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The Lodestone

A true understanding of Nature can only come from the correct interpretation of reliable facts. Experimental science is the source of an ever-increasing number of facts, more or less reliable, depending upon the degree of success of the experiment and the assumptions implicit in the technique or the analysis of the results. We have a vast amount of data but progress towards certainty is still rather slow. One would think, however, that in modern times we can depend less upon imagination and hypothesis than did our forebears. We should be living in an age of empirical certainty coupled with a clear insight into the reasons for Nature's mysteries as presented by Nature herself. We should have real confidence in the certainty of our knowledge if we are to feel proud masters of mysteries of our physical environment when we look back to the amusing ignorance of the philosophers of the past. Unfortunately this is not true. Anyone looking at physics as an outsider would think that everything had been revealed to the discerning scientist of today. It is so complex and it is founded upon careful research and enquiry by so many workers all over the world. It must be founded well and present a truthful picture of the inner workings of Nature. Yet it does not. Nor do we see an elimination of hypothesis and an account logically founded on factual beginnings. Sometimes one cannot trace the facts which the mathematics are supposed to be explaining. Most published accounts of the physical features of Nature, except, of course, the elementary texts for the school reader, tell their story as if the universe would not exist were it not for certain hypotheses such as the Uncertainty Principle of Heisenberg, the Exclusion Principle of Pauli and the Principle of Relativity of Einstein. Hypothesis and theory dominate all the experimental data. Is it really so different from

four centuries ago? Man's ego is such that he has to explain his knowledge with conviction. He is reluctant to appear weak and insecure, even when he is trying to develop interest in that vast environment in which we all exist and which will, as a matter of mere logic, never yield to complete understanding by mere mankind.

In this book we are treading our path confident only that there is uncertainty about many if not all of our current scientific beliefs. We stand ready to change our minds, and if someone expresses certainty we will question. How otherwise can we be any more knowledgeable than Aristotle? If we superimpose our imagined convictions upon our quest to understand Nature, we will have theorized about ourselves, rather than about Nature alone. I believe that there is an aether. I cannot be certain but I can show stronger reason for believing in the aether than is afforded to the contrary by the counter-arguments in the literature. I want to understand the portrayals of Nature found in so many textbooks, but I am unhappy about their foundations. They do not seem strong enough to support the grand edifice built upon them. What is mass? What is gravity? Why are all electrons alike? Why does light travel at a definite speed? What is magnetism? If you appeal to a principle, have you explained anything until you eventually explain the principle itself? We know so much more today, but relate our knowledge in such a complicated way that one wonders if we really understand any better.

Comparisons to judge man's progress in his intrinsic ability to understand cannot be made by measuring our knowledge of new experimental facts. Effective comparison can only be made from a consideration of the progress of our knowledge in understanding the results of the earliest scientific experiments. It was towards the end of the sixteenth century that experimental science began to develop as an accepted method of enquiry. Much credit in this pioneer effort must go to William Gilbert (1540–1603), who devoted his life to the study of the properties of the magnet. His treatise *De Magnete* was published in 1600. Gilbert's contemporaries well knew of the magnetic properties of the mineral iron oxide, called by the name lodestone. The

concept of poles and their properties of mutual attraction or repulsion were also known. The tendency of the lodestone to set itself in a preferred North–South direction was one of Nature's recognized mysteries usefully applied in compasses for navigation. Hypothesis had it that the lodestone tended to align itself with some northerly star or that it was magnetically attracted to point towards a large lodestone mountain in Arctic regions. Experimental verification of such hypotheses was not an easy task for Gilbert to undertake. He did contrive an experiment to verify his own hypothesis that the earth was a very large magnet and that this could account for the observed behaviour of the compass. Using a lathe, he machined a sphere of lodestone and by using tiny magnets at different positions on its surface he demonstrated that the orientations of the compasses, including their angles of dip, were analogous to the behaviour of compasses reacting to the earth.

Gilbert can be said to have discovered that the earth is a large magnet and it seems that this discovery will stand as firmly established as any ever made by man, but does the modern physicist understand why the earth is a magnet? He thinks he does because he has, in recent times, discovered that a thermally-agitated electrical medium can induce a magnetic field when rotating. We have what is called a theory of hydromagnetism. If the earth has a hot rotating fluid core it is natural to rely on this to account for the earth's magnetism. We do not apparently need any other explanation, even though there is no reasonably certain quantitative verification of the theory.

