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A Reexamination of the Velocity of Light, Dark Mass, and the Accelerated Expansion and Age of the Universe

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Abstract: This paper establishes the amazing ability of space permittivity and permeability to determine the velocity of light, the extent of Dark Mass, and the accelerated expansion of the universe. In addition, taking into account the dependence of the velocity of light on permittivity and permeability, it is shown that the universe is significantly older than is generally accepted.

From Einstein, $E=Mc^2$, or $M=E/c^2$. (1)
From Maxwell, $c^2 = 1/[\varepsilon\mu]$. (2)
Thus, solving for M by substitution of (2) into (1), $M=E\,[\varepsilon\mu]$. (3)

Hereafter, equation (1) will be referred to as the "Einstein" Equation, equation (2), as the "Maxwell" Equation; and equation (3) as the "Einwell" Equation. In these equations, ε denotes permittivity in vacuum space and μ denotes permeability in vacuum space. The subscripted variables ε_0 and μ_0 are used below to denote present established values for ε and μ.

In equations (1) through (3), above, *E* stands for the energy of a selected body in space in units of force-times-the-distance, i.e., in newton-meters, or joules, in the MKS system of units that will be used herein. *M* stands for the measured mass of the same body in units of kilograms. *c* stands for the velocity of light through space in units of meters per second. Permittivity ε and permeability μ are in less familiar units of farads/meter and henrys/meter, respectively, which can be translated in terms of standard MKS units.

For the purposes of this report, the energy, *E*, in equations (1) through (3) will obey the conservation of energy law with no work being done **by** the selected body mass, and no work performed **on** the selected body mass. *E* will therefore be a constant in all the analyses to follow. Also assumed is an expanding universe triggered by the "Big Bang".

Next, with the above assumptions, it will be shown that the Einwell Equation (3) leads to profound solutions to problems encountered trying to understand Dark Matter, the age of the universe, and the accelerating expansion of the universe. As will be clarified below, to do all this only requires an understanding of how the permittivity ε and the permeability μ in effect vary systematically with changes in the condition of the space that surrounds us.

To illustrate how this works, consider the capacitance of any given object in space, which includes, along with many other things, the capacitance to some $4\text{x}10^{22}$ or so stars in the universe around us. The current capacitance to space, C_A, of any object A with an *effective* radius of r is $4\pi\varepsilon_0 r$, or

$$C_A = 4\pi\varepsilon_0 r\,, \tag{4}$$

where ε_0 is the present permittivity of the space around us. Add one, or a few million, stars and equation (4) still holds since the change in capacitance is insignificant. Next, however, consider the universe contracted to a smaller size such as existed a few billion years ago. Then, along with all other things, <u>every</u> star is closer to A and the capacitance of A to each and all of the $4\text{x}10^{22}$ stars has increased considerably. In order for equation (4) to accurately provide the correct higher value of C_A, one can simply use a new value of ε *higher* than ε_0, calling this higher ε value the *effective* permittivity of space for the chosen compressed universe example. Conversely, as the universe continues to expand in the future, the value of ε in equation (4) will need to be decreased to retain the accuracy of the equation as all the objects in space move farther from A. It has been determined experimentally that, simulating conditions in space, and all else equal, the capacitance of a given object A in a volume V of space varies in proportion to 1/V; see reference [1]. It then follows from the above discussion that, under the same conditions, the *effective* permittivity ε varies in proportion to 1/V as well.

Carrying this analysis one step further, similar effects are produced for the permeability μ. Walking into any ferrite maker's establishment, one finds that a given volume V of manufactured ferrite is composed of a volume V_p of hi-μ particles (usually composed of iron or nickel based materials) dispersed throughout the volume plus a usually larger amount of inert low-μ (ceramic) material surrounding the particles. All else equal, the *effective* μ of the total volume V of the manufactured ferrite is determined by the ratio of the particle volume V_p to the total volume V.

Relating this to the universe, the stars, planets and even galaxies are relatively tiny particles with magnetic properties dispersed in the huge volume of inert vacuum space. Consider a time period in the distant past when the earth (in whatever form) was half as far away from the location of the center of the Big-Bang as it is now. It follows that the volume V of the universe in this distant past time period was one eighth of what it is now (volume proportional to the cube of the radius). However, the volume V_p of all the base materials with either hi-ε or hi-μ in this distant past time period was just as it is now.

