International Journal of Scientific Research in Physics and Applied Sciences
Research Paper
Vol.8, Issue.5, pp.01-11, October (2020)
E-ISSN: 2348-3423
DOI: https://doi.org/10.26438/ijsrpas/v8i5.111

Introduction to Particle Theory: The Measurement of the Magnetic Field of Relativistic Electrons and its Implications in Relation to General Relativity

Dino Martinez

919 NW 134th Place Miami, FL 33182 United States

*Author's Mail Id: dino5050@hotmail.com

Available online at: www.isroset.org

Received: 25/Sept/2020, Accepted: 15/Oct/2020, Online: 31/Oct/2020

***Abstract*—**In an attempt to bridge the gap between quantum mechanics and general relativity, Particle Theory is a theory that may try to address this problem. The theory states that indivisible particles of non-zero mass, are instead divided into even smaller particles called EM (electromagnetic) particles. These EM particles collide and are held within a center potential, the speed of light being the limit to their velocities. Some particles that escape from this potential, through "shedding", are responsible for the static and magnetic fields we observe. This also creates a "screening" effect that, for an atomic particle at rest, blocks a good portion (half) of what this theory claims is the true gravitational potential, which is just twice the Newtonian value. When such a system of particles starts moving in one direction, the act of shedding begins to decrease as the EM particles orient themselves in the direction of the velocity, which reduces the electromagnetic field emitted as well as the screening effect in which we would start to observe the relativistic effects of Special and General Relativity. To test this, an experiment was conducted by measuring the magnetic field of an increasing velocity of relativistic electrons recorded at fixed intervals up to a maximum average velocity of up to sixteen percent the speed of light. The results showed the magnetic field of the beam of electrons diverging negatively from a linear pattern with an average second derivative of the plot being -0.02 ± 0.002 microteslas per volts, compared to that of the magnetic field plot of the wire (non-relativistic) being 0.002 ± 0.002 microteslas per volts. As a result, a possible application that this theory uniquely infers is the possibility of increasing the screening effect through emissions of high energy photons consequently reducing the gravitational pull of an object emitting such a field.

Keywords—General Relativity, Quantum Gravity, Particle Theory

I. INTRODUCTION

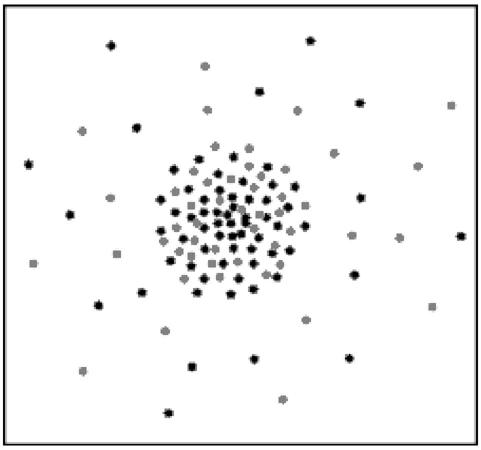

Figure 1. An example of an electron according to Particle Theory

There are currently a few theories trying to bridge the gap between quantum mechanics and general relativity. Currently, treating gravity as a force cannot produce the results given to us by Einstein's general relativity such as the correct values of gravitational lensing, and Mercury's perihelion precession, to name a few. Particle theory is an alternate theory that may try to address this problem. The theory proposes that indivisible particles of non-zero mass are instead made up of even smaller particles called EM (electromagnetic) particles of non-zero mass shown in Figure 1. These EM particles collide with each other and are held into a center potential, (which will be explained in further detail later on) the speed of light always being their limit to their velocities. Some particles, such as from the surface, that escape from this potential, through "shedding", are responsible for the static and magnetic fields that are observed. From this process of shedding of the EM particles also causes a "screening" effect that, for example, an atomic particle at rest blocks approximately fifty percent (this is an assumption based on already observed phenomena interpreted by GR) of the true gravitational potential, which is twice the Newtonian value: $\frac{2GM}{r}$, where G is the gravitational constant, M is the gravitational mass and r is the radius. When such a confined system of particles are moving in a certain direction, the act of shedding and in turn the screening effect begins to decrease as the EM particles orient themselves in the direction of the velocity, which reduces the electromagnetic field it produces as well as the screening effect in which we would start to observe the relativistic effects of General (and Special) Relativity, where gravity can once again be treated as a force rather than a property of spacetime. In this view, photons are considered as a group of EM particles arranged in a sinusoidal structure emitted from an oscillating particle. Since these photons don't have a structure that can produce a screening effect, they are fully subject to the true Newtonian gravitational potential where later we will see how this works when we easily recreate some of the equations from General Relativity using Particle Theory. But first we will briefly discuss some key aspects of this theory and the details and results of the experiment before going into any further details that will be discussed, which will be the subject of Sections II to VI. Section II will describe the theory's interpretation of General Relativity including equations reproduced using Particle Theory. Section III will describe certain aspects on the make up of these particles and details of the inner, center potential, Sections IV, V, and VI will describe the experimental apparatus, the procedures and the results and analysis of the experiment, Sections VII will describe how time dilation works under this theory, Sections VIII, IX, X and XI describes quantum elements of Particle Theory and a comparison to the Klein-Gordon equation, and Section XII describes a possible application that this theory uniquely infers.

