upon the physics we know in the laboratory that, if and when limitations are found to be necessary, these may have a profound effect upon what it is *believed* is seen to happen in the outer parts of space. Gravitational collapse is an interesting idea, but to think that massive stars can go on and on collapsing to become a point in space, at which matter of infinite mass density could form, is hardly credible. Yet, if one can believe that sort of thing, one could be prepared to believe that the sun might have a core rotating in the opposite direction to the gases at the radiating surface. Then, the balance of angular momentum in the solar system becomes possible and progress can be made towards further understanding of our creation.

Quasars

The quasar is a star which exhibits a tremendous red shift. The spectral displacement in some cases is found to exceed 0·5. To explain this in terms of doppler effects resulting from the expansion of the universe and the related motion of the star and our system is ruled out. The stars exhibiting the anomaly appear too close for this. To explain the shift as a gravitational red shift, on the theory presented in Chapter 5, requires, for constant G and a mass of the order of that of the sun, that the density of the star should be about 10^{16} times that of the sun. The quasar is then a potential anomaly, even on this theory.

We have an answer, however. Gravitation has been shown to be an electrodynamic property. It is due to the disturbance of electric charge in the G frame of space–time arising indirectly from matter in the E frame. We have not considered the effect of a charge which happens to be pushed into the G frame. Our study of the break up of the deuteron in the previous chapter showed us that in such nuclear situations charged matter could move transiently over to the G frame. We will thus analyse the effect of a charge e, sitting in the G frame and constituting a disturbance. Immediately, since the polarity of the charge is the same as that of the continuum in the G frame, we see that there is an effective gravitational mass due to e of $e/\sqrt{G}$. Remember that the G frame moves at velocity c relative to the E frame. The force between two parallel-moving charges e is then e^2 at unit distance, ignoring electrostatic action. This is equivalent to G times the product of their effective gravitational masses. Now, if the particle of charge e is a positron, we see that transiently its presence in the G frame will increase its mass by the factor $e/m\sqrt{G}$, as measured gravitationally. This is 2 10^{21}.

It follows that if, say, one part in 2,000 of an atom makes such a transient contribution in a nuclear situation, 10^{18} is a measure of the increase of the effective constant of gravitation if all atoms are in this nuclear state. Now, to explain a red shift of 0·5, if one of this magnitude existed on the sun, we would need G to be greater by a factor of 250,000. Thus, one atom in 10^{13}, say, would have to be in the nuclear reaction state. This, then, may be the difference between the sun and the quasar. It is merely a question of the degree of nuclear activity in process.

The Origin of Matter

Nuclear processes must occur in stars. However, this does not mean that the creation of matter on a really fundamental basis involves nuclear action. Nuclear action is the transmutation of matter between its various elementary forms. It is known that atoms can change their form and release energy. Hydrogen is an atomic form able to release energy by forming other elements. Accepting that there is hydrogen already in existence in a star we can expect that there will be energy available for radiation as the hydrogen converts into heavier atoms. This leads to the belief that a star radiates energy by virtue of the nuclear processes of atomic transmutation. Nevertheless, this belief is founded upon assumption. If it is necessary to recognize that there is a more fundamental process by which hydrogen itself is created, it is not improbable that there could be energy surplus to this non-nuclear reaction. Then, on the assumption that a star may be in its creation phase, it is possible that energy available for radiation may, indeed, have its origin, for the most part, in a really fundamental process, different from that currently accepted.

