CHAPTER 5

The Law of Gravity

Introduction

Here in this chapter we will revert to a consideration of the phenomenon of gravitation as it is seen from the perspective of orthodox physicists. They do not have insight into the processes by which Mother Nature develops the force of gravity and have no way of regulating its action, which means that there is little they can do, apart from measuring the laboratory value of G and observing gravity's action in the astronomical arena.

Having, as this work shows, spent many years developing and publishing accounts of the theory which forms the subject of this work, this author can but be a little depressed upon reading something concerning gravity and published in the British press during the days when this chapter is written.

The TIMES newspaper dated January 9, 2003 highlighted a feature as 'News' under the heading: '*Einstein vindicated at Newton's expense'*. It would seem that at the annual meeting of the American Astronomical Association the results will be announced which 'show that Einstein was right'. The 'speed of gravity' has been measured at 1.06 times the speed of light, with a margin of error of plus or minus 0.21 and 'since the speed of light is the only possibility for the speed of gravity that falls within that range', so gravity complies with Einstein's prediction. Newton suffers defeat! His theory has failed because Newton deemed the force of gravity to be an instantaneous action-at-a-distance.

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On such a basis those involved in this research justify the following statement as quoted at the end of this newspaper article.

> "We also hope that over the next decade Russia, Japan and the United States will succeed in extending the largest radio telescope arrays beyond the diameter of Earth by putting radio telescopes in orbit, and that this will confirm and greatly increase the accuracy of our result."

One can but wonder why it is that scientists believe they can justify vast expenditure on future research enabling them to look deeper and deeper into outer space in search of inspiration by which to find solutions to the problems they confront here and now on body Earth. Accordingly, in this chapter the author will indulge in a critical survey of the 'state-of-the-art' pertaining to gravity and ask the reader to weigh the case for and against the opinions expressed. The issue is not whether Einstein was right and Newton was wrong. The issue is simply that of understanding how fast gravitational action does assert itself and here, in this chapter, one can open the debate by reference to an assertion often made concerning quantum theory that electrostatic action is an instantaneous action-at-distance. Having, in chapter 2, introduced the notion that gravitation might well be rooted in electrostatic action, readers will then see why, in the light of the above newspaper article, this debate is needed.

I will in this chapter discuss the theme generally but nevertheless show how the evidence of record deemed to support Einstein's gravitational theory is better explained by analysis based on the role played by the aether. The 'debate' which follows is merely an introduction.

Quotations

The TIMES article was authored by Mark Henderson, Science Correspondent. It included as aside remarks the following statements:

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> **"General theory of relativity:** Einstein's most famous work, which accounts for the nature of the cosmos, was proved in 1919 by the British astronomer Sir Arthur Eddington, who showed that light from distant stars was bent by the Sun during a solar eclipse.
>
> **Quantum theory:** Einstein's other great work remains the best model that physicists have for understanding the forces that govern the interior of atoms, matter's building blocks. But it does not incorporate gravity, and scientists are still seeking a "grand theory of everything" that unites relativity and quantum mechanics, knitting together every aspect of physics."

So, there you are, Einstein's theory is 'proved' and to move forward to achieve the ultimate target of all physicists one must seek a way of uniting relativity and quantum mechanics.

Well, the aether theory on offer in this work does unite quantum mechanics with gravity but ignores Einstein's doctrinaire distortions of a four-dimensional space medium that physicists refer to as 'space-time'. Those scientists who follow the Einstein track can never, ever, reach their Holy Grail, that 'grand theory', without getting off that track and setting off on ground first trod by Sir Arthur Eddington and confronting with an open mind the task of deciphering the significance of Nature's physical constants.

The TIMES article tells us that the speed of gravity being equal to the speed of light has:

> 'never been anything more than an assumption and has always been impossible to test. ..... The experiment to measure gravity's speed was conceived by Ed Fomalont, of the National Radio astronomy Observatory in Charlottesville, Virginia, and Sergei Kopeikin,

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Professor of Theoretical Physics of the University of Missouri-Columbia.'

That experiment involved the use of radio telescopes to measure the effect of planet Jupiter in traversing across the path of the radio waves we receive from a very bright quasar named JO842-1835 and, owing to Jupiter's gravitational field, thereby deflecting the path of those signals so that the quasar's position appeared displaced.

