So now let us see how the aether coextensive with the sun reacts to the presence of this charge. Being a little impatient here I rush to say that it shares the spin of the sun at the time the sun comes into being, simply because aether spin means electric charge induction, displacement of charge from its core body to its spherical aether boundary. You might then say that such a proposition would mean that the sun along with other stars would then have a magnetic moment and so a magnetic field should be in evidence. You could even suspect that body Earth, if also having a coextensive aether sphere spinning with it, would be subject to an internal electric strain and also possess a magnetic moment giving rise to a magnetic field.

All very well, you might then say, but how does theory yield quantitative results that we can check with observation and measurement? As I now show, the solar system can be obliging in this endeavour but we need to be cautious. We will proceed in stages and I am sure you will find the commentary interesting and convincing.

The Schuster-Wilson Hypothesis

That comment above that the sun should exhibit an electric charge density in its core equal to the square root of G times the sun's mean mass density should remind any well-read cosmologist of what came to be known as 'the Schuster-Wilson hypothesis'. A. Schuster [Proc. Roy. Soc., **24**, 121-137 (1912)] and H. A. Wilson have shown that the magnetic moments and angular momenta of the sun and Earth are approximately related in a common ratio. This led to the hypothesis, the speculation that a moving element of mass as measured in gravitational units might have the same magnetic effect as an electric charge measured in electrostatic units.

It seems not to have occurred to those interested in this hypothesis that rotation of an astronomical body might entrain

rotation of aether, which could involve the induction of an electric field and so electric charge displacement duly cancelled by charge displacement in that astronomical body. If the latter and not the former gives rise to magnetic action one has here a situation where one can explain the presence of a magnetic moment with no commensurate evident presence of an electric charge.

Wilson sought to prove the hypothesis by experiment based on seeking to detect the magnetic action of a swinging iron bar [Proc. Roy. Soc. A., **104**, pp. 415-455 (1923)]. The null result of the experiment is hardly surprising. I would not expect the aether to respond to the oscillations of an iron bar though I could contemplate a response if a rotor spinning at the same speed for a prolonged period was used and there were some effect akin to the presence of an electric charge within that rotor. However, one must keep in mind that in 1923 the aether was not surviving as a popular notion in the vocabulary of science. Nor, indeed, could one expect that hypothesis to survive, given the boldness of what it claimed.

However, interest in the Schuster-Wilson hypothesis revived in 1947 when W. W. Babcock [Publ. Astr. Soc. Pacif., **59**, 112-124 (1947)] succeeded in measuring the magnetic field of the star 78 Virginis. The hypothesis was verified as being fully applicable to three bodies instead of two, the range of angular momenta then being 10^{10}:1. Nobel Laureate P. M. S. Blackett [Nature, **159**, 658-666 (1947)] then became very interested and wrote an extensive article on the subject. He began by presenting the hypothesis in the form:

$$\text{(Magnetic moment)/(angular momentum)} = \sqrt{G}\,(\beta/c)$$

where β is a constant of the order of unity, c is the ratio of electrostatic to electromagnetic units and G is the constant of gravitation.

This was followed by a Table I in which he presented numerical data in support of the above formulation before then enlarging on the whole theme by reference to the research findings of several authors. What is however perplexing for a serious reader of his account is the data he provides in that table for the magnetic moments and angular momenta of the sun and the Earth. The ratios of magnetic moment to angular momentum for Earth and sun are shown to be 1.11×10^{-15} and 0.79×10^{-15}, respectively, whereas my calculation of $\sqrt{G}/(\beta c)$ gives the value β times 0.86×10^{-14}.

There is a factor of 10 discrepancy if β is to be 'of the order of unity' and I can but suspect that there has been a numerical miscalculation on Blackett's part which is quite misleading even if an error factor of 10 was seen 'as of the order of unity' in the context of a number 10 raised to the fifteenth power. In the event, however, Blackett himself was sufficiently intrigued by the Schuster-Wilson hypothesis to mount a further experiment [Phil. Trans. Roy. Soc., **245A**, 309-370 (1952/53)]. He contrived to acquire a quite large object of pure gold just for the period of the experiment and placed this in a wooden shed in a rural location remote from any metal objects or external power supply equipment, his purpose being to use an extremely sensitive magnetometer to see if the concentration of mass by the high density of gold allowed that object to reveal a magnetic property attributable to its rotation with body Earth. Again, not surprisingly, there was a null result, because surely, if we are really looking at a property of the aether, one cannot expect the aether itself to increase its action merely because of a mass seated in very dense matter.