II. IN RELATION TO GENERAL RELATIVITY

A. General Relativistic Potential

According to Particle Theory, the shedding of the EM particles responsible for electromagnetic fields, also cause a screening effect that blocks half of what is the true gravitational potential that this theory predicts, which is twice the Newtonian value:

$$\frac{2GM}{r} \qquad (1)$$

When a particle with a structure that produces a screening effect approaches the speed of light, the screening effect approaches zero and the potential the particle feels the true Newtonian potential (1). To demonstrate this I will reproduce the gravitational potential energy unique to General Relativity using this concept of the varying screening effect by using a modified Lorentz factor squared: $\gamma_+^2 = 1+\frac{v^2}{c^2}$ which uses a plus sign instead of minus sign and which has a maximum value of 2 when the particle reaches the speed of light, making the screening effect reduced to zero, and we obtain:

$$\frac{GMm}{r}\left(1+\frac{v^2}{c^2}\right) \qquad (2)$$

Focusing on just the second term, and solving for a two body problem, where the angular momentum, $L = \mu r^2 d\theta/dt$, where $\mu = Mm/(M+m)$, the reduced mass, and $v = rd\theta/dt$ we obtain:

$$\frac{GMm}{r}\left(\frac{v^2}{c^2}\right)$$

$$\frac{GMm}{r}\left(\frac{L^2}{\mu^2 r^2 c^2}\right)$$

and expanding out one μ factor gives us (3):

$$\frac{G(M+m)L^2}{\mu c^2 r^3} \qquad (3)$$

The attractive potential energy from (3) is the same result as the potential unique to General Relativity from the Schwarzschild metric that is responsible for accurately calculating the observed Mercury Perihelion Procession value. We can see how easily we obtained this just from using the concept of the screening effect in accordance with Particle Theory.

B. Gravitational Lensing

The result of the deflection angle of light caused by a gravitational potential through Newtonian formulation [1] is only half of the value observed, the correct value being:

$$\theta=\frac{4GM}{rc^2} \qquad (5)$$

obtained from General Relativity. Under Particle Theory, since a photon is a collection of EM particles that are static in every way except for the direction of their velocity (or we can also say the photon has no screening effect since it is traveling at light speed), there is no mechanism for the production of a screening effect. Due to this, and using the true Newtonian Potential (1), this will lead to the correct value, that of equation (5). Therefore, the curving of spacetime is unnecessary under Particle Theory, as photons being a collection of EM particles are able to be affected by gravity as any other system of EM particles.

From this and the previous example so far, gravity can be once again treated as a force rather than a property of spacetime!

C. Schwarzschild Radius and Black Holes

For a massive system of particles, each particle having mass m, colliding at light speed within a radius r for a total kinetic energy $T=1/2Mc^2$ and using the true gravitational potential and the Virial theorem:

$$\langle T\rangle = -\frac{1}{2}\sum_{k=1}^{N}\langle F_k * r_k\rangle$$

obtaining:

$$2\langle T\rangle = n\langle V\rangle$$

and approximating:

© 2020, IJSRPAS All Rights Reserved

$$<V> = -\sum_{k=1}^{N} <F_k * r_k> = -2GM\sum_{k=1}^{N}\frac{m_k}{r_k} \approx -\frac{2GM^2}{r}$$

with n = -1 since $V=\alpha r^n$

$$2\left(\frac{1}{2}\right)Mc^2 = \frac{2GM^2}{r}$$

which will give us the Schwarzschild radius:

$$r = \frac{2GM}{c^2} \qquad (4)$$

Since the Schwarzschild radius is a feature of black holes, this implies, according to Particle Theory, that when a black hole is formed, all the distinguishable atoms break down into a collection of EM particles, just like that for an atomic system of particles. But an important note: when working with atomic particles, usage of the wave equations in quantum mechanics should be used, where in the case of macroscopic bodies like black holes, formulations such as the true Newtonian gravitational potential (1) should be used.

Since the gravitational potential in black holes are meant to hold particles that are moving at the speed of light, the distinct feature of emitting no light is possible under Particle Theory as the potential is strong enough to hold particles of light speed within its body. But this does not mean that shedding, like in atomic particles, does not occur. It could do so due to internal screening which may allow particles on the surface to escape just as in an atomic system of particles. To what extent it may vary, but this may give some credence to Hawking Radiation under this model.

D. Gravitational Redshift Approximation

For a particle leaving the surface of a stellar body at light speed, one can calculate the velocity at infinity after the deceleration due to the gravitational potential simply using classical formulation:

$$\frac{dv}{dt} = -g$$

$$\int dv = \int -g\,dt$$

and substituting using $c=\frac{dr}{dt}$ and $g=\frac{GM}{r^2}$ we obtain:

$$\int dv = \int \frac{-GM}{r^2}\frac{dr}{c}$$

and integrating from the body's surface r to infinity and:

$$\int dv = v_\infty - v_r$$

$$\Delta v = \frac{GM}{rc}$$

and dividing by c we obtain:

$$\frac{\Delta v}{c} = \frac{GM}{rc^2} \qquad (6)$$

and using this approximate proportional relation for small Δv $\frac{\Delta v}{c} = \frac{\Delta\lambda}{\lambda_r}$ for a photon starting at c from the radius of the gravitational mass we obtain:

$$z = \frac{\Delta\lambda}{\lambda_r} \approx \frac{GM}{rc^2} \qquad (7)$$

This method gave us the approximation of the redshift when r is really large. This is the result when using an approximation method on the correct value in GR:

$$z = \left(1 - \frac{2GM}{rc^2}\right)^{-\frac{1}{2}} - 1 \qquad (8)$$

But for a particle such as a photon, the true gravitational potential must be used which would make it twice the approximate redshift, which would be too much for bodies with large surface radii.

With the previous instances such as with the two body problem and gravitational lensing, both involved the particles moving around the gravitational potential. For small particles moving away from a potential, especially with photons which have such small amplitudes, the gravitational flux such that of a weak field would have much less influence on photons than much more stronger fields, especially when the separation of the gravitational particles emitted by a body can eventually equal the amplitudes of these photons shortly after leaving the surface of a stellar body as shown in Figure 2.