The Debate

The reference to the 'speed of gravity' is itself something that needs definition. If one considers the speed of light, at least one can interrupt the light beam at a distance from the point of measurement and so relate time and distance as needed to make the measurement. Gravity as a force exists given the existence of a source body and we really have no way of turning that force on and off. All we can do is to move the body itself and then the question arises as to whether the gravitational field shares that motion as if rigid (instantaneous action) or adjusts to the motion with a time delay.

Keep in mind that there is a world of difference in physics as between the notional retardation of the action of a force such as gravity and the delay involved in gravitational potential energy redeploying in the field system which envelops the mass involved. The reader, in yielding to theoretical notions, has to decide whether to think in terms of force or in terms of energy, whereas Mother Nature does not 'think' but simply 'acts' by a process of adjusting the distribution of the energy in the system to optimise action leading to a minimum energy potential state.

If the motion of a planet around the sun were truly a circular motion with the planet's orbit having a constant radius, then the mutual gravitational energy potential between sun and planet would surely be constant as no energy is being transferred to cater for changes of kinetic energy by the two interacting bodies. If, however,

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there were to be a cyclical change of that radius, as applies for elliptical orbital motion of the planet, then there would be energy transfer to and from the planet drawing on, or replenishing, that gravitational potential resource. Now, in the context of this situation, what is meant by 'speed of gravity'? Gravity does not move, so are we referring to the speed of energy that is traversing between planet and the gravitational field system? Then one must ask where that potential energy is seated as it can hardly be that it sits at the Sun's centre and to apply the proposition that the energy we associate with gravity travels at the speed of light we need to know where it sets out from in its journey in order to reach the planet and resettle as it adds to the kinetic energy of that planet.

As to the basic orbital component of circular motion, the radius is determined by a balance of centrifugal force and the force of gravity. The balance is an unchanging quantity and if 'gravity has a speed' is this something that was only a factor when the solar system was first created or is it somehow something that affects the planet's motion on an ongoing basis?

The history of this subject tells us that, if we assume the circular component of orbital motion is not affected by the 'speed of gravity' but the radial component of motion is so affected, then the radial period of the oscillations will be slightly retarded in relation to the orbital period. This explains why the orbit is subject to a slow progressive advance of its perihelion, something observed and particularly noticeable in the case of planet Mercury.

Indeed, to get the theory to fit what is observed, namely the 43 seconds of arc anomalous advance of perihelion per century, the speed of that radial gravitational retardation effect has to be deemed to involve the speed of light. Gerber in 1898 (*Zeitschrift f. Math. u, Phys.*, **43**, 93), in explaining this 43 second of arc advance per century, assumed the gravitational action to have that speed of light limitation.

Readers who regard Einstein as the genius who discovered why the planet Mercury has such an anomalous motion should take note

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that Gerber's paper was published 18 years before that of Einstein. Gerber's formula for the anomaly was exactly that which later appeared in Einstein's paper. Gerber's paper was entitled: *'The Space and Time Propagation of Gravitation'* and, though not published until after Gerber's decease, a second paper repeating and expanding on Gerber's analysis appeared in January 1917 in Gerber's name in the same German scientific periodical: *Ann. d. Phys.* in which Einstein's 1916 paper had appeared. It was obvious that there was concern that Gerber's contribution had been ignored and there was then onward debate as Seelinger drew attention to a mathematical flaw in Gerber's analysis. Oppenheim responded, stressing that the issue of finite speed was still open, but Seelinger reasserted his position to ensure that his arguments were not eroded by Oppenheim's views. (See: *Ann. d. Phys.*, **52**, 415; 1917: **53**, 31 & 163; 1917 and **54**, 38; 1917).

That debate revealed the difficulties of picturing how gravitational action asserts a retarded effect, given that one can hardly expect the flow of energy to be along a pencil thin line drawn between Sun and planet and given that point above that one is not even sure where the energy that is fed to the planet is seated before it sets off on that journey. However, one can be certain that somehow the speed of light is a governing factor and that what was needed was the proper interpretation of that observed 43 arc-second value to gain insight into the physical action.

