8 July 1998

PERMITTIVITY CREATES DARK MATTER AND AN OLDER UNIVERSE WITH ACCELERATING EXPANSION

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Abstract: The purpose of this report is to provide simple answers to the following three questions by considering the effects of what has been happening over time to one single property of open space; namely, the *permittivity* of that space:

- What is *dark matter* and why does it exist?
- Why do so many distant stars appear to be older than the expanding "Big Bang" Universe of which those same stars are a part?
- Why is our Universe expanding at a greater velocity now than it did many millions of years ago?

Introduction

There are many puzzling things happening in our huge space-time home which, so far, cannot be explained by modern physics in a manner acceptable to a majority of those exploring the Universe. Three specific unanswered questions are: 1.) What is *dark matter* and why does it exist? 2.) Why do so many far-away stars appear to be older than the expanding "Big-Bang" Universe of which those same stars are a part? 3.) Why is our Universe expanding at a greater velocity now than it did many millions of years ago?

The purpose of this paper is to submit simple answers to the three questions above by just considering the effects of what has been happening over time to one single property of open space; namely the *permittivity* of that space.

Permittivity is one of the properties of an "absolute vacuum" space that determines the velocity of light and the same velocity for other electromagnetic wave energies which happen to propagate through the space. It is also a factor that determines a different velocity of light through other media such as glass or water. However, the usual meaning for "the speed of light" is thought of as a light wave traveling through vacuum space (or through air which lowers the velocity by an insignificant amount for most purposes).

The other important property which determines the velocity of light, and the velocities of other electromagnetic wave energies propagating through a medium, is called *permeability*. For this paper, the permeability of open space is assumed to always have the same value, although open space in early times, shortly after the big bang for example, may have contained enough disbursed magnetic materials to increase the space effective permeability value.

Dark Matter

To begin the analysis of the Universe pertinent to this report, start with the famous Einstein expression,

$$E = Mc^2 , \qquad [1]$$

where E is the energy and M is the mass of a selected portion of matter at rest, and c is the velocity of light. From this, one knows the total energy E that theoretically can be extracted from a particular blob of anything when all of its mass M is converted to energy. There are additional internal energies such as motional ones produced by individual particles within the mass at high temperatures. Also, if the entire blob is set in motion at a velocity v, the blob of mass has extra kinetic energy so that the Einstein energy-mass relation becomes $E = Mc^2 + Mv^2 / 2$. Next, in this report, however, only masses at rest and at a constant temperature are considered.

The velocity c in the expressions means a velocity of light of approximately 2.99792×10^8 meters per second, which is the unique speed of light measured through vacuum space and not through any other medium. But when one defines our present "vacuum space" the implied meaning is a medium with a permittivity ε_0 of approximately 8.85419×10^{-12} farads per meter and a permeability μ_0 of approximately 1.25664×10^{-6} henrys per meter. The subscript zero is used to denote particular constant values for both ε and μ that apply to open vacuum space. It follows that c_0 should be used instead of just c in the Einstein expressions since c_0 also applies to a unique velocity of light in the same vacuum space; thus

$$E = Mc_0^2 . \qquad [2]$$

There is a direct relationship between c_0, ε_0, and μ_0 given by the equation:

$$c_0 = 1/\sqrt{\varepsilon_0 \mu_0} \text{, or } c_0^2 = 1/\varepsilon_0 \mu_0 . \qquad [3]$$

Therefore, for this report there is no reason that Einstein's energy equation cannot be shown in another and more useful form:

$$E = M / \varepsilon_0 \mu_0 . \qquad [4]$$

There are enormous consequences that effect radical changes to the model of the Universe if the permittivity of open space somehow varies with time. It is the specific purpose of the material that follows to show that not only does the permittivity of open space lessen with time in an expanding universe, but also to demonstrate just how this happens.

First in an experimental laboratory, two metal plates with parallel surfaces spaced at a reasonable distance in a vacuum can be used as terminals of a capacitor across the tuned circuit of a high frequency oscillator. The frequency of the oscillator is recorded. When a quantity of separated solid particles, vaporized liquids or gases are inserted in the capacitor space (as long as a conductive short circuit is not made between the plates), the new frequency generated by the oscillator is reduced. The capacitance of the capacitor has therefore increased, which really means the *effective permittivity* of the space between the plates has increased. Using this kind of increase in permittivity, applied to earlier times in our compacted young expanding Universe, results in visualizing a greater permittivity for space as one looks back in time at the distant galaxies. A given large volume of space, for example, contained many more solid particles (the stuff galaxies and stars are made of) and there were many more clouds of various gases and vaporized liquids per a large volume of space. Consequently, the overall effective permittivity of open space was greater then than it is now – there shouldn't be much doubt about that.

