ELECTRIC THEORY OF GRAVITATION

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Independent positive and negative partial fields of equal value are assumed to be associated with every source mass. These complimentary electric fields behave like dormant fields with a net zero field strength except in the region of a proton or electron. A mass upon which these fields are impressed contains an equal number of protons and electrons. Even a neutron is assumed to contain a proton and electron. The impressed partial fields exert a combination of attraction and repulsion on proton and electrons embedded in that mass. A nonlinearity in the region of each of those charges tilts the balance such that the net electric force is one of attraction that meets the conditions of a gravitation force. The theory is then extended to include additional properties of the dormant field, such as a "medium" to take the place of Maxwell's luminiferous ether and a feedback medium in electrodynamics. This unification of electromagnetic theory and gravitation also includes gravitational radiation.

Introduction

One of the long-sought goals of physics is a unified field theory, a theory that combines the foundations of physics into a minimum of basic principles. James Clerk Maxwell was able to unify electric, magnetic, and optic phenomena into one theory, his electromagnetic theory of light. This paper attempts to extend that unification to include gravitation.

After making certain assumptions related to the electric property of matter and the superposition of electric fields, the gravitation force is shown to be an electric force. This new concept includes independent positive and negative electric fields that may add up to a zero net field but still possess dormant properties that make possible the extension of electric theory to gravitation.

Elementary Fields From Uncharged Matter

Ordinary matter is assumed to contain an equal number of positive and negative elementary charges. It is well known that an uncharged atom contains an equal number of electrons and protons. In accordance with a previous paper the neutron contains an electron and a proton.[1] This composition of a neutron should not be surprising because it is known that a free neutron decays into an electron and proton.

Each of the elementary charges in matter has its own elementary electric field and they are independent of each other. Each elementary electric field varies inversely as the square of the distance from its source charge. Since there are an equal number of positive and negative charges in the source matter the net electric field is zero. That does not mean that the positive and negative fields vanish. They are independent of each other. The net field is evaluated by the superposition of those two kinds of vector fields, a process that implies the independence of each of those fields. Figure 1 illustrates that superposition process.

One might think of these two kinds of electric fields as *partial fields* very much like the *partial pressures* in gases. The law of partial pressures states that the total pressure is the sum of the individual partial pressures. In the case of electric fields the total electric field is the vector sum of the + and − electric fields. Those individual electric fields may be thought of as *dormant* fields that have an important part to play in the electric theory of gravitation.

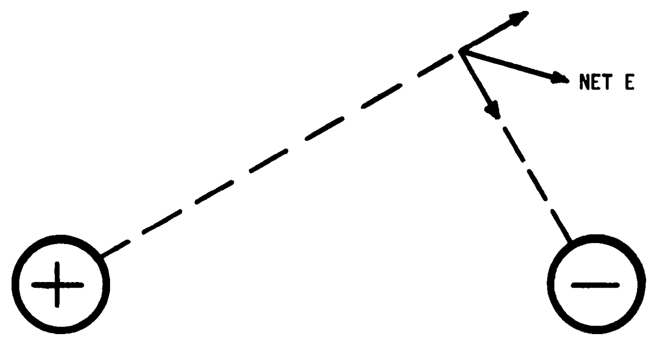

Figure 1. The vector sum of the two independent electric fields yields the net electric field.

Unbalanced Force on Elementary Charges

The gravitation force on an electron or proton is extremely small compared with the ordinary electric force. If the gravitation force is to be an electric force on those elementary charges it must be a very very small fraction of the ordinary electric force on them. It is indeed a second-order electric force effect that is herein interpreted as the gravitation force.

Since there are an equal number of protons and electrons in uncharged mass, an electric field acting on that mass would exert an equal attraction and repulsion force on it except for the second-order effect. That second order effect always tilts the balance to a small attraction force, the gravitation force. The unbalancing effect is due to nonlinearity in the electric field force at the proton or electron, yielding a slightly less than expected Coulomb repulsion. As will be shown later this difference in the "expected" electric force and the actual repulsion force is only about one part in 10^{36} but it is sufficient to account for the gravitation force.