Since physics involves matching assumptions with observations to verify those assumptions we then have a kind of chicken and egg argument. If the measurement is made before the assumption is recorded then that is not regarded as proving the theory, but if the assumption is made and duly found to be consistent with later measurement that is said to prove the theory. Such is the illogical arena in which the contests between theoreticians are staged. One must, it seems, predict what is later verified by experiment in order to be applauded by acceptance of one's theory. To explain by theory what is already known is not a respectable pursuit.

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In the case of the anomalous perihelion motion of Mercury the measurement antedated the theory, but in the case of gravitational bending of light Einstein's theory predated the measurement by the eclipse expedition in which Eddington was involved.

Thus one may wonder how one can ever explain why gravitation deflects a ray of light, except by Einstein's argument, given Eddington's assertion that this latter phenomenon is 'proof' of Einstein's theory.

Well, light-energy quanta, photons, supposedly travel at the speed of light and energy E has mass E/c^2, in accordance with classical electron theory, so those light-quanta, in moving past an astronomical body, are subject to the pull of gravity. Since, as light from a distant star, they do not travel around that body in a circular orbit, their distance from the body is changing constantly and so energy transfer should be occurring. Now here there is a real problem. How can those photons change their energy, energy surely gained by them as they approach the deflecting body and lost later on receding from it? Does the light frequency change during passage? Do they travel faster in their close transit past that body? If so then their deflection would be away from the body rather that towards it. Alternatively, maybe we should be thinking in terms of electromagnetic wave theory, rather than photon theory. Maybe we should be wondering how the gravitational action of that body affects the refractive index of the aether and thereby the speed of light through that aether which becomes a function of that refractive index.

That TIMES article, in telling us about the 'speed of gravity' does not provide any answers. I believe that photons, the product of quantum theory, do not in fact travel at the speed of light. Photons are events at localities in the aether where energy shed by matter is absorbed into the aether or energy shed by aether is absorbed by matter. A photon is deemed to travel between two such localities but in reality all that travels is an electromagnetic signal which is a mere ripple of energy already present in the aether, a ripple characterised by

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direction and frequency. Such hypothesis is not tested by the quasar radio wave deflection observations. However, if you think of photons as energy quanta travelling at the speed of light as part of a ray in close transit past the Sun, then, since energy has mass, but yet photons seem to have no mass, you confront a conflicting situation, one made all the worse by the fact that, owing to the gravity, a mass quantum, as just indicated, should go faster in its transit past the Sun and that means that, as a part of a ray of light, that ray will surely be deflected away from the Sun rather than towards it, contrary to what is found by observation.

Do be assured, therefore, that a ray of light cannot be the flow of a train of photons and so seek instead to understand how gravity affects the refractive index of the medium that pervades all space. To base one's arguments on vague terminology, the expression 'speed of gravity', is only a way of raising more unanswerable questions rather than explaining unanswered questions!

The Way Forward

To reach a position on common ground with that of physicists familiar with Einstein's theory I will proceed by making an assumption and I will show how this leads directly to the formulation of Einstein's law of gravitation. This should be seen as verification of that assumption. Then I will show by separate aether-based theory that the formulation governing light ray deflection arises from the effect of gravity upon the refractive index of the aether. The inference is that, whereas Einstein's theory explains the perihelion anomaly and light ray deflection by the same modification of the Newton's law of gravitation, the physics of gravitation requires two separate theoretical foundations for these two phenomena, because there is no analogy between planetary mass and the electromagnetic wave.

I note, however, that before leaving this chapter I will discuss the fascinating topic of whether gravity is an electrodynamic

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phenomenon, as assumed so far by those who seek a unified field theory, or an electrostatic phenomenon as implied earlier in this work.

The assumption is that the gravitational potential energy GMm/R that arises between two bodies of rest-mass M and m, respectively, having their mass centres spaced at a distance R is enhanced by the factor:

$$(v/c)^2 \quad \text{..... (5.1)}$$

if there is relative motion at velocity v between the two bodies, c being the speed of light.

For Sun and planet v will, in the main, comprise a component of motion tangential to the orbit of the planet as supplemented by a radial lesser component of motion in that orbit. Such motion is, by standard physical principles rooted in Newtonian mechanics, subject to conservation of angular momentum and v being very small in relation to c. One can therefore, by close approximation, write h as vR, assuming the mass m to be constant.