The physicist constantly discovers new experimental facts. The sun is also a magnet. Its magnetism can be measured by examining the spectrum of solar radiation. But there is a problem here. The sun's magnetism is changing and it appears that it may reverse cyclically over a period of years. Indeed, evidence has been afforded by some stars showing that their magnetic poles exchange positions every few days. Even the earth is now believed to reverse its magnetism every million years or so. Writing about the rapid reversals of the stellar magnetic fields, S. K. Runcorn said in *The Times* (London) of April 26, 1965:

This is one of the most stimulating challenges of cosmic magnetism.

This is no understatement. The star itself, contrary to observation, would have to change its direction of rotation for the existing theory to explain the magnetic reversals. We cannot then assert any reasonably confident knowledge of the nature of cosmic magnetic properties. Certainly, we must doubt the current theory of the earth's magnetism.

Even the nature of the intrinsic ferromagnetism of the lodestone has remained one of the cardinal problems of theoretical physics. There are so many alternative physical models side-by-side in modern texts on magnetism, all purporting to explain the same phenomenon, that no one can assert that we truly understand today the fundamental magnetic nature of the lodestone. Curious though it is, the earliest discoveries—lightning, magnetism, gravitation—are the ones which present the greatest problems, no doubt because they are so fundamental.

There is really nothing sacrosanct about the physicist's present interpretation of Nature. We are all free to think things out for ourselves and we can explore our own ideas without being obliged to conform to the pattern already set by others. If we are to fathom the basic structure of Nature we cannot be timid in the approach we take. Let us explore here a hypothesis of our own, boldly forging a link between gravitation and magnetism. Take the idea of Weber and Zollner already presented and develop it one step further. If gravitation were attributable to a greater force of electrostatic attraction between charge than of repulsion, then possibly charge of different polarity may display a similar inequality in producing a magnetic field. For example, suppose that a small fixed proportion of all positive charge, say, is ineffective in producing any mutual repulsion with its counterpart in other positive charge and that it is ineffective in inducing magnetism as well. Then, given the mass of any element of neutral material, we can associate with it a virtual negative charge, in electrostatic units, given by its mass in grams multiplied by the square root of the Constant of Gravitation G. This follows from the comparison of Coulomb's law of electrostatic interaction and Newton's law of gravitation. If any body of material is rotated it then follows that it will induce magnetism as if this virtual negative charge were set in

rotation. Analysis shows that for any such body the ratio of the magnetic moment as expressed in electrostatic units to the angular momentum is simply one half of the square root of G. Hence our hypothesis has something to predict, both qualitatively and quantitatively. It can be tested.

In fact, something very similar to this hypothesis emerged historically and from empirical study, as the subject developed over the years. Schuster (1912) and Wilson (1923) have shown that the magnetic moments and angular momenta of the sun and earth are approximately related by a common ratio. This led to the hypothesis, the so-called Schuster–Wilson hypothesis, that a fundamental property exists which causes any rotating body to have a magnetic moment. A particularly significant result emerged from the quantitative aspects of the hypothesis. It was shown by Wilson that the right order of magnitude for the magnetic fields of the earth and the sun is obtained if it is assumed that a moving mass, measured in gravitational units, has the same effect as a moving negative charge, measured in electrostatic units. It was then realized that the possibly coincidental result of the Schuster–Wilson hypothesis might develop the long-sought link between magnetism and gravitation.