It should not be surprising that nonlinearity exists when there is superposition of electric fields at the electron or proton. The self-field of an electron or proton is extremely large in the region of the charge. It is vastly

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larger than the breakdown strength of the electric field on a power transmission line. When a partial field of the same kind, having the same sign, is added to the self-field of an electron or proton the strength of the field tends to saturate, not quite reaching the numeric sum of the two fields. A similar type of field saturation phenomenon is common in electronics. It is called *overloading*.

Arnold Sommerfeld recognized the possibility of non-linearity of electric fields in the region of the electron. He stated it this way: "Who can guarantee that the Maxwell equations can be extrapolated right up to the surface or into the interior of the electron? May not their simplicity and linearity be a consequence of the fact that they are exactly valid only for weak fields and that they must be corrected in the immediate neighborhood of concentrated charges—in such manner as the theory of dilute solutions in thermochemistry?"[2]

The Reduction Factor

The equation for electric force on an elementary charge q in electric field E is

$$F = qE \qquad (1)$$

Ordinarily the impressed electric field E_0 is considered to be unaffected by the charge on which it acts. It is now assumed, however, that the effective value E of the impressed field is diminished by the *reduction factor* k under certain conditions such that $E = kE_0$ and $F = q(kE_0)$. The *effective value of the impressed field is diminished when the impressed field has the same sign as the charge on which it acts.* When a positive field E acts on a proton the effective field is kE. When a positive field E acts on an electron the field is unaffected and it is still only E. This is in accordance with the concepts developed in the preceding section.

An impressed gravitation field is assumed to have both positive and negative partial fields and, as previously mentioned they act separately, somewhat like partial pressures in gas. Hence in a gravitation field it is only the positive partial field that experiences the reduced effect when it acts on a proton. It is only the negative partial field that experiences the reduced effect when it acts on an electron. The sign of the partial field must be the same as that of the charge for the reduction.

When a gravitation field, with its equal positive and negative partial fields, acts on an electron the result is a net attraction. The attraction of the positive field on the electron is undiminished while the repulsion of the negative field on the electron is lessened. Similarly when a gravitation field acts on a proton the result is a net attraction. The attraction of the negative field on the proton is undiminished while the repulsion of the positive field on the proton is lessened.

The reduction factor is a nonlinear function of the strength of the self-field of the elementary charge on which it acts. To get a measure of the strength of the self-field at the surface of the electron or proton one needs to know the radius of the electron and proton. In previous papers[3,4] and a textbook[5] the following equation is developed for the mass of the proton and electron as a function of its radius a

$$m = \frac{q^2}{6\pi\epsilon a c^2} \qquad (2)$$

On the basis of this equation the radius of the proton is smaller than that of the electron. Since the electric field strength is inversely proportional to the radius squared, the reduction factor is much larger for the proton than the electron. This is as one would expect because the gravitation pull on the proton is greater than on the electron, which has less mass.

The Unbalance Factor

Consider the field due to a remote mass located at some distance r, containing N protons and N electrons. The value of the − partial field due to the electrons is

$$E^- = \frac{Nq}{4\pi\epsilon r^2} \qquad (3)$$

and the value of the + partial field due to the protons is

$$E^+ = \frac{Nq}{4\pi\epsilon r^2} \qquad (4)$$

These two partial fields are equal in value, but the reduction factor k must be included with whichever of these partial fields acts on a self-field of its same sign to convert that partial field to its effective field strength.

In order to obtain the unbalancing factor that yields the gravitational attraction force on a proton let the reduction factor be denoted as k_p and applied to the E^+ partial field. The unbalanced force, the attraction force,

$$F_p = q(E^- - k_p E^+) \qquad (5)$$

and in view of the previous two equations

$$F_p = \frac{Nq^2(1 - k_p)}{4\pi\epsilon r^2} \qquad (6)$$

The quantity $(1 - k_p)$ is the unbalance factor for the proton. The gravitation force of that source mass upon the proton is expressed in electric quantities in equation (6). It may also be expressed in the Newtonian gravitation form

$$F_g = \frac{GN(m_p + m_e)m_p}{r^2} \qquad (7)$$

A solution for the unbalance factor can be obtained by equating Equations (6) and (7). Making that solution and substituting Equation (2) for the masses of the electron and proton one has for the unbalance factor for the proton

$$(1 - k_p) = \frac{Gq^2}{9\pi\epsilon c^4}\left[\frac{1}{a_p^2} + \frac{1}{a_e a_p}\right] \qquad (8)$$

where a_p and a_e are the radii of the proton and electron. Similarly the unbalance factor for the electron can be shown to have the same form but with the radii interchanged from the positions they have in Equation (8).