However, though I know that this latter assumption is made in developing Einstein's General Theory as applied to gravitation, I appeal to the relativistically-minded reader familiar with Einstein's Special Theory and say that one could designate m as given by:

$$m = m_o [1 - (v/c)^2]^{-½} \quad \text{..... (5.2)}$$

I then argue that retardation of the force of gravity GMm/R^2 at the speed c will be equivalent to its value having to be enhanced by a factor sufficient to account for the work done by m in moving a distance $fT^2/2$ against such a force, f being the acceleration v^2/R and T being R/c, the time taken to traverse distance R at speed c. That factor then becomes:

$$[1 + (v/c)^2/2] \quad \text{..... (5.3)}$$

Taken collectively, the effect of (5.2) and (5.3) is, to a close approximation, equivalent to requiring the gravitational potential to increase by the factor (5.1) as a result of that planetary motion at velocity v, which then means that our 'assumption' has been derived

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by analysis based on standard physical logic founded on classical electron theory that recognizes increase of mass with speed .

As an aside remark I now stress here that, in quoting the 'relativistic' mass increase formula, I am in no way accepting Einstein's doctrines. My reason is that that formula, as already noted in chapter 1, in no way requires use of Einstein's theory, as I well know from textbook data of my student years.

Now, provided our expression for the gravitational potential is based on the rest-mass m_o of the planet, we derive Einstein's law of gravitation on the presumption that h, meaning vR, is constant by writing it as:

$$(GMm_o/R)[1 + (v/c)^2] \quad \text{..... (5.4)}$$

Replacing v by h/R, differentiate with respect to R to obtain, after reintroducing v by eliminating h as vR, the result that the gravitational force acting on the planet is:

$$(GMm_o/R^2)[1 + 3(v/c)^2] \quad \text{..... (5.5)}$$

Note here that gravitational potential is a negative quantity, which explains why we avoided introducing a minus sign in deriving this force. Note also that energy is shed by the gravitational potential as R increases, which is consistent with the force being one of mutual attraction.

I now point out the fact that, by writing u as 1/R, and introducing polar coordinates based on an angle ϕ, the force can be equated to the dynamic pull of the planet in orbit to lead to an equation for that orbital motion:

$$d^2u/d\phi^2 + u = (GM)[1/h^2 + 3(u/c)^2] \quad \text{..... (5.6)}$$

The corresponding Newtonian equation for planetary motion does not include that quantity $3(u/c)^2$. Equation (5.6) is the law of gravitation derived from the General Theory of Relativity. That additional term which distinguishes it from Newton's law corresponds to the progressive advance of the perihelion of the elliptical orbit of the planet.

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It takes about 20 textbook pages of mathematical analysis that is beyond the comprehension of most students to progress to the above equation through the jungle of relativistic dogma. Here I refer to a book entitled *'Modern Physics'* by H. A. Wilson that I purchased in 1946 when I was a university student. This is also the student textbook just mentioned above by reference to electron theory.

Starting from the doctrine of equivalence, one encounters 'geodesics' and 'world lines' as one enters the realm of 'curvilinear co-ordinates'. Then one comes to the 'curved Minkowski world' and encounters 'tensors', where one is introduced to a 'covariant' form of tensor called 'the fundamental tensor', of which there are three. Next come the 'Christoffel symbols', one of which has particular importance, the 'three-index symbol'. After that the next hurdle is 'covariant differentiation' which, once mastered, brings one to a second covariant derivative, developed in two forms, the difference of which has a special name: the 'Riemann tensor'. This brings us in sight of 'Einstein's Law of Gravitation', but only after we have digressed to calculate the values of a whole series of 'three index symbols' that apply to space surrounding a single heavy particle. To conclude the exercise we then have to introduce and formulate the path of an 'infinitesimal particle' to represent the planet that is to move in orbit around that heavy mass and finally, Lo and Behold, we arrive, after another page and a half, at that equation (5.6) above.