The idea of space–time already presented requires the presence of electrons, negative lattice particles, positive gravitons, an expanded uniform continuum of positive charge and an electrically-neutral energy medium. The latter medium forms the inertial frame, whereas the negative charge constituents define an electromagnetic reference frame, the *E* frame, and move harmoniously about the inertial frame in balance with the positively-charged substance forming the so-called *G* frame. The gravitons are compact and have a high energy content. As space–time expands, the gravitons can expand. Energy is available. However, there is a fundamental balance between the number of gravitons and the number of lattice particles in the space–time system studied. The analysis has shown that we can calculate the relative masses of the lattice particle, the electron and the graviton. Due to the dynamic balance conditions, the ratio in the numbers of these particles in the *E* frame and the *G* frame is a definite quantity. It cannot change merely because space–time expands. The graviton cannot change into some other form, unless this condition of balance is kept. It can be retained provided the transmutation of the graviton is accompanied by the related large number of lattice particles moving out of their normal *E* frame positions. This corresponds to a linear motion of the space–time lattice with the reverse flow of *free* lattice particles, already discussed in Chapter 5 by reference to the perihelion anomaly of Mercury. It is also the key to reconciling the Michelson–Morley experiment with the aether form of space–time. The only problem with this graviton energy release process is that it implies an ever increasing translational motion of the space–time lattice in the vicinity of the graviton. It appears that the motion of a space–time lattice is a characteristic associated with matter in motion. Consequently, the gravitons in the vicinity of matter are the favoured ones to accept the expansion possibilities accompanying the expanding universe. Matter is created from space–time in the vicinity of other matter. The velocity in space of such matter has to *increase* to keep the balance condition. On this basis, stars should have a translational motion through space–time. They could be the seat of energy transfer from space–time to matter form, and their translational velocities should constantly increase. If they are clustered together, their increasing velocities will cause them to move in a spiral sense. This may explain the spiral form of some galaxies.

It is natural to suppose from this that in a star the process of deriving matter energy from space–time energy is proceeding steadily. What is the property, however, which determines the nature of a star? It is suggested that there is something special about a star which is conducive to the graviton expansion process. Possibly other bodies, such as the planets, can increase their mass slowly by a less active participation in the graviton decay process, but, in a star, a large and highly energetic system has passed through a critical size and the graviton decay has become accelerated. A high energy state might permit polarity inversion in space–time itself, and this might allow rapid graviton reaction. By polarity inversion of space–time we mean polarity change from a space–time in which there are positrons and positive lattice particles forming the E frame, and negative gravitons and negative continuum forming the G frame. The E frames of the two types of space–time would need to move 180° out of phase to keep gravity acting across the boundaries, with the harmonious motion condition of universal time unaltered. This brings us to the hypothesis that the sun might comprise, in addition to its matter content, systems of space–time of both polarities. By having this, there are two advantages. Firstly, there is scope for explaining the reversals of the solar magnetic field. Secondly, there is scope for considering reactions involving graviton decay in the presence of electrons, positrons, and lattice particles of both polarities. This is the only feasible way one can come to provide the sources of the electron-positron chains, deduced in Chapter 7 as key components in atomic nuclei.

Terming the two space–time forms positive or negative, one can say that if positive space–time rotates clockwise whilst an adjacent negative space–time rotates anti-clockwise then both will develop magnetic moment in the same direction. Equation (8.1) shows that magnetic moment of the rotating space–time is proportional to volume times peripheral velocity squared. Thus, for a system of regions of space–time in general contact so that their peripheral velocities are all about equal, the total magnetic moment will be the same as if the whole space–time volume rotates with the same peripheral velocity. This is provided positive space–time rotates in the opposite direction to negative space–time. If this is not assured because the polarities can invert cyclically for some reason, then the magnetic moment can fluctuate and can have either direction, subject to the limit on the total magnetic moment as calculated from (8.1) on the basis of a single space–time form. In Fig. 8.3 it is shown how