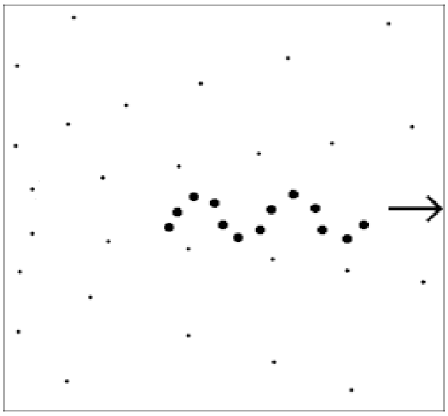

Figure 2. Photon moving away from weak gravitational particle field

Another thing to consider is the adding of a potential to a quantum system. For strong gravitational fields, this will significantly alter the values of the energy levels resulting in a shift in the value of the wavelengths of emitted photons. Using the perturbation approximation of a non-zero potential: $E_n = E_0 - V$ where $V=\frac{GMm}{r}$ (the true gravitational potential is not used since electrons which are responsible for photon emissions does produce a screening effect), we see that a negative potential leads to a decrease in each energy level, and therefore an increase in wavelength for emitted photons for any quantum system within such a field. With the confirmation mentioned

© 2020, IJSRPAS All Rights Reserved

earlier about the Schwarzschild radius and perturbation of quantum systems due to a gravitational potential, where, the wavelength is infinite at the Schwarschild's radius, we will use the Lorentz factor γ and, using energy formulation this time, with the Virial Theorem for the force between two particles (the gravitational mass at a fixed position and a photon of mass m):

$$2<T>=n<V>$$

where $V=\alpha r^n$, n = -1, and Δv is the total velocity change at an infinite radius from the gravitational mass and V equals the true gravitational potential (1), α=2GMm, since photons don't have a screening effect mechanism, we obtain:

$$2\left(\frac{1}{2}m\Delta v^2\right)=\frac{2\mathrm{GMm}}{r}$$

where:

$$\Delta v^2=\frac{2\mathrm{GM}}{r} \quad (9)$$

and

$$\gamma=\left(1-\frac{\Delta v^2}{c^2}\right)^{-\frac{1}{2}}$$

where:

$$z=\frac{\Delta\lambda}{\lambda_r}=\frac{\lambda_\infty-\lambda_r}{\lambda_r}=\frac{\lambda_\infty}{\lambda_r}-1$$

and

$$\frac{\lambda_\infty}{\lambda_r}=\left(1-\frac{\Delta v^2}{c^2}\right)^{-\frac{1}{2}}=\left(1-\frac{2\mathrm{GM}}{rc^2}\right)^{-\frac{1}{2}}$$

and therefore

$$z=\frac{\lambda_\infty}{\lambda_r}-1=\left(1-\frac{2\mathrm{GM}}{rc^2}\right)^{-\frac{1}{2}}-1 \quad (10)$$

we obtain the same result from GR (8) just by using the Virial Theorem (9), the true gravitional potential (1) and the Lorentz factor γ to obtain the total change in velocity of the photon and in effect the change in wavelength at an infinite radius.

E. Rest Energy and Electron Radius Approximation

For a particle composed of a system of EM particles with a total mass m with each particle having an average speed of c (300,000,000 m/s), the kinetic energy becomes T = $\frac{1}{2}mc^2$. In order to contain this, the potential energy must also be $\frac{1}{2}mc^2$. The total energy that would be released by this rest mass would be $E=mc^2$, the same as in Special Relativity. The difference is that half of the energy is electromagnetic while the other half is gravitational.

Using the relation of a particle in a box as a crude approximation:

$$E=\frac{n^2\pi^2\hbar^2}{2\mathrm{mL}^2}$$

where we obtain:

$$L=\sqrt{\frac{n^2\pi^2\hbar^2}{2\mathrm{mE}}} \quad (11)$$

where n = 1, ħ = $1.05\mathrm{x}10^{-34}$ J·s, m = $9.11\mathrm{x}10^{-31}$kg and E = mc^2 we get the approximate radius for an electron of $8.5\mathrm{x}10^{-13}$m.

The potential that contains a system of particles, which involve only gravity particles emitted from the EM particles themselves (more details of this in the next section), is orders of magnitude more than what we would obtain if we used just the gravitational potential equation to formulate the potential using the radius calculated from (11). This is due to the fact of the collisions at light speed of the EM particles which shake off a lot more of the gravity particles within such a system.

F. Usage of Lorentz Factor: A Clarification

Using the Lorentz factor may bring to question the legitimacy of its use. Particle theory is stated to be an alternative to spacetime, where the effects of Special and General relativity depends on the mechanism inherit in the particles themselves, and not from an external fabric of spacetime. But using formulation derived from the flat spacetime metric does not admit its adoption, only that they share the same dependencies on velocity and the limit of the speed of light. In a previous subsection concerning the derivation of the attractive potential unique to GR using Particle Theory we used a modified Lorentz factor: $\gamma_+^2 = 1+v^2/c^2$. This was required for the special case of producing a maximum factor of 2 to indicate the influence of gravity on a particle having the value of the true gravitational potential (1) due to the absence of the screening effect of a particle at light speed. The original Lorentz factor will further be used in upcoming sections to further formulate the dependence of the velocity and limit of c in Particle Theory.

III. MODEL

We will briefly discuss a hypothetical model of how the theory works when it comes to the particles that make up an atom such as that of an electron or quark. These EM particles come in two varieties, EM+ and EM-, responsible for the differences in charges. These are shown in Figure 3, the first being a solid ball on the left, and a cross section of the other one shown in the middle which has a hollow center. Both these particles are made up of smaller structures shown on the right in Figure 3 which we will call gravity particles. These gravity particles are tied together with each other and as such vibrates which also sheds off from EM particles and is evidently responsible for the gravitational force.

© 2020, IJSRPAS All Rights Reserved

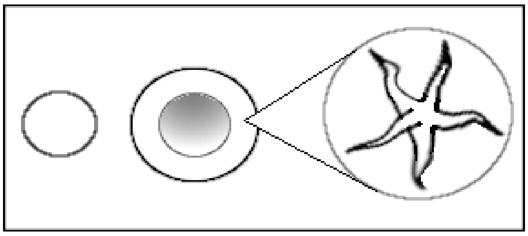

Figure 3. EM particles shown on left, gravity particle on right

Two EM particles of the same charge would naturally collide elastically, which would cause repulsion when for example, a negatively charged particle is within an EM-particle field from a point source. But when two different EM particles come into contact, they merge and come into a complete stop. So when a field of EM+ particles (from a point source) comes into contact with an atomic system of EM- particles, such as an electron for example, they merge on the surface of the electron and prevents that side of the electron to shed EM particles momentarily. Since the other side of the electron continues the shedding process, this propels the electron towards the source of the EM+ particle field until the source field ceases and the merged EM particles themselves shed from the electron. It is very important to note that these particles that are released from the shedding process can be reused in the attraction and repulsion action, especially in macroscopic systems like two charged plates in close proximity to each other. Since the shedding process does infer that these system of particles are slowly decaying, the reusing of EM particles is important as this indicates that the amount shedding of a lone electron, for example, cannot equal what would be expected from Coulomb's law, as the decay rate would be so high that no such system of particles would exist today. The reusing aspect implies that the shedding process and as such the decay rate is much less especially for an isolated system of particles.