I cannot now resist the temptation of quoting a few words from the front page of a Newsletter that I have just received from the U.K. Institute of Physics South Central Branch (January, 2003). The Chairman, Howard Watson, tells us about his preparations to give a public talk on the subject of Physics Nobel Prize Winners and his perception that Einstein is usually about the only Nobel Laureate whose name is recognised by the so-called 'man-in-the-street'. He goes on to say:

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> "The deliberations of the committees in Stockholm are not released for 50 years after the awards. They show, for example, that Einstein was vetoed many times before he finally received the award in 1921. One committee member resolved: 'Einstein must never receive a Nobel Prize even if the entire world demands it'. Part of the problem was that the physicists there could not get their head around the new relativity physics, regarding it as something almost evil and reflecting the undesirable changes that were taking place in the world generally at the time."

So, with the slogan in mind: 'Einstein is right; Newton is wrong', but with that 20 pages of relativity physics still there to mystify the student, are we to accept that the paths of planets are determined and starlight is deflected thanks to Einstein's relativistic doctrines or are we to come to terms with the simple fact that a little commonsense physics that the student can understand will suffice for our onward perception of the universe and its Creation?

That equation (5.6) does hold valid, but surely it must be derived in a different way, as by starting from that formulation of (5.4) and understanding its physical basis.

The Bending of Light by the Sun

Given Newton's law of gravitation as a starting point, equation (5.6) without that term $3(u/c)^2$, the solution for u is:

$$u = (GM/h^2)(1 + e\cos\phi) \quad \text{..... (5.7)}$$

where e, being less than 1, signifies the eccentricity of an ellipse.

Since the additional term added by the Einstein formulation is very small it may then be shown, by a process of successive approximation based on the approximate solution of equation (5.7), that the result corresponds to a slow rotation of the major axis of the ellipse. We shall not work through that analysis here but one will find

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that the result, as applied to planet Mercury, gives the answer that the major axis of its orbit turns at the rate of 43 seconds of arc every 100 years.

Note that we are not involved in four-dimensional space once equation (5.6) is formulated. The answer applies to motion in space of three dimensions. It is, indeed, a trick of relativity to take one into a notional space of four dimensions to justify the distortion of Newton's equation before converting the result back into the three-dimensional world of reality. It is surely so much better to stay in the world of reality and, by understanding the physics which accounts for the gravitational potential expression of (5.4), progress without reliance on the General Theory of Relativity.

Now, so far as the effect of gravitational potential on a ray of light is concerned, Einstein's theory proceeds from the law of gravitation (5.6) and regards h as infinite, which is quite an assumption, one which I prefer to avoid. However, for the record, this leaves us with the equation:

$$d^2u/d\phi^2 + u = (GM)[3(u/c)^2] \quad \text{..... (5.8)}$$

compared with the corresponding expression based on Newton's law of gravity:

$$d^2u/d\phi^2 + u = 0 \quad \text{..... (5.9)}$$

The latter has a solution:

$$u = (1/p)\cos\theta \quad \text{..... (5.10)}$$

which is the equation of a straight line, p being the perpendicular from the origin. This solution represents a first approximation that we can now substitute in (5.8) to obtain the equation:

$$d^2u/d\phi^2 + u = (3GM/p^2c^2)[1 + \cos2\phi]/2 \quad \text{..... (5.11)}$$

a solution of which is:

$$u = (1/p)\cos\phi + (3GM/p^2c^2)[1 - (1/3)\cos2\phi]/2 \quad \text{..... (5.12)}$$

where the angle ϕ is measured from the point where u is a maximum, the point of closest transit.

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The value of u has to be zero at a far distance and so, putting u as 0 in equation (5.12), with ϕ as $\pi/2+\varepsilon$ or ϕ as $-\pi/2-\varepsilon$, ε being small, we obtain:

$$0 = (1/p)(-\varepsilon) + (3GM/p^2c^2)[1 + 1/3]/2 \quad \text{..... (5.13)}$$

which gives:

$$\varepsilon = (2GM/pc^2) \quad \text{..... (5.14)}$$

This parameter ε is the amount of deviation of a ray of light in transit from a far distance to the point of closest approach to the mass M. Therefore, since a similar further deviation occurs as the light ray continues on its way, the total deviation is $4GM/pc^2$.

With the mass of the Sun as $2x10^{33}$ gm, G as $6.67x10^{-8}$ dyne-cm^2 per gm squared, p as $7x10^{10}$ cm, the Sun's radius, and c as $3x10^{10}$ cm per second, the total deflection is therefore indicated by the theory as being 8.47 micro-radians or 1.75 seconds of arc. Since this is consistent with the observation of the deflection of light from stars that grazes past the Sun during a total eclipse of the sun, it has been taken as verification of Einstein's theory.

