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Title : Gravity Paper

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This is an ASCII file of an unpublished paper. The paper presents a hypothesis that gravity is the result of a distortion in space-time This paper does not present basic information and an understanding of college/university level physics and electronics is required. Comments are requested and should be addressed to the address of the person posting this paper.

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# A DIFFERENT POINT OF VIEW

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# AN EXPERIMENT

Let us assume that there is a charged particle in free space. There is an observer which is at rest with respect to the charged particle. This observer "sees" the gravitational field and the electric field of this particle.

Let us now add a second observer. The second observer is exactly like the first observer except that it is travelling at some constant speed, v, which is less than the speed of light, with respect to the first observer and the charged particle. This second observer also "sees" the gravitational field and the electric field of the charged particle. However, this second observer also "sees" a magnetic field surrounding the charged particle.

Now, we will add a third observer which is identical to the first two observers except that this observer is travelling at the speed of light relative to the first observer and to the charged particle. According to the Theory of Relativity, the third observer must "see" an electromagnetic wave at the location of the charged particle since their relative speed is the speed of light.

At the same time, the three observers see the charged particle differently.

At a relative speed of zero, the observer "sees" a mass and an electric field. At a relative speed other than zero but less than that of light, the second observer "sees" a mass, an electric field and a magnetic field. At a relative speed of light, the third observer "sees" an electromagnetic wave with no gravitational field and no electric field other than that associated with the electromagnetic wave itself.

## HYPOTHESIS

The hypothesis is that as the relative speed of a charged particle increases from zero to that of light, the particle appears to change to an electromagnetic wave because of the expansion of the magnetic field. This magnetic field combines with some of the static electric field, in proportion to the energy of the magnetic field, to form an electromagnetic wave. At the speed of light, the electric field is entirely combined with the magnetic field and the particle appears as an electromagnetic wave.[--pagebreak--]

At speeds less than that of light, the magnetic field of the electromagnetic wave collapses. The collapsing field distorts or twists space-time which appears to us as a gravitational field. Thus, it is the distortion of space-time which appears to us as "mass" rather than "mass" causing the distortion.

## JUSTIFICATION

Energy Density

This hypothesis seems to be justified by equations from classical physics. The equation describing the energy density of the particle's magnetic field, Um , is:

$$Um = B2 / ( 2uo )$$

where uo is the magnetic permeability of free space

The equation describing the energy density of the particle's electric field, Ue , is:

$$Ue = eo E2$$

where eo is the electric permittivity of free space

The total energy, Ut , of the electric and magnetic field of a particle travelling at some speed, v, is the sum of these two equations. Converting to like terms and combining terms, the total energy equation is:

$$U_t = ( e_o E^2 / 2) ( 1 + v^2 /c^2 )$$

If we now let V = C, the equation becomes:

$$U_t = e_o E^2$$

which is also the energy density equation of an electromagnetic wave. Classical physics equations also show that the direction of the magnetic field of a charged particle, travelling at some speed, is such that the Poynting Vector cross product is satisfied. That is, E x H = I.

Duality

The hypothesis is also supported by experiments which have shown that charged particles travelling at a high speed exhibit duality. That is, when travelling at high speeds, charged particles exhibit particle characteristics and electromagnetic wave characteristics. If, as is hypothesized, the magnetic field combines with a portion of the static electric field to create an electromagnetic wave, duality is expected. Since the particle is only partially an electromagnetic wave, it should exhibit duality at speeds less than light.

## OBJECTIONS

Mass Increase

Bucherer Experiment

The accepted theory is that mass increases as speed increases[--pagebreak--]. The finding by Bucherer in 1908, that the electric field to mass (e/m) ratio is less for high speed particles, has been accepted as proof of an increase in mass. The hypothesis proposes that the reason for this finding is not that the mass has increased but rather that the electric field and the mass have decreased. That part of the electric field which combines with the magnetic field to create an electromagnetic field can not participate in static charge measurements. Therefore, those experiments measuring e/m will show a lower value for high speed particles than for slower particles.

Momentum Selector

Experiments with particle accelerators seem to show an increase in mass with an increase in the speed of a particle. After being accelerated, charged particles are passed through a velocity selector which passes only those particles which are travelling at a predetermined speed. Immediately, the particles are passed through a momentum selector which is a uniform magnetic field. This magnetic field produces a constant acceleration on the particle which causes the particle to travel in a circular path. The radius of the path is proportional to the linear momentum of the particle. Since momentum is proportional to the mass of the particle, it is assumed that the radius of the path is then proportional to the mass of the particle. Experiments have shown that the higher the speed of the particle, the greater the radius through the momentum selector. It has been assumed from these experiments that the greater radius is due to a greater mass.