As for the gravitational particles, the hypothetical structure shown in Figure 3 on the right makes it so that their interaction will always cause a merging and produce an attraction, as their collisions will always cause an entanglement when interacting with both types of EM particles. The shedding of these particles can vary, as the collisions of EM particles can drastically increase this shedding effect of the gravity particles, such as in an atomic system of particles. In fact, these systems are held together by the field of gravity particles that are shed from such intense collisions, and therefore it is this field of gravity particles that make up the center potential responsible for the intact structures of these system of particles. The stability of these systems of particles start to decline the bigger these systems become, since the half-lives of these particles decrease as the mass of these systems increase as we see when we compare the half-lives of different leptons, for example.

Since gravity particles are much smaller than EM particles, this suggests that they may move at or faster than the speed of light. But in order for certain phenomena, like gravitational redshifts, to work, gravity particles may require to have a speed higher than light speed. Keep in mind that the method of acceleration determines the maximum speed of a particle allowed by the momentum of the method itself. Therefore, systems of particles that are accelerated by particles limited to the speed of light can only have a maximum at or close to the speed of light. If another method of acceleration has the possible attribute of being greater than the speed of light, such as the proposed gravity particles, it may be possible to accelerate a particle or object faster than the speed of light, such as the proposed gravity particles.

Given that this paper will assume that the shedding and consequently the screening effect of a particle goes to zero as it approaches the speed of light, there still may be a possibility for a theoretical system of particles going at the speed of light to emit a minimum electromagnetic field. As it will be mentioned later in this paper, the internal potential reduces to a minimum as a particle approaches the speed of light. This minimal internal potential may act to preserve the spin of the particle, which may reduce to a spinning, flat disc of particles show in Figure 4, where, if shedding occurs, will only do so perpendicular to the axis of the disc (keep in mind that under this theory spin is now a physical attribute rather than an inherit one). This may lead to a minimum electromagnetic field produced by the particle, yet still provide a reduction in its intensity. The screening effect of the system of particles will also be substantially reduced since the shedding is limited only to the sides of the disc of particles, exposing most of it to the true gravitational potential (1). But for the entirety of this paper we will assume that the shedding goes to zero as the particle approaches the speed of light.

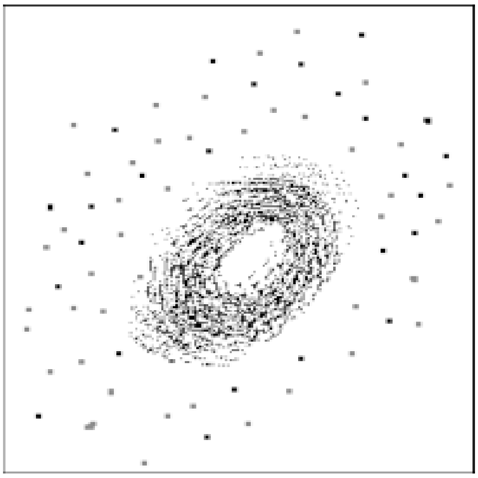

Figure 4. Particle near or at light speed may reduce to a small, flat disc of rotating particles

And finally, under this model, since these particles have a structure and are not zero dimensional point particles, elastic collisions are possible with other particles. In the event of the interactions between electrons and neutrinos, for example, the current model states that since they cannot interact through the electromagnetic force, since neutrinos are neutral, they can only interact by exchange of a Z boson. But in Particle Theory, they simply just collide elastically with each other. And in particle accelerators, where according to Particle Theory, the relativistic particle's static electric field is reduced significantly, they still are able to elastically collide with each other, which means they still require strong magnetic fields to make the beam narrow.

IV. EXPERIMENTAL APPARATUS

The materials used in this experiment include all that is required to create a beam of electrons, very similar to a cathode ray tube. A vacuum chamber shown in Figure 5 and a vacuum pump were used to create the vacuum required for the experiment.

A variable voltage transformer was used to vary the voltage from the source (120V). An oil transformer with a 20kV peak was used to produce the voltage necessary to create relativistic electrons, along with a voltage doubler circuit to

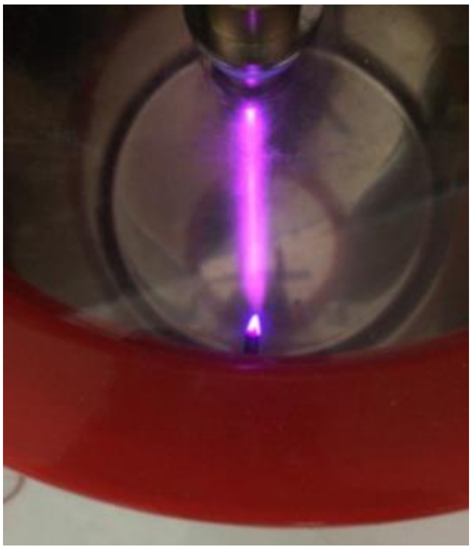

Figure 5. Beam of electrons inside vacuum chamber

increase the voltage peak to 40kV. A copper cathode tip used as a field emission source, rather than a thermionic source, inside the vacuum chamber was used, with a curved aluminum sheet as the anode connected to the a brass nut within the chamber that is connected to the pressure meter on the outside. Since the vacuum chamber and the pressure meter are electrically isolated from each other, the negative electrode is connected to the metal chamber where the cathode is connected to, while the positive electrode is connected to the pressure meter which is connected to the anode. The setup was successful in creating such a beam of electrons as shown in Figure 5. And lastly, an electromagnetic sensor in units of microTeslas, within two decimal points, was used to measure the magnetic field of the beam and the wire separately.