Second, however, there is another compelling reason to project a space permittivity that lessens with time in our expanding Universe, even for the smallest of space volumes. To visualize this happening, assume that a vacuum pump has evacuated a bell jar volume down to absolute zero pressure with nothing but pure vacuum in the jar (possible only as a thought experiment). The value of ε_0 for the pure vacuum space in the bell jar is the same as mentioned earlier, and measures about 8.85419×10^{-12} farads/meter. The bell jar volume can be expanded or contracted with no change in the permittivity value for the space inside. Either there is *nothing* in the bell jar, or whatever is in it passes freely through the walls with no friction or any other known effect. Although the term *aether* (or *ether*) has gone out of vogue for designating the medium of pure vacuum space, many modern physicists believe that vacuum space is composed of something(s). Otherwise how can electric and magnetic fields be maintained propagating through nothing, or how does a magnet attract a piece of iron through nothing? And, even more puzzling, how can properties like permittivity and permeability exist in nothing? If vacuum space consists of something(s), however, what does it consist of? One of the popular theories visualizes vacuum space packed with many neutrinos, those illusive very small particles that carry no electrical charge. The *String Theory* advances the concept of our Universe filled with even smaller minute "strings" and "trouser-shaped particles" that are present everywhere dominating space. Still another theory contends that vacuum space consists of protons and electrons without electrical charges, ready to form hydrogen when electrical discharges through space energize many of the protons and electrons to effect an "ether to mass" transformation.

It does not make any difference for purposes of this report which theory (or none of them) is correct, because in an expanding universe the density of whatever one believes exists in vacuum space is lessening. For detailed calculations, who knows, or can even guess, what the permittivity is of a neutrino, or a string, or an electron, or a proton or any other sub-atomic particle. But, as long as the particles individually have a greater permittivity than the space around them, the overall space permittivity will decrease with expansion. This effect cannot be verified by experiments with present state-of-the-art techniques, because in a laboratory a portion of vacuum space can not be forced to contract or expand by compression or decompression.

Next, consider that every blob of mass *M* is an equivalent bit of energy *E* that cannot be increased without some work done on the mass, nor can the equivalent energy be decreased unless some work is done by the mass on something else. Assuming no work is done on or by the mass, the energy *E* will have a constant value over any time period (from a past time at –t, through the present time at 0, to a future time at +t). Thus:

$$E_{-t} = E_0 = E_{+t} = (M_{-t} / \varepsilon_{-t}\mu_{-t}) = (M_0 / \varepsilon_0\mu_0) = (M_{+t} / \varepsilon_{+t}\mu_{+t}) \,. \qquad [5]$$

But how can Expression [5] be true when the value of permittivity over time is changing? It has just been shown how open vacuum space permittivity ε in an expanding universe must decrease with time so that:

$$\varepsilon_{-t} > \varepsilon_0 > \varepsilon_{+t} \;. \qquad [6]$$

And, in the Expression [5], if the permeability μ stays at the same constant magnitude over time (as assumed in this report), there is only one other parameter left which has to change to keep *E* from changing too; that is, <u>the *effective mass of M* must be decreasing with time</u>! This decrease in mass is then at the identical rate as the decrease in permittivity with time. (If one were to assume also a lessening of permeability with time in our expanding Universe, there would be an even faster rate of effective mass lessening with time, proportional to the $\varepsilon\mu$ product). The ε, *M* dependency relationship leads to the required conclusion that:

$$M_{-t} > M_0 > M_{+t} \;. \qquad [7]$$

The effect of mass reduction with time applies to not just a single portion of mass under scrutiny, but to all masses. This means that at a given time in the distant past, for example, that the gravity force between <u>two</u> masses, $GM_{1(-t)}M_{2(-t)} / r^2$, was increased relative to today's mass effects by the square of the M_{-t} / M_0 (or $\varepsilon_{-t} / \varepsilon_0$) ratio, as deduced from Expressions [5], [6] and [7]. Suppose Professor A, a leading astronomer-cosmologist-physicist, looks with his powerful telescope far away and back to a time when $\varepsilon_{-t} = 3\varepsilon_0$. He carefully observes that all heavenly bodies that he watches are being pulled nine times as much as they ought to be, so he naturally concludes that there are mysterious unseen bodies of mass eight times as prevalent as the detectable bodies. He presents his results to the scientific community, concluding that the mass we are familiar with is only about 11% of the total, while nearly 89% of the mass in our Universe is *dark mass* (or *dark matter*) that has not been observed. Professor B, on the other hand, then looks back to a time when $\varepsilon_{-t} = 4\varepsilon_0$. She presents her equally convincing recorded data that shows a fifteen-to-one ratio of dark matter to normal matter, or dark mass consists of about 94% of the total. And so it will go until permittivity is recognized as a truly important property of space, affecting and effecting many other phenomena.