So here was an astronomical observation of major importance but, owing to it not complying with one's hopes on the laboratory front and in spite of the related efforts of many authors, it was merely a hypothesis that had somehow to be

buried and forgotten. The aether had not been seen as a factor involved owing to it also having been buried and forgotten for not itself complying with an assumed property that it did not possess and yet the basis of the Schuster-Wilson hypothesis was a pointer to the existence of the aether. Such is the arena of scientific endeavour, at least where cosmology is concerned.

If the aether spins with an astronomical body and such spin can induce electric charge displacement, then one might still expect that hypothesis to hold true at least in a limited sense as applied to hydrogen in a star, and all the more so, given the opening comments of this chapter, my observation that ionization in the sun must endow it with a core charge that has the density implied by that Schuster-Wilson hypothesis.

It could well be that there is something fortuitous about the way in which the Schuster-Wilson hypothesis has crept into physics. The problem with the numerical data might well arise because it is so difficult to be sure what magnetic properties a star has. There are sun spots on the sun which signify regions of ionized gas spinning independently of the general spin of the sun itself. The magnetic fields in evidence from spectral line shifts in radiation from the hydrogen atom fluctuate over time and make estimates of magnetic moment unreliable. Accordingly, whilst accepting that the $\sqrt{G}\,(\beta/c)$ factor has a role in cosmology by linking gravitational action on ionized gas with an astronomical body having a core electrical charge density and core mass density that are uniform and related, we will not ponder further on the specific values of magnetic moments of such ionized bodies. Instead, we shall look to the aether to reveal something of relevance to this curious factor.

We are converging onto the proposition that aether spin involves induction of a charge density within the spinning aether sphere, owing to charge being displaced to or from its spherical boundary. This charge density is neutralized in its electrostatic

effects by virtue of a corresponding charge deployment of opposite polarity within the astronomical body seated within that aether sphere. Accordingly, one can only sense the magnetic effects associated with one of those charge components, namely the action of the charge displaced within matter. This is further supported by my contention that the ionization of hydrogen in a star will, owing to collisions between K shell electrons in gravitationally compacted hydrogen atoms, freeing just enough protons to set up the precise density of positive core charge that the hypothesis requires.

I can provide some further insight into the reasons why aether charge itself, absent a reaction in coextensive matter, does not set up a primary magnetic field action. Reason (a) is that we found in chapter 7 that all the right results emerged from analysis of aether structure without our incorporating any magnetic interaction in the aether model considered. Reason (b) will emerge from chapter 9 where we derive the Neumann potential and see that we need to retain the Fechner hypothesis to explain the phenomenon of electromagnetic interaction. The Fechner hypothesis requires quantum electrodynamic charge pair creation and annihilation of the kind we associate with moving electrons, but electrons are not part of the basic aether medium. Reason (c), also to be discussed in chapter 9, is that the aether charge that has freedom of movement is governed by statistical factors by which the energy involved optimizes its deployment. The aether can set up a magnetic effect by the reaction which accounts for that gyromagnetic factor of 2 being halved, but this is a reaction and not a primary action unless, as applies where we have stored field energy in an inductance, we deliberately terminate current flow in matter with the result that the aether induces the back-EMF that feeds the return flow of the induction energy. Reason (d) is the fact that, contrary to general expectation, one can

explain gravity and derive the value of G as an aether property without associating gravitation with an electrodynamic action.

Enough has now been said to show that the aether figures prominently in the process of star creation. In contrast with my earlier accounts of the theory involved, where I discussed first how the setting up of an electric charge density in a body of astronomical proportions accounted for the creation of our sun and the planets, I will, before delving into the mathematics of space domains, start here by introducing space domain theory.

Space Domains

Although cosmologists like to think that the action of gravity knows no bounds and that matter, however separated by distance, will be subject to the unabated action of gravity as defined by the value of G that we measure here on Earth, I think otherwise. Gravity has a limited range of action. It only operates between matter seated in the same space domain or between matter and quons of the aether lattice seated in the same space domain.