V. PROCEDURES

After using the vacuum pump to create a near vacuum in the chamber, the hose is then removed and the anode electrode is connected in its place. The cathode electrode is then connected to the handle of the metal chamber. Starting with the variable transformer at the 78 volt marker, which with the high voltage transformer produces approximately 7.6kV, the magnetic field of first the beam of electrons is recorded with the electromagnetic sensor. This is repeated for increments of 6.5 volts to the maximum of 130 volts marked on the variable transformer marker, or approximately 12.7kV (RMS Voltage) total. This procedure is then repeated for the magnetic field of the wire. In both the measurement of the beam and the wire, a pause of 5 seconds is giving at each increment before recording the value. This is to ensure equal timing in the heating of the wire to account for the resistance created as the temperature of the circuit increases.

Particle theory predicts that for a relativistic electron, the magnetic field diverges negatively with increase in velocity, approaching zero as the velocity of the electrons approaches the speed of light.

VI. RESULTS

A. Theory

The magnetic field from a wire's current is known to be $B=\frac{\mu I}{2\pi r}$ where μ equals 4π x 10-7 Tm/A, I is the current, and r is the radius from the wire . With I = V/R, and with a fixed value for the radius r and the resistance R, an increase in voltage should give a linear increase in the magnetic field B. With increasing resistance with an increasing current, the result might diverge slightly from linearity.

For the beam of electrons, the magnetic field is calculated as

$B=\frac{n\mu qvr}{4\pi r}$ where v is the velocity of the electrons, n is the number of electrons, q is the charge of each electron ($1.6\text{x}10^{-19}$ C) and r is the radius from the beam, as long as v is perpendicular to r. Keeping in mind the conservation of the current, an increase in current from an increase in voltage would also provide a linear increase in the magnetic field, or a divergence similar to the wire if the resistance varies with increasing current.

But according to Particle Theory, the magnetic field of relativistic particles will diverge negatively, and then decline, approaching zero as the particles approach the speed of light. Using the inverse of the Lorentz factor $\gamma^{-1}=\sqrt{1-v^2/c^2}$ where B→ B γ^{-1} and where c=1, we obtain what we see in the purple curve in contrast with the linear representation of the current model in green:

© 2020, IJSRPAS All Rights Reserved

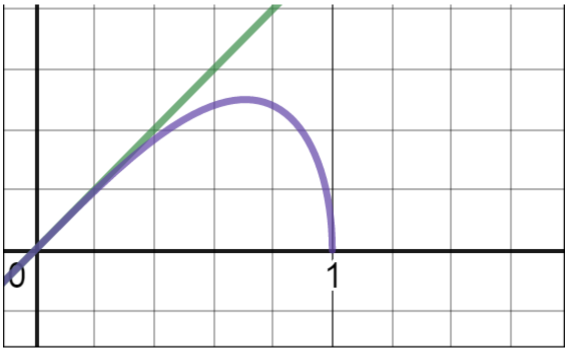

Figure 6. Magnetic field vs. speed of charged particle. Green curve shows current model and purple curve shows model under Particle Theory

Lastly we will calculate the maximum speed of the electrons that we will be able to produce from the equipment used in this experiment. Using qV = 1/2mv^2 where V is the volts, v is the velocity, q is the charge and m is the mass of the electron, and including the Lorentz factor γ we obtain:

$$qV=\frac{1}{2}mv^2\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}} \quad (12)$$

and solving for the velocity v, we obtain:

$$v=\frac{\sqrt{2qV\left(-qV+\sqrt{(qV)^2+m^2c^4}\right)}}{mc} \quad (13)$$

With a voltage peak of 40,000 volts where we obtain the RMS value of a half wave rectifier of 12.7k volts, and m = 9.11x10^{-31} kg, c = 300,000,000 m/s, and q = 1.6x10^{-19} C we obtain a average velocity of approximately 67,000,000 m/s, or 22% the speed of light. Due to this limitation, we can only depend on comparing the magnetic field of the beam with the wire and look for a negative divergence in the beam greater than that of the wire. To do this we will be comparing the average second derivatives of both plots.

B. Results

(1) First trial:

After running the first trial, we obtained this plot (Magnetic Field [microTesla] vs. Voltage) where the blue line is the wire and the red line is the beam of electrons:

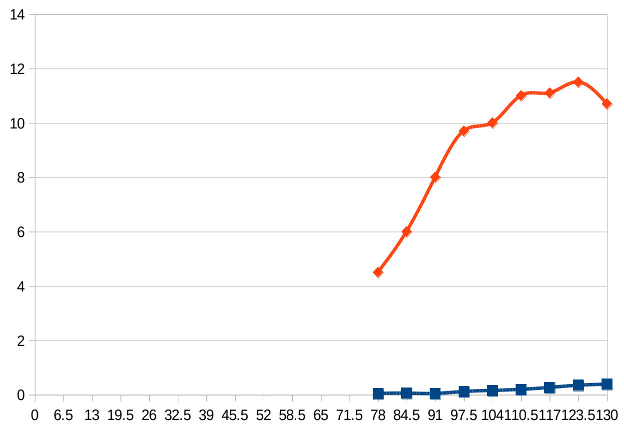

Figure 7. Plot of first trial. Beam (red) and wire (blue)

The data being shown in Table 1:

Table 1. Data for first trial

Voltage	Wire	Beam
78	0.04	4.5
84.5	0.05	6
91	0.04	8
97.5	0.11	9.7
104	0.15	10
110.5	0.19	11
117	0.26	11.1
123.5	0.34	11.5
130	0.38	10.7

And obtaining the differentials and reducing the voltage intervals from 6.5 to just 1 we obtain:

Table 2. First and second differentials for first trial

Wire f '(x)	Beam f '(x)	Wire f "(x)	Beam f "(x)
0.01	1.5		
-0.01	2	-0.02	0.5
0.07	1.7	0.08	-0.3
0.04	0.3	-0.03	-1.4
0.04	1	0	0.7
0.07	0.1	0.03	-0.9
0.08	0.4	0.01	0.3
0.04	-0.8	-0.04	-1.2
Avg. f(x)	Avg. f(x)	Avg. f'(x)	Avg. f'(x)
0.0425	0.775	0.0042857	-0.3285714

In the second trial, we used a slightly shorter cathode tip. The plot, the blue line being the wire and the red line being the beam just as before we obtain:

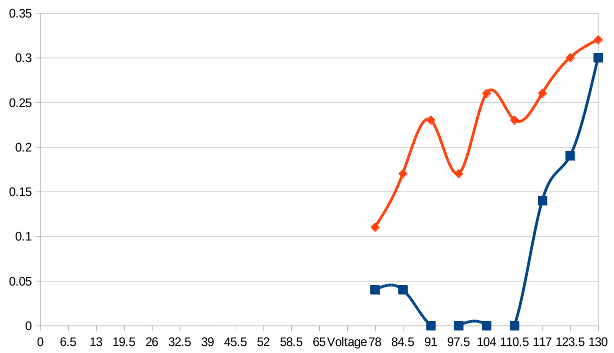

Figure 8. Plot of second trial. Beam (red) and wire (blue)

The data being shown in Table 3:

Table 3. Data for second trial

Voltage	Wire	Beam
78	0.04	0.11
84.5	0.04	0.17
91	0	0.23
97.5	0	0.17
104	0	0.26
110.5	0	0.23
117	0.14	0.26
123.5	0.19	0.3
130	0.3	0.32

© 2020, IJSRPAS All Rights Reserved

And obtaining the differentials and reducing the voltage intervals from 6.5 to just 1 we obtain:

Table 4. First and second differentials for second trial

Wire f '(x)	Beam f '(x)	Wire f "(x)	Beam f "(x)
0	0.06		
-0.04	0.06	-0.04	0
0	-0.06	0.04	-0.12
0	0.09	0	0.15
0	-0.03	0	-0.12
0.14	0.03	0.14	0.06
0.05	0.04	-0.09	0.01
0.11	0.02	0.06	-0.02
Avg. f'(x)	Avg. f'(x)	Avg. f''(x)	Avg. f''(x)
0.0325	0.02625	0.0157143	-0.0057143

C. Analysis

From the experimental results we can see the divergence of the magnetic field of relativistic electrons from linearity. This, compared to the wire's magnetic field, we see a stark difference confirmed from the average second derivative of the plots, where we reintroduce the original voltage interval (6.5 volts) into the differential, it was close to zero (0.001), zero defining a linear plot, for the wire, and -0.04 µT per volts for the beam in the first trial, and 0.003 and -0.002 µT per volts respectively in the second trial. Combining both trials, we find an average second derivative being 0.002 µT/V for the wire and -0.02 µT/V for the beam, with a margin of error of ±0.002 (±0.01µT/6.5V) due to the reading of the magnetic field of from the sensor.

We see from these results that for a relativistic beam of electrons, as their speed increases, the magnetic field starts to fall off from a linear pattern at a negative rate, while for non-relativistic electrons (wire) the magnetic field increases in approximately a constant rate as the current increases.

VII. TIME DILATION

In this section we'll briefly go over the interpretations of time dilation according to Particle Theory.

A. Special Relativity

According to Particle Theory, when a system of particles is in motion, its shedding effect is reduced due to the particles orienting themselves in one direction, while movement perpendicular to the direction is reduced, consequently reducing the EM field. In a classical example of an electron orbiting a nucleus, the decrease in the potential from the nucleus slows down the orbit of the electron. Other factors include the electron itself orienting in the direction of motion as well as and elongation of the orbit itself due to a decrease of the potential φ, where $\varphi \rightarrow \varphi\gamma^{-1}$, where the inverse Lorentz factor is $\gamma^{-1}=\sqrt{1-\frac{v^2}{c^2}}$, especially for relativistic speeds. The slow down in the angular frequency as well as the decreasing EM fields originating from the electrons themselves, which weakens the interactions between them, which govern both atomic and macroscopic systems such as electrical and mechanical processes (and as a result biological processes), would result of a slow down in these processes themselves.

B. General Relativity

As mentioned previously in the gravitational redshift subsection in Section II, a quantum system under a perturbation of a non-zero potential gave us $E_n \approx E_0 - V$ where $V=\frac{GMm}{r}$. For a particle in a box, where $E_n \approx \hbar w - V$, where *h* is the reduced Planck's constant and *w* is the angular frequency, and making $E_n = \hbar w'$ we obtain: $\hbar w' = \hbar w - V$ which means $w' < w$. So due to the gravitational potential, the reduction of the energy level of a particle leads to a reduction of the angular frequency. And as stated in the previous subsection, time dilation is a result of the reduction of the angular frequency of particles such as electrons in a quantum system.

The formulation for the time dilation is the same as in Special Relativity, $\tau = t\cdot\gamma^{-1} = t(1-v^2/c^2)^{1/2}$, except that $v^2 = 2GM/r$ like in equation (9) since the proper time is zero at the Schwarzschild radius.

VIII. ALTERNATIVE TO RELATIVISTIC MASS

Particle Theory provides a different interpretation to relativistic mass proposed by Special Relativity. Under Particle Theory, the structure of a system of particles is retained by the collisions that create a gravitational potential many orders of magnitude normally obtained by the law of gravitation. When a system of particles are moving in a specific direction, these collisions starts to reduce in intensity and frequency, and consequently in the reduction of this inner potential. As this system reaches the speed of light, the potential reaches a minimum, since even without collisions these EM particles still produce a potential from the shedding of gravity particles, which at this point can be described by the true Newtonian potential. This possibly allows for a system of particles to preserve its spin even at or near light speeds.