Wilson carried out laboratory experiments. He made magnetic tests on a large swinging iron bar. The magnetic field predicted by using the hypothesis did not exist. The hypothesis stood refuted. Then, two decades later, there was a revival of interest. Babcock (1947) succeeded in measuring the magnetic field of the star 78 Virginis. It now became possible to apply the hypothesis to three bodies instead of two. Coincidental results might stem from a comparison between two astronomical bodies. Coincidence was unlikely if the hypothesis worked on the only three large bodies for which the parameters being compared had been measured. The hypothesis was verified. It was fully applicable to them all, notwithstanding the fact that angular momentum involved in the comparison was for the star 10,000,000,000 times greater than for the earth. Blackett (1947) was quick to draw this to attention.* Seemingly, if we accept Wilson's experiment, there is something special about large bodies. Their

* *Nature*, Vol. 159, pp. 658–66.

ability to induce magnetic fields seems different from that of simple iron bars. Blackett then set about the task of carrying out a much more sophisticated experiment to check the hypothesis in the laboratory. Meanwhile, in this period, unsettling anomalies were being discovered. For example, Babcock (1948), Thiessen (1949) and Von Kluber (1951) were discovering that the solar magnetic field varies. Changing magnetic moment is not consistent with the hypothesis. Blackett (1952) made tests on a large gold cylinder fixed in position in a remote test location. It rotated with the earth. It was of very dense material and, by the Schuster–Wilson hypothesis, this concentration of mass rotating slowly with the earth should be the seat of a magnetic moment. Very delicate and extremely sensitive magnetometer measurements were made. The remote location minimized any ambient interference from noise and vibration or other man-made causes. The instrument was sensitive enough to detect the proverbial needle in a haystack, even at a distance measured in hundreds of yards. But, there was no evidence substantiating the hypothesis. The gold body exhibited no magnetic effects attributable to its rotation with the earth. The hypothesis again stood refuted.

Furthermore, Runcorn and others (1950 and 1951) made measurements on the variation of the earth's magnetic field over a range of depths below the earth's surface and were able to analyse the shape of the earth's field. The magnetism which would arise if the implications of the Schuster–Wilson hypothesis are given meaning has a different field form to that which arises merely if there is, in effect, a large magnet at the centre of the earth.

The principal and clear distinction to be drawn between these two concepts is that for one the horizontal component of the geomagnetic field should increase with increasing depth below the earth's surface, whereas for the other this component should decrease with increasing depth. The result found experimentally went against the Schuster–Wilson hypothesis. It is refuted and it stands refuted. So our own version of the hypothesis is short-lived. We are left with the inevitable challenge of still finding the real answer.

A little reflection here might help. Had the hypothesis been verified, what would that have really told us? Would we not then have confronted just another problem, one still more elusive? What is virtual charge? Why should there be the non-symmetrical behaviour of charge of opposite polarity? Surely, it is just as well that the hypothesis failed. Nature should be simple and never non-symmetrical in its endowment of properties to electric charge of different polarities. We should not invent a pattern of scientific behaviour and expect Nature to conform. We should perceive Nature's own pattern. Our examination of Nature's phenomena will lead us to the answer. The clues to this great mystery are there if only we can see them. Yet, as I write this, I am mindful of a private communication I have just received from a young French scientist presently in North America. Edouard Rocher's thesis is that space–time has a metric composed of two four-dimensional systems interacting in conjunction with an operator j, the symbol for the square root of minus one, as used by the electrical theorist. It symbolizes the act of half-reversing a vector, that is a phase change through a right angle. By using it in conjunction with field theory one can make attractive interactions repulsive and vice versa. Rocher's eight-dimensional universe is his starting point in an attempt to relate gravitation and magnetism, and he takes encouragement from the Schuster–Wilson hypothesis, notwithstanding its rejection. Rocher's ideas may gain strength if Einstein's principles survive, but I believe they will collapse alongside Einstein's. Nevertheless, Rocher is undaunted by the rejection of the hypothesis under study. Therefore, let us keep it in mind as we now look for the signs Nature is presenting to us to help us in our quest.