The latter can be verified in the following way. Consider a region of aether in the near vicinity of Earth and the effect of the gravitational potential of Earth and sun on quons located in that region. Those quons, which define the E frame of the aether, move in circular orbits in which they are dynamically balanced by the gravitons in the G frame. Each has a mass m_0 which, subject to gravitational potential Φ, imports an amount of energy Φm_0 which is held at the seat of that quon as the thermal vibration energy of that quon. This is an energy quantum kT, owing to the quon having only two degrees of freedom, imposed by the constraint of keeping in synchronism with the orbital motion of other quons, this constraint precluding the third degree of freedom. T is the temperature in Kelvin and k is Boltzmann's constant, 1.38×10^{-16} ergs/K. This gives us the equation:

$$\Phi m_o = kT \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8.3)$$

Now, in chapter 7, we were able to show that the mass of the quon was 0.0408 times the mass of the electron, as one can see from equation (7.25) by substituting the value we derived for r/d. It follows from this, that since we know that the electron has a mass of 9.109×10^{-28} gm, the temperature of the quon system, which we can refer to as the 'aether temperature' or 'cosmic background temperature', if it can be measured, will give us the value of Φ, the gravitational potential in the near vicinity of Earth.

Now, of course, we can only be referring here to the 2.7 K temperature exhibited by any rarefied form of matter that interacts with the aether at high altitudes above the Earth. It appears that radiometers carried by U-2 aircraft flying at altitudes of 20 km detected a 390 km/s component of Earth motion through space by interpreting the observed local anisotropy of the 2.7 K temperature by reference to an assumed isotropic distribution. This was reported in October 1977 [Phys. Rev. Lett., **39**, 898] and again, on November 3rd 1977, under the title: '*Aether drift detected at last*' at page 9 of the journal 'Nature', followed in May 1978 by an article '*The Cosmic Background Radiation and the New Aether Drift*' in 'Scientific American'.

With T as 2.7 K, equation (8.3) tells us that Φ is 1.002×10^{13} erg/gm-cm. So here we have an approximate measure of the local gravitational effect of all the matter in the universe that lies within the range of gravitational action. I say 'approximate' because one cannot rule out a small contribution to temperature from another source and because the assumption concerning the two degrees of freedom may be too rigid an assertion. However, since G is 6.67×10^{-8} cgs units, body Earth of mass 5.977×10^{27} gm and radius 6.378×10^{8} cm contributes about 6.2% of this value of Φ. Also, the sun of mass 1.989×10^{33} gm at a distance of 1.496×10^{13} cm contributes 88% of this value of Φ and so, even if the other planets plus the rest of the universe

within gravitational range contribute nothing to this potential, we can account for 2.6 K of that temperature. This is close enough to justify my assertion that gravitation has a limited range.

As I show in Appendix II, the inertial property of a particle vests in its electric charge responding to the influence of an accelerating electric field in just such a way as to conserve its energy and avoid radiation of its intrinsic electric field energy. This is not to say that the accelerated electron is inactive in the role of radiating energy, because a group of electrons accelerated together can operate collectively in developing such radiation and one has to look also at the kinetic energy (magnetic energy) associated with electromagnetic wave propagation. This key to understanding the nature of inertia is of vital importance to cosmological theory.

Ernst Mach (1893) regarded the background of very distant stars as a firm base of reference for the determination of inertial action. Quoting from p. 169 of the book: '*The Structure of the Universe*' by J. Narlikar (Oxford University Press: 1977):

> "Mach concluded that inertia owes its origin to the background of distant stars. Remove the background and the body will cease to have any inertia! This reasoning is known as 'Mach's Principle'."

Then on p. 170 of that book one reads:

> "In the early 1950s the Cambridge physicist Dennis Sciama suggested an interesting interpretation of Mach's principle. He argued that, when a non-inertial coordinate frame is used, the inertial forces arose because of gravitational forces exerted by distant matter. Imagine a body like the Earth which is being attracted by the Sun's gravitational field. In the frame of reference in which the Earth is at rest,

we can argue that it is acted on by two equal and opposite forces: (1) the Sun's gravitational force of attraction and (2) the force exerted by the rest of the Universe. The latter is expected to depend on the density of distant matter and its distance from the Earth. Starting with this idea Sciama deduced from general arguments the relation:

$$\rho G T^2 = 1$$

In this relation, ρ is the mean density of matter in the Universe and T is the time scale associated with the expansion of the Universe. If we use Hubble's constant H, we may write $T = 1/H$."