Due to the reduction of this potential as the system of particles orient themselves in the direction of its velocity, the structure itself weakens. As such, the influence of any external electric or magnetic potential is reduced as the internal structure weakens especially at relativistic speeds. Another interpretation that can be made is that a reduction of the internal potential increases the radius of the entire system of particles, where the particles from EM fields have more of a chance of going straight through the system without any interaction. Or a shrinking in size of relativistic particles due to the reduced impact of internal

© 2020, IJSRPAS All Rights Reserved

collisions may also explain the reduced influence from an external EM field. This also may explain how deep inelastic scattering is possible in electron-proton scattering, since the size of the relativistic electron must be small enough to be able to strike the constituent quarks of a proton.

This is not the case with a gravitational potential, as we will see in the upcoming sections concerning the gravitational acceleration's inertial mass invariance, where, due to the size of gravity particles being orders of magnitude smaller than that of an EM particle, the permeation of such a field through a system of particles is far higher than that of an EM field.

In the next section we'll delve further into an electric potential acting on a relativistic particle defined by Particle Theory by looking at the relativistic, zero spin particle, like the one described by the Klein-Gordon Equation.

IX. KLEIN-GORDON EQUATION COMPARISON

A. Free Particle

The Klein-Gordon equation describes a relativistic particle with a spin of zero, given here [2]:

$$\hbar^2 \frac{\delta^2}{\delta t^2}\psi - \hbar^2 c^2 \nabla^2 \psi + m^2 c^4 \psi = 0 \qquad (14)$$

and using a plane-wave solution $e^{-iwt+ikx}$ with

$$(\hbar \frac{\delta}{\delta t})^2 \psi = \hbar^2 w^2 \psi = E^2 \psi$$

and

$$(-i\hbar c \nabla)^2 \psi = \hbar^2 k^2 c^2 \psi = p^2 c^2 \psi$$

we obtain the energy of a relativistic particle:

$$E = \sqrt{m^2 c^4 + p^2 c^2} \qquad (15)$$

where p = mvγ and $\gamma = (1 - \frac{v^2}{c^2})^{-1/2}$.

For a relativistic free particle with zero spin according to Particle Theory we use the total rest energy of a system of particles from Section II: $E = T + V = mc^2$ where $T = V = \frac{1}{2}mc^2$. But when the particle is in motion the internal potential starts to decrease and approaches a minimum potential V_{min} as the particle approaches the speed of light. Giving that this minimum potential is small compared to the rest internal potential, we will set $V_{min} = 0$

For this formulation we will use the Schrodinger equation while using the inverse Lorentz factors in the appropriate place to make it relativistic. Therefore we obtain:

$$i\hbar \frac{\delta}{\delta t}\psi = \frac{-\hbar^2}{2m}\nabla^2 \psi + mc^2 \gamma^{-1} \psi$$

Using again the plane-wave solution $e^{(-iwt+ikx)}$ we obtain

$$E = \frac{p^2}{2m} + mc^2 \gamma^{-1} \qquad (16)$$

where p = mv and $\gamma^{-1} = \sqrt{1 - \frac{v^2}{c^2}}$. So at rest, the energy equals mc^2. But when the particle reaches light speed, the energy becomes:

$$E = \frac{p^2}{2m} = \frac{1}{2}mc^2 \qquad (17)$$

which is correct for a system of particles oriented completely in the direction of the velocity. This is far different from the Klein-Gordon solution for a relativistic free particle, where the energy approaches infinity as it approaches light speed. But as we will see in the next subsection, the inclusion of an electric potential is necessary as it is the only way to observe the results of these equations. From this we will find that the Klein-Gordon equation and the one under Particle Theory describes the same physics as we include an electric potential V(r). Although one thing to note for a relativistic particle is that since the particle's shedding is reduced, its elasticity is reduced since EM particles, which are usually reused during interactions, is reduced, which may make such a particle a lot more penetrative when encountering a physical or potential barrier.

B. Relativistic Particles Under an Electric Potential

For relativistic particles, under the influence of an EM potential (and in this case from a static electric field) included in the system, certain behaviors of these particles can only be explained under Special Relativity. Particle Theory is no exception. Under Special Relativity, using $m \rightarrow m_0 \gamma$ (relativistic mass) and Coulomb force we obtain:

$$m_0 \gamma a = \frac{kqq}{r^2} \qquad (18)$$

In the previous section, where I proposed an alternative to relativistic mass, as a system of particles orients itself towards the direction of the velocity, the collisions of EM particles responsible for internal potential is reduced, and in turn the internal structure is weakened, making it less susceptible to electromagnetic fields. In this case, any potential φ is transformed $\frac{\delta\phi}{\delta r} \rightarrow \frac{\delta\phi}{\delta r}\gamma^{-1}$ or:

$$m_0 a = \frac{kqq}{r^2}\gamma^{-1} \qquad (19)$$

© 2020, IJSRPAS All Rights Reserved

This result is the same result as (18). In both cases, the influence of the field decreases and approaches zero as the particle approaches the speed of light.

In the previous subsection, the free particle solution according to Particle Theory did not match that of the Klein-Gordon equation for relativistic particles. But in order to confirm either case, an external field is required in order to observe the behavior to confirm the right physics. In order to do this, we must factor out the Lorentz factors properly in accordance to the two different cases. Then we will take the extreme case $v \to c$ for a quick comparison of the two equations without having to solve them explicitly.