Let us go back in time to that period following Benjamin Franklin's discovery of the electrical nature of lightning. Some years thereafter, in 1774, Joseph Priestley (1733–1804) wrote:

> There is nothing in the history of philosophy more striking than the rapid progress of electricity. Nothing ever appeared more trifling than the first effects which were observed of this agent in nature, as the attraction and repulsion of straws and other light substances. It

excited more attention by the flashes of light which it exhibited. We were more seriously alarmed at the electrical shock, and the effects of the electrical battery; and we were astonished to the highest degree by the discovery of the similarity of electricity with lightning, and the aurora borealis, with the connection it seems to have with water-spouts, hurricanes, and earthquakes, and also with the part that is probably assigned to it in the system of vegetation, and other the most important processes in nature.*

As already noted, we read in *Nature* in 1970 that the lightning accompanying earthquakes is difficult to explain. There seems no link between the two phenomena, and yet the relation has been a feature demonstrated, it seems, for so long and commented on in records two centuries ago. What is the use of theories, such as Einstein's, when we cannot explain those powers of destruction commanded by Nature and called lightning and earthquakes. Surely, we can explain each of them, but it seems that something is lacking if there is a definite link which we cannot explain. What does Einstein have to say about lightning? He does not explain lightning at all. Franklin did that! To Einstein, lightning is merely a flash of light which is signalled at the speed of light. He uses lightning to explain his concept of time, in his discussion of what is and what is not simultaneous.† Given two flashes of lightning Einstein argues that they are simultaneous only if they are seen simultaneously by the observer. Yet, his argument is based upon the acceptance that it takes time for their light to travel to the observer at a finite speed. Therefore, the observer may see them simultaneously and know that they are not simultaneous. The observer may then well wonder why his time measure has to be modified to suit Einstein. Do we really live in a world of makebelief? Time is one of the most basic sense references we have for understanding our environment and as a basic reference its constancy ought really to be taken as 'timeless'. It is so fundamental. We will proceed on this conviction. We will see whether we can come to understand more about phenomena such as lightning, on this foundation, rather than following Einstein and bringing

* Quoted from *Science Past and Present*, by F. Sherwood Taylor, Heinemann, London, 1945, p. 129.

† *Relativity*, by A. Einstein, Crown Publishers, New York, 1961, p. 25.

lightning and other such physical experiences into account to explain variations in the measure of time while yet not explaining the nature of time.

Nordenson (1969)* is highly critical of Einstein's ideas on simultaneity. He writes:

> According to this declaration the concept of simultaneity does not exist *a priori*. It is only by performing certain physical experiments that the concept achieves any sense. This is a most remarkable philosophical proclamation in any context.

However open-minded we are, surely we must believe that an instant in time is universal. No apparition can shatter such belief. It is necessary if only as a matter of definition. If we appeal to definition we can, I suppose, adopt Einstein's definition instead. But why complicate things? Use the natural sense conception of time. It must be right and Nature must be capable of more straightforward interpretation if we stay with this notion. If, after checking the synchronous running of my wristwatch against a clock in my house, I went away on a one-day trip and returned to find these chronometers disagreeing by one hour, and could trace this to no normal cause, I would still believe simultaneity had meaning divorced from signal propagation considerations. Time is fundamental. The chronometers may behave in a queer fashion, evidencing some interesting physical phenomenon, which hopefully would yield to eventual explanation. But if time has to be redefined to provide an explanation one might as well take, as scientific, observations made in one's dreams. To resort to abstract thinking merely to satisfy one's ego that one can find explanation for Nature's elusive behaviour and then to project such ideas is to render science a disservice. It is the universality of time, the sharing of the succession of instants in time by mankind which constitutes the related existence about which man can usefully philosophize. Time has to be fundamental.

Adherents to Einstein's theory talk of 'time dilation'. Some elementary particles are unstable. They have a finite lifetime before they decay into something else. Like man, they die after

* *Relativity Time and Reality*, by H. Nordenson, Allen and Unwin, London, 1969, p. 45.

their due lifespan. Experiment shows that the faster they travel, the longer their expectancy of life. They do not share man's experience in this regard. Scientists attribute this increased lifetime to Einstein's 'time dilation'. In a frame of reference moving faster than ours time passes more quickly—or is it more slowly? Then again, how fast are we moving in space? No, it is the relative velocity which counts, and it is better not to try to explain this in words. Mathematics can extricate us from the confusion. Or do mathematics really obscure the problem? The increase in stability with speed might have been explained before the days of Relativity had the observation been presented. Perhaps the elementary particle, being electrically charged and having all its charge elements mutually repelling according to statistical energy considerations, would find that at speed it has a mutual magnetic attraction between its charge elements which offsets the repulsion and delays the likelihood of disruption to a degree depending upon speed. The experiment supports the idea of time dilation, to be sure, if one merely seeks a metaphysical explanation, but the physicist ought really to look first for a truly physical explanation before abandoning his cause.