The hypothesis states that the apparent mass of the particle decreases with relative speed and that the magnetic field combines with a portion of the electric field to produce an electromagnetic wave. A decrease in apparent mass should be observed in particle accelerator experiments by a decrease in the radius of the path of the particle if mass were the determining factor.

However, electromagnetic waves also have a linear momentum and this momentum is not affected by an external magnetic field. When passed through a momentum selector, an electromagnetic wave would pass straight through and not describe a circular path. Since the electromagnetic wave is characteristic of the particle, it's path is the same as the particle's path. The linear momentum of the electromagnetic wave adds to that of the particle and increases the radius of the path.

## CHARACTERISTIC VELOCITY OF SPACE

It has been assumed that electromagnetic waves can travel only at the speed of light. The hypothesis proposes that there is an electromagnetic wave which is a characteristic of any charged particle travelling at any relative speed greater than zero and less than the speed of light.

Since electromagnetic waves travel through transmission lines and through space, it is possible to model their propagation through space by a transmission line analogy. Transmission lines and space share common parameters. The most notable are the parameters of distributed inductance (or magnetic permeability) in henries per meter, distributed capacitance (or electric permittivity) in farads per meter, characteristic impedance in Ohms and characteristic velocity in meters per second.[--pagebreak--]

Models of transmission lines are basic in the study of electricity and electronics. A model circuit diagram describing a typical, real transmission line is shown in Figure 1. The inductance, L, is in terms of henries per meter. The capacitance , C, is in terms of farads per meter and the resistance, R, is in terms of Ohms per meter. Note that the circuit diagram basically consists of one RLC circuit repeated for the length of the transmission line. The resistance, R, is responsible for losses in transmission lines. In an "ideal" transmission line, without losses, the resistance is ignored. Since it seems that an electromagnetic wave travels through space without losses, we may assume that the model for an ideal transmission line is adequate for an analysis of free space. Also, since the circuit segment is repeated for the length of the transmission line, the analysis of one segment is sufficient. Figure 2 shows the circuit diagram for an ideal transmission line.

Circuit modeling involves determining the voltages and currents through the circuit. By Ohms Law (E = I x Z), the voltages and currents are related through impedances. (Note: Impedance is mathematically treated as a resistance. It differs from a resistance in that there are no energy losses through an impedance.) Figure 3 shows the same circuit with the impedances of the circuit elements. The values of the impedances are shown in typical electrical analysis notation. Since the impedance of an inductor varies directly with the frequency of the current through it or voltage applied to it, the impedance is in terms of the frequency, jw. Since the impedance of a capacitor varies inversely with the frequency of the current through it or voltage applied to it, the impedance is in terms of the inverse frequency, 1/jw. (In electrical analysis, since the symbol "i" is used to represent current flow, the symbol "j" is used to represent the square root of -1 and the symbol, w or omega, is used to represent frequency where w = 2 pi f.)

It can be seen that this circuit is also the circuit of a series L-C circuit. To go from a transmission line model to a series L-C circuit model all we need do is change the terms of the parameters from henries/meter and farads/meter to henries and farads. The normalized transfer function, H(jw), of such a circuit is:

$$H(jw) = 1/( w2 - wo2)$$

The symbol w represents the frequency of the signal applied [--pagebreak--]to the circuit. The symbol wo represents the resonant frequency of the circuit and it is numerically equal to the square root of (1/LC). The resonant frequency is the frequency preferred by the circuit. If a signal was applied to the circuit and it was not at the resonant frequency, the circuit would
offer an impedance to the signal. If a signal at the resonant frequency was applied to the circuit, the circuit would offer no impedance. The reason for this is that the impedance of the inductor (jw) varies directly with the frequency of the applied signal. The impedance of the capacitor (1/jw) varies inversely with the frequency of the applied signal. At the resonant frequency, the magnitude of the impedance offered by the inductor and the capacitor are equal. Impedances due to inductors and capacitors are vector quantities. The direction of the inductor's impedance vector varies directly with the frequency of the applied signal in the positive direction. The direction of the capacitor's impedance vector also varies directly with the frequency of the applied signal but in the negative direction. At resonance, the magnitudes of the impedances are equal but the vectors are 180 degrees out of phase with each other and thus cancel. At resonance, the circuit offers no impedance. The values for L and C in a series L-C circuit are in terms of henries and farads. The resonant frequency, wo, is equal to the square root of (1/LC). The resonant frequency, then, is in terms of 1/second or Hertz. If we were to substitute henries per meter and farads per meter for the values of the circuit elements, then resonance would be in terms of meters per second. Instead of a resonant frequency we would have a resonant velocity. Indeed, for transmission lines, the velocity of propagation is the square root of (1/LC). The speed of light is the square root of (1/uoeo) which are the magnetic permeability and electric permittivity of free space. Therefore, we may assume that the speed of light is the resonant velocity of free space. The series L-C circuit does not forbid frequencies other than the resonant frequency but it does provide an impedance to them. Similarly, we may assume that the universe does not forbid speeds other than the speed of light but would provide an impedance to them. Electromagnetic waves, which are characteristic of charged particles, can travel at speeds other than the speed of light. We should note that the series L-C circuit does not prohibit frequencies greater than the resonant frequency. Since the analogy between series L-C circuits and free space has held in other circumstances we may assume that space also does not prohibit speeds greater than resonant speed but will provide an impedance to them.