Let ε and μ denote the effective permittivity and effective permeability of the universe in this distant past time period. By previous discussion, the ratios $\varepsilon / \varepsilon_0$ and μ / μ_0 are each approximately 8. Let M denote the mass of the earth in this distant past time period, and let M_0 denote the present mass of the earth. It then follows by the Einwell Equation (3) that M/M_0 equals $\varepsilon / \varepsilon_0$ times μ / μ_0, meaning M would have been larger by a factor of 8 x 8, or by 64! The same argument applies to show that every mass in the universe would have been larger by a factor of 64.

Moreover, since gravity between any two masses is proportional to the product of both masses, this implies gravity forces would have been larger by a whopping factor of 64^2=4096. This bigger value, caused by no observed new physical entities, is more than enough for any "Dark Mass" enthusiast, especially if one looks back at a time when the earth was only one third or one tenth as far away from the center of the Big Bang as now.

In summary, by this analysis, there is no need to introduce a concept such as "Dark Mass" to explain higher mass in the past. There is simply the need to recognize that permittivity and permeability in vacuum space vary systematically in proportion to V_p/V, and that V was smaller in the past.

All of the foregoing would be elegant except for two reasons. First, the long-ago mass step-up seems to be excessive. Second, the analysis in reference [1], while it also concludes by a completely different approach that gravity is proportional to ε^2 (permittivity squared), does not say anything about dependence upon μ (permeability).

The realization that there are two kinds of masses which have to be considered separately solves both dilemmas. Gravitational mass is one kind; inertial mass is the other. In reference [1], any gravitational force is an electrostatic phenomenon. In this paper, an assertion is made that any inertial force is a magnetic phenomenon. Charges dragged through space make electric currents. Electric currents are produced only by applying forces to charges in masses. Such currents are increased or decreased only by applying forces. With no applied force a current will remain constant, either zero or at a steady value. These inertial effects all happen because electric currents produce associated magnetic field energies which can be steady, built up or collapsed. Positive currents are not significantly offset by negative currents (calling positive charges moving though space as positive currents; negative charges moving through space as negative currents) because the spacing between separate charges in a mass is very great in comparison to the sizes of the charged particles themselves.

On the basis of these assumptions and experimental evidence, the Einwell Equation (3) is divided into two equations – one for gravitational masses dependent upon ε, and one for inertial masses dependent upon μ – as follows:

$$M_g = k_g E \varepsilon . \quad (5A)$$

$$M_i = k_i E \mu . \quad (5B)$$

Interestingly, by all present measurements, the gravitational mass M_g is equal to the inertial mass M_i. Assuming equations (1) and (2) are correct for ε_0 and μ_0, the present established values of ε and μ, it then follows from the derived equation (3) applied to M_g and M_i that

$$M_g = k_g E\varepsilon_0 = k_i\ E\mu_0 = M_i = E\varepsilon_0\mu_0 \,. \qquad (6)$$

Consequently, the constants k_g and k_i must satisfy

$$k_g = \mu_0 \,; \qquad (7a)$$

$$k_i = \varepsilon_0 \,. \qquad (7b)$$

Equations (5a), (5b), (7a), and (7b), together with the Maxwell Equation (2), logically imply that the Einstein Equation (1) divides into two equations, one for gravitational masses and the other for inertial masses, as follows:

$$E_g = [\mu/\mu_0]\, M_g c^2 \,; \qquad (8a)$$

$$E_i = [\varepsilon/\varepsilon_0]\, M_i c^2 \,, \qquad (8b)$$

where it is important to recall from the Maxwell Equation (2) that $c^2 = 1/\varepsilon\mu$. However, an additional critical observation can be made. Combining the four equations (5a), (5b), (7a), and (7b),

$$Mg/Mi = [\mu_0/\mu][\varepsilon/\varepsilon_0] \,. \qquad (9)$$

As previously argued, ε and μ both vary in direct proportion to 1/V, where V denotes the volume of the universe. Letting V_0 denote the present volume of the universe, this implies