Time is measured by the pendulum because, thanks to gravity, the pendulum has the property of relating displaced mass with a restoring force proportional to displacement distance, and because mass, force and distance are appropriately related by the time parameter. Time may be measured by a spring controlled device in which the restoring force is linearly related with displacement by virtue of the elastic properties of the spring. Clocks and watches are useful because they keep time and time keeps constant itself. Since time and its constancy are inherent to Nature as its prime universal property, Nature is not dissimilar from the mechanism of the clock. Our unseen aether medium, if this is the universal clock, has its own harmonious oscillations. It must have a feature by which its distortion is opposed by forces linearly proportional to displacement. If it is a subtle electrical substance, we can imagine a negatively charged system somehow swinging as a whole within a cancelling positive charge. If the unseen aether medium is a plenum of electrical charge and there are, therefore, no voids, then the

motion is more likely to be a cyclic rotary motion, with the whole system of negative charges rotating in harmony in balance with the positive charge. Russell (1946)* tells us how the early Greeks believed that there had to be a void as, otherwise, there could be no motion. But Russell contests this by the words:

> It will be seen that there was one point on which everybody so far was agreed, namely that there could be no motion in a plenum. In this, all alike were mistaken. There can be cyclic motion in a plenum, provided it has always existed.

This is quoted not merely to support the argument that the motion of charge in an electrical aether is likely to be cyclic, but also to suggest that if we had to wait for Russell to correct the thinking of the ancient Greeks, we cannot take as certain the present state of rejection of aether ideas by the modern cosmologists. Besides, the modern cosmologists are mere disciples of great thinkers such as Einstein and Dirac, who have both, in their own way, suggested the existence of an aether having a universal harmonious motion. We will come to this specifically later, when we also examine the ideas of a relatively unknown French cosmologist, Véronnet. All three have presented the basis of the idea we are following here, but seem not to have pursued the thought further.

The step forward we are taking is to examine how this aether provides the universal time, and, if the reader has not forgotten, how lightning and earthquakes have possible association. Guided by the time requirement and the restoring force criteria, we note that electric charge distributions are possible, by which to explain the linear restoring force rate using Coulomb's law of electrostatic action. Furthermore, it works out that the system of electric charge which satisfies this criterion, and which is a plenum as well, happens to be the most simple kind of electrical system imaginable. One merely has a uniform continuum of positive charge in which discrete identical negative charges are arrayed in simple cubic formation. These negative charges form a lattice which oscillates relative to the positive continuum. Seemingly, we are immersed in speculation,

* *History of Western Philosophy*, by Bertrand Russell, Allen and Unwin, London, 1961 edition, p. 86.

but we are not lost with this idea, and it can now take us to a new explanation of the earth's magnetism.

All we have to ask is what happens if a large spherical section of this universal aether medium has its own rotation. Remember, time has to be universal in spite of rotation and our time measure has to stay constant. In other words, the cyclic oscillations of the system will retain their synchronism. Simple analysis readily shows that the superimposed rotation will permit the stable relative motion of the discrete negative charges provided there is a small radial displacement of the mean position of the charge. In effect, the rotation of the large sphere of aether within surrounding aether will cause a radial electric field to be established, as the sphere effectively acquires a uniform distribution of charge balanced by a shell of charge transferred to its surface.

A mechanical analogy is seen if one imagines a boy standing anywhere on a rotating turntable and swinging a weight at the end of a spring around in a circle in a plane parallel with the turntable. We presume an arrangement by which the spring force is linearly proportional to the radius of this circle. The time of rotation of this weight will not depend upon the speed of rotation of the turntable, but the faster the turntable goes, the more eccentric will the orbit of the weight become relative to the end of the spring held by the boy. Time as measured by this rotating weight will remain universal, but the disposition of mass contained by the turntable system has changed. There has been an outward displacement of mass from its centre if the turntable rotates in the same direction as the weight in its orbit.