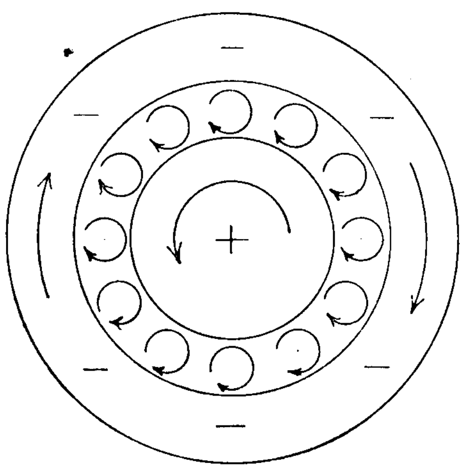

Fig. 8.3

different forms of space–time may be formed in the sun. The outer space–time shell is assumed to be of negative form rotating as is seen from inspection of the sun's surface. The core of the sun comprises positive space–time rotating in the opposite direction. Intermediate space–time zones rotate with a kind of idler-wheel action. If these zones comprise negative space–time, the maximum magnetic moment is to be expected. If, however, the polarity fluctuates in a system, which, of course, will be turbulent and by no means as simple as that depicted, fluctuations of magnetic moment are bound to occur. The angular momentum must remain constant, but could be oppositely directed from that judged by observation of surface velocity. Also, if the core is substantial in size, the angular velocity of the core would be somewhat higher and in the opposite direction to that observed at the surface. This would be highly consistent with the requirements for balance of angular momentum in the solar system.

Such thoughts are mere speculation. Our objective is really to justify bringing electrons and positrons as well as lattice particles of both polarities into account in the matter creation process. The fact that we have come to expect this to occur at the boundaries between positive and negative space–time, and that such boundaries are to be expected within the sun, is the result emerging from the speculation. This introduces the analysis of the true mass of the graviton. It has to have a certain energy to be able to undergo transmutation at the boundary between the two types of space–time.

Derivation of Graviton Mass

It has been suggested in Chapter 6 that the formation of the muon is connected with graviton expansion. Also, in Chapter 7 we have seen how large numbers of electrons and positrons are required to provide bonds in the atomic nucleus. It will now be supposed that at the boundary between the two polarity forms of space–time two gravitons of opposite polarity react together to store the energy of a muon on the lattice particles in the E frame. The loss of the gravitons makes a great many lattice particles of both polarities unstable in their E frames. Many become free and many are available to absorb the surplus energy released by the graviton expansion.

The buoyancy of the lattice particles storing the muon energy is reduced by their compression. This means that, not only has the muon energy quantum to be balanced by a similar quantum in the G frame, but, also, extra energy in equal measure is needed in the G frame to balance this loss of buoyancy. It follows that the energy of three muons 5062 m_0c^2 is deployed from the two gravitons, leaving the remainder of the energy surplus to provide electrons and positrons.

When several lattice particles are compressed slightly to store the energy of the muon, their total volume reduction is $d^3 - 4\pi b^3/3$. The two gravitons and, of course, their associated electron and positron expand to determine two new units of volume d^3 in forming two new lattice particles and related continuum. Two units of expanded space–time are generated when two gravitons decay in the manner described. Matter is formed as a product of this space accommodation process. Allowing for the volumes of the initial electron and positron, the volume of space required for the deployment of the surplus energy is $d^3 - 4\pi b^3/3$.

Let g denote the energy of the graviton. Then $2g - 3(5{,}062)\ m_0c^2$ is the energy needed to compact enough lattice particles to take up the volume $d^3 - 4\pi b^3/3$. When one lattice particle is compressed into an electron or positron its volume is reduced by $4\pi(b^3 - a^3)/3$ and the energy required is $2mc^2 - 3\ m_0c^2$. This energy requirement follows because the electron needs its own rest mass energy and the secondary energy to sustain the G frame balance. As explained in discussing the processes in which electrons and positrons are transmuted, the energy available from a lattice particle is $2\ m_0c^2$ from the E frame and m_0c^2 from the G frame. This is due to the buoyancy effect of the energy medium, which makes the dynamic mass of the lattice particle only half that found for other particle forms on the basis of their electrostatic energies.

It is seen from the above that we can write:

$$2g - 3(5{,}062)\ m_0c^2 = N(2mc^2 - 3m_0c^2) \tag{8.3}$$

$$d^3 - 4\pi b^3/3 = 4\pi N(b^3 - a^3)/3 \tag{8.4}$$

where N is the number of lattice particles converted to electron or positron form. Note that to conserve charge we must have N as an even integer. Also note that in this process we have taken lattice particles from the E frame. If we take lattice particles from the inertial frame, that is the unbound particles in free motion, we are involved in many difficulties of angular momentum and energy balance. It seems that the energy relation (8.3) is best kept in the E and G frames to conserve angular momentum. This means deployment of E frame lattice particles in the initial reaction processes. However, the muons are unstable and there has to be deployment of E frame lattice particles anyway, since many go into the free state, so our equations look well founded. From the data we have for d, b and