Sciama's ideas on this theme are typical of the reasoning used by cosmologists who cannot contemplate gravity having a limited range of action, and look to find answers to the problem of inertia in the far distance of space, whereas the phenomenon of inertia is something they can research on a laboratory bench. All they have to do is to look into the physics of the electron and avoid the a priori assumption that a single accelerated electron must radiate energy by saying instead that it seeks to conserve the energy it acquires from its interaction with the electric field that produces that acceleration [see Appendix II].

In mentioning Sciama, I am reminded that I received my Cambridge Ph.D. in 1954 as did Sciama, and that a few years later I met with Sciama to discuss my ideas and the aether theory I present in this work. He was polite and attentive but showed little interest other than saying: "We all believe in the aether, but we call it 'space-time'." The message was clear: relativity rules in the mind of the cosmologist and unification of field theory means building on Einstein's foundations to discover the ultimate link.

I maintain that the 2.7 K cosmic background temperature, coupled with the theoretical derivation of the quon mass, in the aether which I have explored in deciphering Nature's coded messages, provides the evidence that gravitation has a restricted range of action.

I would have liked in this section on space domains to be able to explain what, on an ab initio basis, determines the size of such a space domain. That is a problem I have not solved and one which I can but bequeath to future researchers. In the analogous situation, that of the magnetic domains which form in the crystals of a ferromagnetic material, domain size is determined, as ever, by an energy optimization process. The domain walls which divide adjacent domains have an energy density per unit area owing to the field reversal that occurs in traversing the wall. The volume of domain enclosed by the domain walls determines an energy which scales in proportion to domain size, the energy density being partially strain energy (positive potential) and magnetic field energy (negative potential). Combining these energies, optimum (minimum) energy criteria determine the domain size, of the order of 100 microns or so in iron.

It is not so easy to see a way forward along these lines when considering the space domain, bearing in mind we are dealing with distances measured in light years. However, before moving on from this chapter section, we will approach the problem by imagining the initial creation of our sun in a space domain and looking to see if, in acquiring its initial angular momentum, it did that by drawing on the resource of the space domain in which it was born. We shall assume one single space domain devoted to the creation of the sun and see if we can deduce the physical size of that domain, using the data we have derived for the photon in chapter 6 and for aether structure in chapter 7.

In deriving equation (6.17) we saw that an energy E fed into the aether involves the addition of an angular momentum of E/Ω and, from equation (6.16), half of this energy goes into kinetic energy. Conversely, if the aether sheds an energy E as gravitational energy it loses angular momentum E/Ω and kinetic energy E/2. This angular momentum, as shed by an entire space domain, is assumed to go to the star.

On this basis each quon in the domain will shed energy given by the equation:

$$\Phi m_0 = \Omega H \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8.4)$$

where H is here the angular momentum released by each unit cell of the aether. We have seen that the mass of the quon is 0.0408 times that of the electron and we know r/d is 0.3029, where r is the Compton electron wavelength 2.426×10^{-10} cm divided by 4π, and so can determine d. From this, given that each cubic cell of the aether has a volume d^3 and that electron mass is 9.109×10^{-28} gm, the mass density of the quon lattice is approximately 144 gm/cc.

When we double this to add the equal mass density of the graviton system, the total mass density of what might be referred to as the 'structured space medium' is 288 gm/cc. It is high compared with the mass density of Earth or sun but low in comparison with the mass-energy density that applies to the virtual muon population of the aether. Yet we do not sense any resistance in moving through this aether, thanks to the inherent inertial balance of the aether medium. We shall see presently in this chapter how such a mass density can be confirmed by the evidence available.

Meanwhile we denote this 288 gm/cc mass density as ρ_0 and formulate an equation for the total angular momentum (AM) shed by a domain to form a star. Although space domains must have planar boundaries as with magnetic domains and so are likely to be cubic in form, it eases calculation to assume a