$$\varepsilon = V_0\varepsilon_0/V \,; \qquad (10a)$$

$$\mu = V_0\mu_0/V \,. \qquad (10b)$$

Consequently, combining (9), (10a), and (10b), in all time periods

$$\varepsilon/\varepsilon_0 = \mu/\mu_0 = V_0/V \,; \qquad (11a)$$

$$M_g = M_i \,. \qquad (11b)$$

It follows from (8a), (8b), (11a), and (11b) that the original Einstein Equation (1) must be generalized to the following form in order to be applicable for the case of a universe undergoing changes in volume:

$$E = [V_0/V]\, Mc^2 \ . \qquad (12)$$

Combining the Maxwell Equation (2) with (12), the original Einwell Equation (3) must in turn be generalized to the form

$$M = [V/V_0]\, E\varepsilon\mu \ . \qquad (13)$$

Note that the volume ratio V_0/V in (12) is the inverse of the volume ratio V/V_0 in (13).

In summary, assuming the universe is expanding over time, equations (12) and (13) imply that the original Einstein Equation (1) and the original Einwell Equation (3) are valid only for the present time period in which the volume V of the universe is equal to the present (reference) volume V_0. The volume ratio V_0/V in equation (12) is *greater* than 1 for distant *past* time periods when the universe volume V was significantly *smaller* than V_0 and it is *smaller* than 1 for distant *future* time periods when V will be significantly *larger* than V_0. The reverse observations hold for the volume ratio V/V_0 in equation (13).

With the analyses shown, one is now able to understand some of the great effects of space permittivities and space permeabilities. Consider next the expansion of the universe. Let the energy of the earth's movement away from the Big-Bang be represented by:

$$E_e = M_e v_e^{\ 2} / 2 \ , \qquad (14)$$

where the subscripts e all relate to the earth's energy, mass and velocity with the earth moving radially outward. It has been shown earlier that any mass such as M_e is reduced with the universe's expansion, even though the energy E_e is constant. Thus, to keep equation (14) valid, $v_e^{\ 2}$ must increase by the same amount that M_e has decreased.

All the parts of the universe moving outward, therefore, have accelerated expansion! Actually, any detectable effect happens so slowly that no one has been able to postulate or measure any acceleration until recently. An analogy to this effect may be understood using an ice skater's rotational speed increasing with no outside-added energy when the arms of the skater are brought in close to the body. The term *I* in the constant energy equation, $E = I\omega^2/2$, has been reduced by bringing the average mass in closer to the center, making the square of the rotational speed ω^2 increase to keep the energy *E* constant.

Also, consider the Maxwell Equation (2) alone. It shows that when ε and μ were much greater than at present, the velocity of light was much slower. Therefore, the images from distant space we see today are actually from much longer ago than implied by the conventional assumption that the velocity of light is constant. Since the ages of all things in the universe have been determined using the present velocity of light and its travel-time to determine distances and times of happenings, the resulting conclusions are mostly in error. For example, the universe from the time of the Big-Bang is much older than the presently determined 13 to 14 billion years. This allows ample time for the formation of old stars, a process that heretofore has been mysteriously assumed to take more than 13 to 14 billion years, i.e., more than the estimated age of the universe.

However, the contracted universe is not the only way to get increased ε and μ. In high- density clusters of galaxies or stars, higher permittivities and permeabilities occur with the same resulting effects as the foregoing. That is, light travels more slowly through the space in clusters (delaying light signals arriving here on earth passing through them), gravity is more intense (indicating incorrectly additional dark masses, black holes or neutron stars) and the expansion in the confines of the cluster is accelerating.

Another interesting thing to note is that electromagnetic forces between charges are inversely proportional to ε; that is $F_{em} = q_1 q_2 / 4\pi\varepsilon r^2$. This means that, while gravity forces are increasing proportional to ε^2 looking back in time, charge electromagnetic forces are decreasing proportional to $1/\varepsilon$, suggesting perhaps that far back in time they were the same. This seems a little far-fetched, however, as there is an approximate 10^{39} amplitude ratio of charge-to-gravity forces to overcome.

Nothing much has been said here about the future universe, but using the Einwell Equation (3), as generalized in equation (13) for an expanding universe, the reader can postulate for himself what might be in store for us.

References

[1] Spears, Morton F., "*An Electrostatic Solution for the Gravity Force and the Value of G*," January 9, 1997. http://www.econ.iastate.edu/tesfatsi/MFSpears/mfsgravity.g.figs.pdf