a, (8.4) gives a value of N slightly less than 5,065. If N has to be an integer, one then sees from (8.3) that g is slightly less than 5,064 mc^2. This result is consistent with the empirical value of 5,063 mc^2 presented at the bottom of page 119. In a reaction in the laboratory environment we must expect single gravitons, with their associated electrons, to provide the nuclear energy quantum. In such reactions the electron is separated and must take with it an amount of energy adequate to provide the G frame balance originally provided by the graviton. The energy left is 5,063 mc^2.

A value slightly less than 5,063 mc^2 gives the right answer for the constant of gravitation in (6.73). Therefore, this evaluation of the energy of the graviton is reasonably satisfactory. However, even the small difference thus obtained requires explanation. The best explanation which the author can offer is that there has been error in neglecting the presence of free particles. The constant of gravitation G is measured in the solar system. It may be very slightly dependent upon the general motion of the solar system in the galactic reference frame. Also, the energy of the graviton may, indeed, vary with this motion. After all, the graviton is carrying the secondary G frame energy due to the presence of matter. If its energy can be so varied as matter passes by it, then its base energy quantum, which is the unit under analysis, may have some dependence upon the motion state of the space–time present. To calculate this, let there be a translational motion of the space–time lattice at k times the speed of light c. Then, since the reverse motion of free lattice particles is at the velocity $c/2$, the orbital velocity they have when in the E frame, there are $2k$ free particles for each bound particle in the lattice. These free particles will distort the lattice in their vicinity. Assuming that $2k$ is small, there will be substantial regions where one can ignore the presence of free particles and there will be localized regions where significant distortion will occur. Above, we are trying to calculate the value of the graviton mass energy, as set initially. The graviton energy is being calculated from analysis of the reaction process, but it does not depend upon this process. The factor k will affect N as derived from (8.4), unless we can apply the analysis to regions devoid of free particles. This seems logical. The value of g cannot vary according to the presence of free particles. Hence, it must have the value of something just smaller than 5,064 mc^2, notwithstanding the factor k. Accepting this, we turn back to Chapter 5. It is seen that G, as given by (5.12), is increased in proportion to the square of σ. Now, σ does depend upon the presence of free lattice particles. It has to be greater, the more free particles there are, to allow the general analysis to remain applicable. It must be greater in proportion to $2k$. Then, G is increased in proportion to $4k$, whereas, to keep G the same, the mass of the graviton has, according to (5.12), to be increased by one-eighth of $4k$. In other words, all is well with the analysis if the discrepancy between 5,063 and 5,064, which must be explained to reconcile (6.73) with the above evaluation of g, is simply equivalent to the factor 0·5 k. This means that k has to be two parts in about 5,064, or that the space–time velocity involved is this fraction of the velocity of light. The velocity of the space–time system has to be about 120 km/sec. This, of course, is only rough approximation, but the theory does indicate that the earth should have a motion relative to surrounding space–time of this general order. This means that cosmic background radiation referenced on this space–time electromagnetic frame, if isotropic, should evidence a relative motion by the earth of this order of 120 km/sec.*

On this evidence, one can see that this theory has tremendous scope for application to cosmic phenomena. As shown, the value of the mass of the graviton can be deduced from the theoretical foundations of the theory, and, indeed, the right value is obtained to provide the quantitative explanation of the constant of gravitation. This is a result which is totally beyond the scope of the Theory of Relativity, and one on which the author bases his beliefs that the theory under review is the correct theory of gravitation and that the Theory of Relativity has nothing to contribute to the understanding of gravitational phenomena.