Using known values of the physical constants and Equation (2) one obtains from Equation (8) the value for the unbalance factor for the proton $(1 - k_p) = 8.094 \times 10^{-37}$ and for the unbalance factor for the electron $(1 - k_e) = 4.408 \times 10^{-40}$.

Given a mass which has N protons and N electrons as the source mass, its gravitational attraction on any proton at distance r from this source mass is given by the electrical Equation (6) with the unbalance factor value listed above. Similarly the gravitational attraction of that source mass on any electron at distance r from that source is given by the same type electric equation using the unbalance factor for the electron listed above.

Total Gravitation Force

The mass upon which a gravitation field acts consists of protons and electrons. Remembering that the neutron contains a proton and electron, the total number of protons in an atom is its atomic mass number and that is also the number of electrons in the uncharged atom. To get the total gravitation force on a mass one must sum up the force on each proton and on each electron. Denoting the total number of protons as N_2, which is also the number of electrons, and summing all the forces yields the total force of gravity

$$F_g = \frac{N_1 N_2 q^2}{4\pi\epsilon r^2}\left[(1-k_p)+(1-k_e)\right] \qquad (9)$$

where N_1 is the number of protons and also the number of electrons in the source mass.

In light of Equation (8) the bracket factor in Equation (9) reduced to

$$(1-k_p)+(1-k_e) = \frac{q^2}{9\pi\epsilon c^4}\left[\frac{a_e+a_p}{a_e a_p}\right]^2 \qquad (10)$$

which is the important conversion factor from electric to gravitation force, as seen in Equation (9). Note that this conversion factor is inversely proportional to the square of the geometric mean radius of the electron and proton. One would expect the electric unbalance to be inversely proportional to the square of the mean radius because the nonlinearity in the superposition of the impressed field on the strong field at the elementary charge is proportional to the strength of the self-field. The self-field strength is inversely proportional to the square of the radius of the proton or electron as the case may be.

Referring back to Equation (9) it is seen that this "electric" force varies inversely as the square of the distance, as one would expect of the gravitation force. This meets all of the conditions needed for the gravitational attraction between two masses. It does raise a question as to whether gravitational mass is equal to inertial mass. That will be discussed in the next section.

Gravitational and Inertial Mass

Gravitational mass and inertial mass are not necessarily the same quantity. Gravitational mass is the mass employed in Newton's universal law of gravitation. Inertial mass is the mass in Newton's second law of motion, the inertial reaction to any acceleration. Historically the two have been considered to be the same quantity. Certain experiments are supposed to have confirmed the equality of gravitational and inertial mass. There is always some question as to whether or not these experiments have in fact shown that the two quantities have the same value under all conditions.

There is excellent experimental evidence that inertial mass increases with speed, as one would expect from the special theory of relativity. J.J. Thompson and others have shown that a high speed electron when acted upon by a transverse magnetic field can not make as sharp a turn as one with lower speed and the same transverse force. This seems to confirm that there is an increase in *transverse* mass with speed and this is an inertial property. Strangely there is an even greater *longitudinal* mass associated with that same speed.[6] It is more difficult to accelerate a "speeding" electron longitudinally than transversely. Each of these masses is defined by Newton's second law in the familiar vector form $F = ma$; mass is that inertial property that makes it more difficult to be accelerated.

The question naturally arises as to how gravitational mass could possibly be the same as inertial mass if there are two different inertial masses for the same body, a transverse mass and a longitudinal mass? Some writers give this as an illustration that gravitational mass and inertial mass are not the same.

It seems that this present electric theory of gravitation requires a distinction between gravitational mass and inertial mass. Thus far the treatment has been considered independent of motion. Equation (2) for mass (2) relates to rest mass and the charge on the electron or proton are considered to be constant, independent of motion. Conversion factor (10) is not a function of motion. So at first glance it would appear that the gravitational mass in this electric theory is independent of speed. There may however be a need to include speed in the conversion factor because the self-field of a moving charge is altered and it was the value of the self-field that was considered to cause the nonlinearity, the greater the self-field the greater the nonlinearity. So it may be necessary to alter the conversion factor so as to take care of high speed motion effects. But a cursory look at this theory does not seem to yield mass increases that would correspond to the transverse and longitudinal inertial masses. The increase in the self-field of an electron in high speed motion is in the transverse direction and not in the longitudinal direction.