## STEADY-STATE IMPEDANCES

The hypothesis predicts that electromagnetic waves can travel at speeds other than at the speed of light. At light speed, the universe offers no impedance to the propagation of electromagnetic waves. At other than light speeds, it is expected that the universe will provide an impedance to these waves.[--pagebreak--]

We are familiar with speeds less than light. At a zero relative speed, the "stopped" electromagnetic wave appears as a "particle" and exhibits a gravitational field and an electric field. In the series L-C circuit, the impedance encountered by a signal with a frequency of zero Hertz is provided entirely by the capacitance. As the frequency of the signal is increased, the impedance of the capacitor is reduced. Similarly, as the speed of a particle increases, the effects of the static electric field are decreased.

Similarly, we may compare the impedance of the inductor to the magnetic field of a particle in relative motion. At zero Hertz, there is no impedance offered by the inductor and a "particle" at zero relative speed has no magnetic field. As the frequency of the applied signal to the circuit is increased, the impedance provided by the inductor is increased. As the speed of the particle increases, the effects of the magnetic field are increased.

At frequencies less than the resonant frequency, the impedance of the circuit is due primaily to the capacitor. At speeds less than that of light, the electric field is dominant and the magnetic field is a function of the electric charge.

At frequencies greater than the resonant frequency, the impedance of the circuit is due primarily to the inductor. We may then assume that, by analogy, at speeds greater than the speed of light, the magnetic field will dominate and will appear to be as constant as the electric field at sub-light speeds. At these speeds, it may appear that the electric field is a function of the magnetic field.

To repeat for clarity: The impedance offered by the capacitor is analogous to the electric field of a charged particle and the impedance offered by the inductor is analogous to the magnetic field of a charged particle in motion.

# NON-STEADY-STATE CONDITIONS

Let us assume a series L-C circuit, as described above, with no applied signal. The inductor does not have an initial magnetic field nor does the capacitor have an initial electric field. Now let us apply a signal of zero Hertz and the circuit will oscillate at its resonant frequency. In a real circuit, resistances cause the oscillation to dampen. In an ideal circuit, the oscillation does not die out and continues forever. If we assume the creation of a particle, we would see that this particle causes a disturbance which propagates as an electromagnetic wave.

Now we change the frequency of the applied signal. Again the circuit will respond with an oscillation at it's resonant frequency. Similarly, if we accelerate a charged particle, an electromagnetic wave is generated. Indeed, any change in the frequency of the applied signal to a series L-C circuit will generate transient oscillations just as acceleration of a charged particle will generate electromagnetic waves.

# GRAVITY

The electric and magnetic fields of a particle have been associated with the impedances offered by the capacitor and inductor of an analogous series L-C circuit. The hypothesis proposes that the mass of a particle is due to the collapse of the magnetic field of the particle.[--pagebreak--]

Mass is not recognized directly but a gravitational field is. A gravitational field is probably not a different form of a magnetic field. The gravitational field is, most likely, a result of the collapsed magnetic field. It is possible that the collapsed magnetic field pulls or twists the fabric of space-time in such a way as to form what we call a gravitational field.

As the speed of the charged particle increases, the magnetic field expands and decreases its pull or twist which causes a decrease in the gravitational field. At speeds greater than light, the hypothesis predicts that the effects of the electric and magnetic fields will be reversed. At these speeds, it is likely that the magnetic fields will become polar and the electric fields will become circular, that is, a magnetic monopole will result.

At speeds much greater than that of light, the electric field may be expected to collapse. This collapsed electric field may also pull or twist the fabric of space-time and form a type of field not now known.

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