Perihelion Motions

From (6.69), the value of the lattice spacing d can be calculated in terms of the known parameters of the electron. From (6.63), the mass of the lattice particle is known in terms of the mass of the electron. Hence, we can calculate the mass density of the lattice of space–time. It is 144 gm/cc. Note that it was shown from (5.9) that the anomalous motion of the perihelion of the planet Mercury could be explained if the mass density of the space–time lattice were to be

* It is reported in *Nature*, June 7, 1969, page 971 by E. K. Conklin that measurements of the cosmic background radiation show the earth to be travelling at 160 km/sec.

about 150 gm/cc. The theory has, therefore, excellent support from the perihelion anomaly.

It is appropriate to check (5.9) as it applies to the earth. Using the value of space–time lattice density of 144 gm/cc., and noting that the earth has an average mass density of 5·52 gm/cc and a radius of 6·378 10^8 cm, the value of the earth's "anomalous" perihelion motion should be given by;

perihelion motion	*R*
5·2	6·45 10^8
5·4	6·50 10^8
5·6	6·55 10^8

The perihelion motion is given in seconds of arc per century. *R* is the radius of the earth's space–time lattice. One has to conclude that the theory indicates a perihelion advance of perhaps 5·4 seconds of arc per century. This compares with the observed anomaly according to Clemence (1948) of 8·62 seconds of arc per century. The earlier-derived anomaly according to Doolittle (1925) was 2·52 seconds of arc per century, but Doolittle used an assumed mass of Mercury, in calculating the perturbation of the earth's motion, of 1/7,500,000 times the solar mass. Rabe (1951) has shown that the mass of Mercury is 1/6,120,000 times the solar mass. The effect of this is to increase Doolittle's estimate of the earth's perihelion anomaly to 5·0 seconds of arc per century. Further, since Clemence used an assumed mass of 1/6,000,000 times the solar mass, his figure should be reduced slightly. It has to be remembered that the measured anomaly is hardly accurate on such analysis. It can be said, however, that the explanation afforded by this theory is better than the value of 3·83 seconds of arc per century afforded by Einstein's theory.

For the planet Venus, this theory gives a value of the order of 15 seconds of arc per century for a radius of about 6,000 km. Clemence obtained a value of 15·15 seconds of arc from observation, and the radius of Venus is somewhat greater than 6,000 km, probably 6,100 km. Nevertheless, bearing in mind the uncertainties in observation and the indirect analysis in such observations, it is appropriate to claim that this theory does offer a feasible account of the anomalous perihelion behaviour of the planets.

Summary

After demonstrating the power of this theory in explaining phenomena associated with the atomic nucleus, we have come in this chapter to the problem of the cosmos. The concept of a large volume of space–time in rotation with an astronomical body has been explored. The principle that the harmonious cyclic motion of the lattice is retained, notwithstanding such rotary motion, has provided an explanation of the nature of intrinsic magnetism in such bodies. The geomagnetic moment has been explained quantitatively, with remarkable results. The principles have been extended successfully to Jupiter and the sun. The idea that the earth has a space–time lattice terminated in the ionosphere has been explored in relation to the zodiacal light. An explanation of the generation of light at the boundary between the earth's space–time and surrounding space–time has given the right quantitative results. In considering the solar system, further support for the theory has emerged since the balance of angular momentum in the solar system is feasible, if we recognize the presence of space–time. The reversals of the magnetic field of the sun have been explained. An account of the extra-gravitational properties of the quasar has been outlined. Also, we have been led to consider the origins of matter and to the thought that there are opposite-polarity forms of space–time. In this way the reactions which are the source of matter, and probably cosmic radiation, have been analysed. The mass energy of the graviton has been deduced and found to be in agreement with that derived empirically earlier in this work. Finally, a little more has been said about the perihelion anomalies of the planets. These have been of such importance in supporting Einstein's Theory of Relativity that they have deserved rather special attention in the analysis. In fact, the observational data is in such doubt that exact analysis has not been possible. Yet, exact analysis is a real strength of this theory, as has been shown in earlier chapters where basic physical constants have been calculated. It is concluded that this theory will have potential in the cosmic field, and that it can claim to be a unified theory since it does embrace basic principles of field behaviour and has application from the sub-atom to the galaxy. This concludes this work, save for a discussion of some general features of the theory in the light of recent discoveries. This discussion is the subject of the next chapter.