To quantify dark mass in an expression, let $(\varepsilon_{-t} / \varepsilon_0) = k_{-t}$, where k_{-t} represents the *dielectric constant* of vacuum space at some time long ago. Also, let M_d represent a hypothetical quantity of dark mass and M_n represent a hypothetical quantity of normal mass. Then:

$$M_{d(-t)} = M_{n(-t)}(k_{-t}^2 - 1) . \quad [8]$$

The Age of the Universe

One of the "untouchables" of science, considered sacred and invariable, has been c_0, the speed of light through open vacuum space. But, when permittivity lessens with time, it's a whole new ball game. When we look through our telescopes at galaxies and stars as they were aeons ago, because of a greater ε permittivity then, light was traveling at a slower velocity. It follows that the light we see has traveled part of its distance through a medium that slowed it down. This means that the light has taken a longer time to get here than previously supposed; and the Universe, and everything in it, is therefore older than we have heretofore recognized.

Accelerating Expansion of the Universe

Earlier in this report it was mentioned that a quantity of mass does not change its energy unless some work is performed by the mass for a loss of energy, or some work is performed on the mass for a gain in energy. Take the case of a mass like our Earth moving radially outward over time from the center where the big bang initially erupted, and assume no energy has been added or taken away, as far as expansion is concerned. The mass of the Earth M_e has a constant energy E_e associated with its radial expansion velocity v_e so that:

$$E_{e(0)} = (M_{e(0)} v_{e(0)}^2 / 2) = E_{e(-t)} = (M_{e(-t)} v_{e(-t)}^2 / 2) = E_{e(+t)} = (M_{e(+t)} v_{e(+t)}^2 / 2) . \quad [9]$$

Eons ago, according to Expression [7], the effective mass of Earth M_e was greater than it is now because of the greater permittivity of open vacuum space, which in turn means that the velocity of Earth during expansion had to be less at the same time to conform to Expression [9]. Much later on, the effective mass of the Earth will be less than it is now, causing a greater expansion velocity. From Expressions [6], [7] and [9] it can be shown that the radial expansion velocity of the Universe v_r is continuously increasing with time, and that the rate is proportional to the square root inverse of permittivity. The mathematical representation for this is:

$$v_r \propto \varepsilon^{-1/2} \tag{10}$$

To provide a somewhat applicable analogy to this, think of a person holding a pair of dumbbells rotating on a frictionless platform. When the two weights are held in two hands at full arm's length, rotation occurs at a slower rate than when the dumbbells are pulled in closer to the body. The energy has not changed in the system as a whole, but the rotation rate changes to preserve the $Mv^2/2$ energy of the two weights (plus the two arms). Similarly, the energy of an object moving with expansion stays constant, but when the effective mass is reduced, the expansion velocity must increase to keep the energy constant.

Conclusions

In accordance with the stated purpose of this paper, answers to the three questions posed in the opening paragraph are given below. Now that it is recognized that the properties of open vacuum space can change with time, however, a number of new unanswered questions arise, not discussed herein. One such question concerns the effect of changes in vacuum space with time in relation to electrical charge forces.

1. Dark matter, as a separate entity, does not exist. Instead, dark matter is an illusion arising from greater gravitational forces for normal masses as they existed a long time ago. The *effective masses* then for the same bodies today were greater, but were, and still are, lessening with time. The rate of decrease in mass is extremely slow, only significant over time periods of many millions of years. The mass decrease is proportional to the permittivity decrease of open vacuum space with time. The permittivity decrease is the result of expansion of our Universe, which provides over time a lowering population of particles of whatever nature for any volume of space. When the individual particles are assumed to have greater permittivities than their surrounding space, a lower particle count results in a lower effective permittivity for that space. Then, by energy conservation, a lessening effective permittivity in the expanding volume of our Universe dictates a lessening of effective mass as determined by Expressions [4] and [5]. Finally, looking back in time from the present, one sees greater mass effects than expected, leading to the postulation of additional dark mass (or dark matter).

2. The age of our expanding Universe from the initial "big-bang" until now is a lot older than the 10-15 billion years as hypothesized in all the scientific literature. The methods of acquiring information from deep space to formulate the age have always depended upon the velocity of light, assumed to be consistently about 2.99792×10^8 meters per second. However, as brought out in this paper, the permittivity of space in the distant past was higher than it is now which decreased the speed of light passing through the space. Consequently, the information received by light has taken a longer time to get to us than cosmologists have postulated, making the Universe significantly older. For example, the age may be as much as 20-30 billion years or more,

which provides ample time for the formation of even the oldest stars in accordance with accepted theory.

3. Our Universe is expanding at an ever-increasing velocity. The accelerations of the bodies in space moving radially away from the Universe "center" are not enough to have been detected until recently. Postulations of the cause so far have not been convincing. The true reason for the increased rate of expansion with time still remains a mystery. However in this paper, the combination of the conservation of energy plus the lessening of effective mass with time, serves to provide the answer. The kinetic energy $E = Mv_r^2/2$ of a radially moving body with mass M and radial velocity v_r is constant; yet the mass is decreasing with time (as developed for Expression [7] in the text). To conserve the energy of the body, the square of the velocity of the body has to increase with time to just compensate for the decrease in mass.