The reader will, however, have noticed that the mass m_o has somehow dropped out of the equation, but, though its value does not affect the numerical result just obtained, its presence is essential to the formulation of the theory. Clearly, Einstein's theory requires light, as a stream of photons, to be a ballistic phenomenon or, alternatively, requires energy that gravitates to be transported by the electromagnetic light wave. But here I stress that one must keep in mind that the ray of light cannot be deflected in the manner observed unless its components closer to the Sun travel more slowly than its components further removed from the Sun so we have to believe that the speed of light in vacuo need not be constant, given the presence of a nearby body. Furthermore, I again make the point that the energy or mass quanta that are conveyed by the light ray must somehow be slowed down, retarded, as they approach that body, whereas gravitation is supposed to attract and so accelerate such quanta

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because the gravitational potential is shedding energy and augmenting their kinetic energy.

This poses a dilemma, but relativists are not daunted by this, because it is assumed that such problems can be answered by looking into the fabric of four-dimensional space and, accepting that a constant speed in four-space means a variable speed in three-space, so that the resulting formulations override the normal physics encountered in the three-dimensional world of reality.

We reach then a position where the formula for ε derived above is seemingly valid but its derivation is questionable, whereas the law of gravitation according to equation (5.6) holds valid, because it does account for the anomalous advance of planet Mercury's perihelion.

To add further confusion one can refer to authoritative works aimed at helping the student to better understand Einstein's theory. Here I will quote two contrasting statements, one by Einstein himself in his final and fifteenth edition of his book *'Relativity'* (Crown Publishers Inc, New York), where, in his Appendix III concerning experimental confirmation of his theory, he arrives at the $1.7/\Delta$ arc-second value for light deflection by the Sun at a distance of Δ solar radii from its centre:

> 'It may be added that, according to the theory, half of this deflection is produced by the Newtonian field of attraction of the sun and the other half by the geometrical modification ("curvature") of space caused by the Sun.'

The other statement is quoted from a book by V. Fock (1964) entitled: *'The Theory of Space Time and Gravitation'*, (2nd. Ed., Pergamon Press, London), where, on p. 222, one reads:

> 'The fictitious medium of refractive index n is optically more dense in the vicinity of the Sun than it is far away from it. Therefore, light waves will bend around the sun.'

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This is said in relation to a formula for refractive index:

$$n = 1 + 2GM/Rc^2 \quad \text{..... (5.15)}$$

where M is the mass of the Sun, and R here is distance from the centre of the Sun.

So, you see, Fock does not agree with Einstein on this aspect of Einstein's own theory. Einstein thinks that the deflection of light by the Sun is half due to the pull of gravity acting on mass-energy of the light itself and half due to refraction by the space medium, whereas Fock finds that all of the deflection arises from that refraction. Also, the space medium has become 'fictitious' rather than 'curved'.

I ask the reader what he or she, as a student, would learn from such enlightenment and note that the caption on the front cover of that book by Einstein (printed in 1961) reads:

> 'A CLEAR EXPLANATION OF THE FAMOUS THEORY THAT BROUGHT ABOUT THE ATOMIC AGE. With Only a High School Education The Reader Can Understand Albert Einstein's Explanation of His Epoch-Making Theory'.

I submit, therefore, that since equation (5.15) gives the appropriate measure of the light deflection observed by starlight grazing past the Sun, we should seek to derive it without thinking it represents the action of gravity on mass moving at the speed of light, but rather as the action of gravity on the aether itself. The aether should not be regarded as a 'fictitious' medium but rather as a real medium, the properties of which are rather subtle and somewhat elusive until we probe to discover the answers we seek.

Introducing the E and G Frames of the Aether

The aether itself must be the seat of something in motion, something having a mass density and an energy density and so a characteristic that provides the relationship between energy and mass, which accounts for its light-speed determining property.

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The aether must have a rhythmic motion, a frequency, by which it acts as a kind of clock which determines what we call time.