The increase in nonlinearity appears to be in the opposite direction from the increase in inertial masses. But that problem must be studied more carefully before drawing a firm conclusion.

It may be that the difference in inertial and gravitational mass can be shown to cause the well known precession of the perihelion of Mercury, which Einstein considered to be proof of his general theory of relativity. This would be a totally different approach to that subject.

Extension Of The Theory

The concepts included in this electric theory of gravitation may be extended to unify additional areas of physics. The dormant field, the + *and* − partial field, may be the medium in which light is propagated. In a previous paper, A Classical Foundation For Electrodynamics[7], an alternative to special theory of relativity was developed. It made use of feedback from the ambient medium, associated with a preferred frame of reference. This dormant field is now considered to be that ambient medium. Since it has also been considered to be the gravitation field, the conclusion is reached that the gravitation field is the light-bearing field. It may be the answer to that elusive search for the luminiferous ether which was originally proposed by Maxwell in his electromagnetic theory of light.

The concept of the gravitation field as the field in which electromagnetic waves are propagated has far reaching consequences. If that be correct, it means that Einstein's second postulate of special relativity is wrong. It means that one can reject the concept of relative time, the so-called time dilation, and the concept of space contraction. It means that modern physics can now return to ordinary time and ordinary geometry, as was proposed in the previously mentioned paper. A justification for the abandonment of Einstein's special theory was treated in the previously mentioned paper and its companion paper, A New Theory of the Electron[8]. Numerous other authors have challenged Einstein's second postulate, including Herbert Ives of the Bell Telephone Laboratories[9]. There is no longer any reason for blind faith in the special theory of relativity. Modern cosmology has acknowledged that special theory of relativity can not hold for extended regions. Cosmologists have adopted an absolute rest frame, which is completely contradictory to Einstein's special theory. However, they hedge by using special theory locally and rejecting it for space in general. That contradictory turn of events is seen in Martin Harwit's *Astrophysical Concepts* page 178: "Rather, the establishment of an absolute rest frame would emphasize the fact that special relativity is really only meant to deal with small-scale phenomena and that phenomena on larger scales allow us to determine a preferred frame of reference in which cosmic processes look isotropic."[10] It is much more reasonable to have a unified theory of electromagnetic and gravitational phenomena than to follow the present practice of attempting to "have the cake and eat it too".

A further step in the development of a unified field theory is taken by combining the electric theory of gravitation with the concepts developed in the paper by Barnes and Upham, Another Theory of Gravitation: An Alternative to Einstein's General Theory of Relativity[11]. In that paper gravitational fields d, g, b, and h were defined to be analogous to the electromagnetic fields D, E, B, *and* H and postulated to obey four field equations that were analogous to Maxwell's four field equations of electromagnetic theory of light. One difference in those equations and the Maxwell equations was that a negative sign had to be introduced to specify attraction between "like" masses whereas the electric equation has repulsion between like charges. One can now extend the present paper's electric theory of gravitation to give the justification for that negative sign and to ascribe electric properties to each of those gravitational fields. That paper developed equations for gravitational radiation.

Gravitational radiation can now be described as the radiation of both elements of the dormant field, the − partial field and the + partial field, and only detectable on the order of magnitude of gravitational effects and due to the nonlinearity of the electric fields at the protons and electron as previously described in this paper.

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We understand that the Australian Journal *EX NIHILO* is now available in the United States, at P.O. Box 281, Glen Ellyn, Illinois 60137. The cost of a subscription is $15.00 per year.

EX NIHILO seems to be published quarterly. The position taken in it seems to be much like that usual in our *Quarterly*, for instance, the young-earth viewpoint. The articles and items are perhaps on the whole somewhat less technical than those in the *Quarterly*; but it is intended to have one technical article per issue, for instance those by Setterfield, mentioned in Panorama of Science in this issue of the *Quarterly*.

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