The first observation we make from this concept of a rotation of electrical aether is that a magnetic field should be established which is attributable partly to a distributed charge and partly to an opposing effect due to a charge at the outer surface of the sphere. The magnetic field distribution for such a system will be more like that of a magnetic dipole located at the centre of the aether sphere. Hence the Runcorn mine experiments would support rather than negate the theory for the earth's magnetism to be adduced from this. Secondly, the implication that the magnetism of a body like the earth is due solely to the aether,

to a medium which is not affected in its concentration by the density of matter, means that the gold cylinder tests of Blackett would give a negative result, as was found. The magnetic moment has become an aether property and, though the Schuster–Wilson hypothesis is incorrect, some modification of the hypothesis now looks feasible. Thirdly, there is charge displacement if the aether changes its speed of rotation, as we presume it would if the large astronomical body associated with it were also to alter speed. Charge displacement is a flow of current and could induce lightning. An alteration in speed of rotation could come from a redeployment of the earth's mass, as in an earthquake. Hence, the possible linking of earthquakes and lightning. All this comes from a willingness to recognize the ever-present aether medium. It is not a nothing that we see only by following mere notions and principles. It is a reality we perceive by taking note of Nature's own manifestations.

Of course, there is so much more to scientific theory than might appear from this casual treatment. Nothing can be certain about the conclusions just presented. Much more thought and analysis are needed even to begin to have a viable theory. There are still many problems to put on the list needing attention if we are to take this effort seriously. One problem is that if the earth developed a charge due to its rotation and sufficient to account for the earth's magnetic field, then the electric fields within the earth would be so high that conduction effects would obliterate them. This point was well recognized by Augenheister (1925).* However, this is not a problem but a clue to the content of the unseen aether medium. We know there is a magnetic field associated with the earth's rotation. We have been led to the idea that the rotation of an aether enveloping the earth induces this magnetic field. Consequently, we must look to this aether to have properties which cancel the electric field set up by rotation. If the cancellation does not affect the magnetic field, then the charge giving the cancellation cannot be rotating with the earth's aether. It is a direct self-evident conclusion which we have to accept. What does this mean? Simply, that there is free charge beside that contained in the lattice system. Why should

* Augenheister, *Phys. Zeit.*, 26, p. 307, 1925.

there be such free charge? Well, the Earth moves linearly in space as well as rotating on its own axis. It can hardly sweep its aether through other aether and retain its harmony. There would be all kinds of turbulence, drag and disturbance, not at all consistent with the existence of a medium which sets universal constants and puts order into the physical universe. No, the sphere of positive aether continuum can rotate smoothly with the earth, wherever the earth is located, but this charge cannot be carried forward with the earth as it moves around the sun. Consequently, the charge of the system of discrete negative charges cannot do other than remain also effectively undisplaced, save for rotation with the earth.

Now, since this system of negative charge tends to form into a cubic array, what happens is that such an array is formed by the vast majority of the discrete negative charges within the earth's aether but some very small proportion of them are free and move in the direction opposite to the earth's translational motion. Thus the array itself can move forward with the earth and, indeed, rotate with the earth, but the free charge does not share this rotation with the earth. The result is the production of a magnetic field but a compensation of the radial electric field effects set up by the rotation of the aether enveloping the earth. This compensation is possible because there will be a uniform distribution of free charge within the earth as long as the earth moves at a steady speed. The lattice displacement develops a uniform displacement charge density determined by its speed of rotation about its axis. There will also be charge compensation at the boundaries of the aether because the total bounded aether charge sums to zero and balance inside the boundaries assures also a balance at the boundaries.

Nevertheless, should the angular speed of the earth change or should its translational speed change, there will be transient electrical field disturbances developed in the aether itself. In earthquakes there is a rapid but small change in the angular speed of the earth and an induction of lightning could well occur as an aether phenomenon. Also, due to the ellipticity of the earth's orbit around the sun, we have a slow continuous change in the earth's translational speed. This could well

explain other sporadic electrical disturbances in the earth's atmosphere.