With this cursory introduction I will now present a formula for its kinetic energy density that appears on p. 82 of my book *'Physics without Einstein'*, published in 1969:

$$(2\rho)(c/2)^2/2 \quad \text{..... (5.16)}$$

This formula represents the kinetic energy density of the aether, on the assumption that it has two systems, each of mass-density ρ, moving at speed c/2, but having a relative velocity c. Because that motion is an orbital motion that is strictly harmonious, having a fixed frequency, ρ does not depend upon speed and so is not subject to 'relativistic' mass increase owing to the way in which energy is deployed in such a system. It is therefore correct to use the Newtonian expression for kinetic energy even though the speeds involved are c/2.

The reader may have already guessed that one of those systems is provided by the gravitons introduced in chapter 2, whereas the other system is that of mass for which those gravitons provide gravitational interaction. So, even with no matter present, the aether intrinsically does have a state regulated by gravitation.

Now, since ρ cannot exhibit the inertia of translational motion owing to the preservation of equilibrium within the aether, its self-gravitational interactions are merged with the electrostatic interactions of its electric charge properties and so the gravitational feature only reveals itself when matter is present.

Suppose that a material object of mass M exists and interacts gravitationally with the mass-density ρ. Then at a distance R from M, one can expect the gravitational potential energy density to be $GM\rho/R$, which we denote as $\phi\rho$. This will deplete the kinetic energy density of the aether, because gravitational potential is a negative quantity and its increase in magnitude sheds energy. So we expect the expression in (5.16) to be reduced, but with ρ remaining constant. Therefore c must itself be reduced in proportion to ϕ. One then finds that:

$$\phi\rho = \rho c(\delta c)/2 \quad \text{..... (5.17)}$$

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This means that the aether itself has a refractive index n, a quantity we formulate as:

$$n = c/(c - \delta c) \quad \text{..... (5.18)}$$

which can be written as:

$$n = 1 + 2\phi/c^2 \quad \text{..... (5.19)}$$

or:

$$n = 1 + 2GM/Rc^2 \quad \text{..... (5.20)}$$

which is the above formula (5.15) said by Fock to be a result derived from Einstein's General Theory of Relativity.

However, we have derived it from aether theory. So, you see, the slowing down of light in its close passage past the Sun and its deviation as a result of the Sun's mass and also, for radio waves, that deflection by the planet Jupiter in the recent observations reported at the start of this chapter, are aether-based phenomena.

It is the energy deployment that governs what is observed and, just to show that the aether interpretation can add further insight into this energy deployment process, we can go one step further by asking and answering the question: "If energy is shed by that mass M acting on ρ at a point distant R from the centre of that mass M, where does that energy go? All you have done is to tell us that the kinetic energy density of the aether has been depleted, but surely energy cannot just vanish."

Well, the answer is that it does not vanish. It merely transfers into another kind of motion and is still held at that point. It has been shed by its ordered motion state in those rhythmic orbital cycles and has become kinetic energy associated with what we can regard as thermal vibrations, as if the aether lattice system that provides the mass density ρ has a temperature T. Owing to the fixed rhythm of time the motion involved has only two degrees of freedom, one radial to that orbital motion and one lateral to the plane of that motion. Thus we may well ask if the space here in cosmic regions close to Earth exhibits a temperature.

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If so, what would that temperature tell us about ρ? The message would be that ρ consists of units of mass m_o for which kT is equal to GMm_o/R, where the gravitational potential here is that of the combined effect of the sun and body Earth, k being Boltzmann's constant. Before we embark on the detailed analysis of the aether we already know therefore that the 2.7 K cosmic background temperature of local space can indicate the mass value of that lattice particle, the quon, depicted earlier in Fig. 3.1. Furthermore, once we have derived that mass value independently by theoretical analysis, then we can deduce the very important fact that gravitation has a limited range of action, because distant stars do not contribute much to the gravitational potential matching that mass value.

An astute reader will have noticed that in deriving equation (5.3) I assumed that the energy transit time T was R/c, which is tantamount to saying that the gravitational action travels the distance between the two interacting masses at the speed of light. Here there is an interesting analogy evident from analysis of the deployment of electrostatic interaction energy in the case of two interacting charges. It may be proved (H. Aspden, *'The Spatial Energy Distribution for the Coulomb Interaction'*, Lettere al Nuovo Cimento, **25**, 456; 1979) that if the distance between those charges is R, there is no net interaction energy within a sphere of space centred on either charge and of radius equal to R [See Appendix I]. It may also be shown that the interaction field energy in a spherical shell of radius greater than R does not change as R changes. This means that the field energy associated with that interaction, if it has to be deployed by transfer to or from the kinetic energy of either charge, must traverse exactly that distance R. In other words, if this analogy applies equally to the gravitational interaction, as seems to be the case, then the designation of that transit time T as R/c is fully justified if the energy involved travels at the speed of light. I further point out that, because we are considering an aether that has an underlying energy density, energy can be deployed at what may seem to be the speed of light but without actually moving

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at the speed of light, just as a tidal wave can travel across the ocean without the water it conveys actually moving at the speed of that wave.

As to the so-called E and G frames mentioned in the heading of this section, the G frame is that defined by the graviton system, whereas the E frame is that defined by the system of aether lattice particles. The onward discussion and analysis pertaining to these aether frames in the next chapter takes us into the world of quantum physics and so we now enter the more serious phase of this quest to probe the secrets of Creation. A final word on the subject of gravitation is, however, needed before concluding this chapter.

Gravity: An Electrostatic or Electrodynamic Phenomenon?

When we come to discuss the Neumann potential in chapter 9 it will be seen why the answer to this question favours electrostatic action. As just shown, since electrostatic action and gravitational action, both involving direct inverse-square of distance forces, this puts the emphasis on electrostatic action as the seat of gravitation. One finds from analysis based on the electrodynamic interaction that the distribution of interaction energy in the field does not conform with that we relied on above to derive the factor (5.3). One then confronts the need for special assumptions in seeking to accommodate to the retardation time factors involved. Also, as we shall see in deriving the Neumann potential from Coulomb's Law in chapter 9, I can no longer hold to a position I took in my earlier accounts of the theory of gravitation. This was that the gravitons, in moving with the G-frame at a speed c relative to that of the E-frame, were, in effect, interacting current elements ($\sigma V/c$) moving mutually parallel at the same speed c relative to the electromagnetic frame of reference. To apply the Neumann potential to their mutual interaction can then be argued as giving an attractive force of $(\sigma V)^2$ at unit distance, which admittedly implied this was a gravitational action, but this argument is now thwarted by the proof in chapter 9 that the basis of the

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Neumann potential is the relative velocity of the interacting charges and this is zero. This means that to sustain the argument that gravitation is an electrodynamic phenomenon, one loses the theoretical foundation for the Neumann potential or one has to wander into unacceptable territory by saying that the gravitons, in their motion with the G-frame, exist themselves as leptons by ongoing charge pair creation and annihilation at an enormously fast rate, far greater than that of the rhythmic G-frame motion at the Compton electron. These factors militate against gravity being an electromagnetic phenomenon and favour the electrostatic interpretation. Fortunately the quantitative aspects of the theory affecting the determination of G remain the same as that of the author's earlier theory. Here, then, is the lesson that in developing theoretical accounts of physical phenomena one must persist in probing deeper to understand more and more and must be ready to change direction if Mother Nature guides one along a different path.

I therefore now hold firm to the position I took in chapter 2; gravitation is an electrostatic phenomenon or rather a negative electrostatic phenomenon in the sense that holes in the G-frame continuum charge of density σ mutually attract according to the inverse-square law. Those holes are filled by pairs of oppositely charged gravitons, the motion of which provides the dynamic balance for matter sharing the motion of the E-frame.

[End of Chapter Footnote]

Concerning that TIMES article mentioned in the opening section of this chapter, it is noted that, in the *News and Analysis* section of the February, 2003 issue of *Physics World*, (page 7), the member's monthly journal of the Institute of Physics in U.K., under the title: *'Have we measured the speed of gravity?',* it was reported that the claim by Kopeikin and Formalont had been challenged. Clifford Will of Washington University is said to have calculated that any effects of the speed of gravity cancel out in the experiment

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performed. However, this merely leaves the issue open. All I say is that the speed of gravity, meaning energy in transit owing to change of relative position of Sun and planet does travel at speed c, but, as to the effect Jupiter has on the deflection of the signals we receive from a quasar, this concerns energy deployment as between Jupiter and the aether through which those signals travel and, whatever the answer, I cannot see how Einstein's theory could thereby be proved.

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