What is being presented could also explain a concentrated ionization effect at the spherical boundary of a rotating aether sphere. The earth's ionosphere may then evidence aether boundaries. Also, if the thunderball is, as suggested in Chapter 2, nothing more than a rotating aether sphere, it would exhibit similar ionization effects, explaining its glow. Presumably the thunderball having little forward motion through the earth's aether and rotating at a very much higher speed could not command any more free charge concentration than is available in the earth's aether. Substantial ionization effects deriving energy from the rotational inertia of the aether forming the thunderball must then result.

In addition, the origins of the thunderball become easy to explain. A lightning discharge will ionize the air and the discharge current will be carried essentially by a filamentary core of electrons subjected to an inward electromagnetic pinch action. The positive ions, being relatively inert because of their higher mass, will form a cylindrical plasma around this negatively charged core. As a result there will be a radial electric field developed about the axis of the lightning discharge. It seems likely that the aether may be disturbed to react so as to oppose this radial electric field. We have argued that rotating aether develops a radial electric field provided, of course, the axis of rotation is parallel to the axial direction about which the aether charges are moving in their harmonious time-determining orbits. Therefore, provided the lightning discharge has the right direction it may induce aether rotation which would outlive the discharge itself and in some instances consolidate into a spherical form optimizing its electric energy, to create the thunderball.

Is this outrageous speculation? Possibly it is. It seems rather odd to predict that thunderballs formed from lightning discharges will favour those flashes having a certain direction in space. The earth's magnetism can be attributed to rotation of the earth's aether about the preferred space direction. So we reach the peculiar prediction that, roughly speaking, lightning discharges parallel to the earth's axis will produce thunderballs and

those at right-angles to the axis will not. Thus vertical lightning to ground in equatorial regions will not induce the thunderball phenomena. Horizontal lightning should produce thunderballs in these regions but such lightning would be high in the atmosphere and the thunderballs would be dissipated before reaching the ground.

In polar regions we have the inverse situation. Accordingly, thunderballs should occur in thunderstorms in polar regions where there happen to be few observers and thunderballs are unlikely to occur in thunderstorms in equatorial regions where there are many potential observers. It is no wonder then that the existence of thunderballs has been doubted.

In mountainous regions midway between the equator and the poles thunderballs should appear relatively prolifically because of the higher incidence of ground flashes which can have the optimum direction. But do we have any evidence?

Thunderballs are not just a ground phenomenon. Quoting from Ritchie*

> One large ball was observed to hang near the base of a cloud for 15 minutes.

But more pertinent to the above analysis is the quotation from Sir Basil Schonland's book:†

> There are no reliable reports of ball lightning from Africa, in spite of the high frequency of occurrence of lightning to ground. The American meteorologist, Humphreys, has examined 280 specially collected reports of ball lightning and found himself able to accept only two or three at most as possible, but not necessarily authentic, fire-balls. The residue of reports from the Alps, which alone must be taken seriously, prompt one to enquire whether there are any circumstances peculiar to this region which could create such unusual effects.

We introduced this chapter by reference to the ferromagnetic properties of the lodestone and have considered the earth's magnetism. The nature of ferromagnetism itself remains an enigma in physical theory. Even the nature of magnetism is problematic. What is apparent is the spontaneous tendency possessed by a ferromagnetic material favouring the magnetic

* See footnote on page 10. † *The Flight of Thunderbolts*, pp. 55 and 56.

state. It is as if some natural urge exists which ensures magnetism unless accompanying constraints impose energy requirements which cannot be met. If the aether likes to adopt a magnetic state and yields energy readily in adopting this state we can imagine materials being ferromagnetic if only the strains in them resulting from the condition do not require more elastic energy than is available from magnetic sources. Similarly, the aether itself might tend to be magnetized, as it can be if it rotates. However, its own magnetic energy yielded thus will not, it seems, sustain the other kinetic energy needed to permit rotation. Rotation of aether, given a liberal source of energy, can be expected. This now takes us to the problem of the creation of the solar system, but we will return to ferromagnetism in Chapter 12.

As a small addendum to this chapter reference is made to a report in the December 24, 1971, issue of *Nature*. At page 465 there is an analysis of experimental evidence showing that the earth has a solid core. It is concluded that 'solidity of the inner core represents the only solution consistent with the observations'. Such a discovery invalidates the accepted theory of geomagnetism and should enhance interest in the theory of an aether-based geomagnetic field discussed above.