So using the Klein-Gordon equation of a relativistic, free particle approaching a Coulomb potential [3], $V(r)$, and m_0 being the rest mass we obtain:

$$(E - V(r))^2 \psi = -\hbar^2 c^2 \nabla^2 \psi + m_0^2 c^4 \psi$$

or

$$p^2 c^2 + m_0^2 c^4 = (E - V(r))^2$$

and factoring out the Lorentz factor from the momentum, $p \to p\gamma$, since $m \to m_0 \gamma$ and using this relation: $p = -i\hbar\nabla$ and omitting ψ we obtain:

$$(E - V(r))^2 = -\hbar^2 c^2 \gamma^2 \nabla^2 + m_0^2 c^4 \quad (20)$$

Assuming the particle's path is parabolic for a particle starting from infinity (r = ∞) with a charge opposite of the potential, making $E = 0$,

$$V(r)^2 = -\hbar^2 c^2 \gamma^2 \nabla^2 + m_0^2 c^4$$

and making $v \to c$ where $\gamma \to \infty$, and taking the square root, we obtain:

$$V(r) = \infty \quad (21)$$

In accordance to Particle Theory, the only terms containing a Lorentz factor, and in this case the inverse of it, is the external potential, and the rest mass energy of the system of particles. So using (16) and adding the transformed potential $V(r) \to V(r)\gamma^{-1}$ and omitting ψ we obtain:

$$(E - V(r)\gamma^{-1})^2 = \left(\frac{-\hbar^2}{2m_0}\nabla^2 + m_0 c^2 \gamma^{-1}\right)^2 \quad (22)$$

$$E - 2EV(r)\gamma^{-1} + V(r)^2 \gamma^{-2} = \left(\frac{-\hbar^2}{2m_0}\nabla^2 + m_0 c^2 \gamma^{-1}\right)^2$$

and making $E = 0$ and taking the square root:

$$V(r)\gamma^{-1} = \frac{-\hbar^2}{2m_0}\nabla^2 + m_0 c^2 \gamma^{-1}$$

and multiplying by γ:

$$V(r) = \frac{-\hbar^2 \gamma}{2m_0}\nabla^2 + m_0 c^2$$

and making $v \to c$ where $\gamma \to \infty$, we obtain:

$$V(r) = \infty \quad (23)$$

So even though the isolated, free particle solutions differ substantially in orders of magnitude at high relativistic speeds (or infinite when v → c in the Klein-Gordon equation), under an electric potential, both (20) and (22) obtain the same result when v → c. It is obvious from what we stated in equations (18) and (19), where we confirm that an infinite potential is required to influence a particle at light speed in both Special Relativity and Particle Theory.

X. GRAVITATIONAL ACCELERATION'S INERTIAL MASS INVARIANCE

A unique feature of the law of gravitation is that the acceleration of an inertial body in a gravitational field does not vary with the mass of the inertial body itself.

For an EM field, most of the particles interact only with the surface of a system of particles due to its size. In Figure 9, an EM+ field of particles originating from the right converge with only the surface of a system of EM- particles. The motion in the direction of the EM field, shown in the arrows, is reduced into components as the angle from the direction of the EM field increases, limiting the forward movement towards the field. This also stands for a repulsive EM field. Therefore we can see how the mass of a system of particles will vary the acceleration due to an EM field.

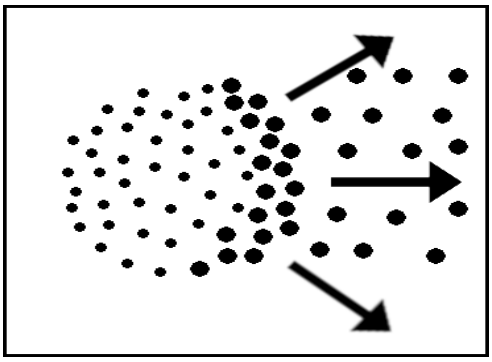

Figure 9. Motion of a system of particles from an attractive EM field incoming from the right

© 2020, IJSRPAS All Rights Reserved

But with a gravitational field, the gravity particles are magnitudes of order smaller than those from an EM field. Therefore, the particles coming from such a field permeates in and throughout the system of particles. This results in the gravitational field affecting most of the volume of the system of particles, rather than just a portion of the surface area as with an EM field. Therefore, Particle Theory can explain explicitly how the acceleration of an inertial body in a gravitational field is invariant with the mass of the inertial body itself, as stated in Newton's law of gravitation.

XI. STRUCTURE OF DARK MATTER SINGULARITIES

From my last paper [4] I hypothesized that Dark Matter may be consisted of concentrated point-like singularities rather than a halo of particles permeated throughout galactic clusters. Particle Theory predicts a possible structure of such singularities postulated from my previous paper.

As we discussed earlier, a black hole consists of the atomic breakdown of what otherwise were individual and distinguishable system of particles such as protons and electrons, into a dense, concentrated bath of EM particles with no atomic distinctions. A DM singularity takes this concept even further, where now the EM particles break down into a far more dense collection of gravity particles illustrated in Figure 3, all entangled together. Due to the totality of theses entanglements, the frequencies of the vibrations are so intense that the shedding of gravity particles from the surface of the DM singularity can be of orders of magnitude more than what is obtained by Newtonian law, which can explain the large gravitational potentials emitted from such singularities that can explain the effects of Dark Matter on celestial systems. But to clarify, as stated in [4], these singularities most likely emerged during or shortly after the big bang, and most likely cannot be created from current celestial systems.

XII. POSSIBLE APPLICATION OF PARTICLE THEORY

A possible application predicted by Particle Theory is the possibility of increasing the screening effect to reduce the influence of gravity.

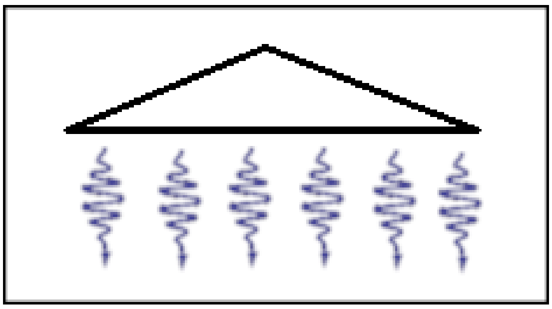

Figure 10. An object emitting high energy photons toward the source of a gravitational field

Figure 10 shows an object emitting high energy photons towards the source of a gravitational field. The type of photon is uncertain, whether gamma rays or x-rays must be used, or if those of a lower energy can be sufficient. Such tests of this hypothesis must include the effect of the exchange of momentum caused by the photons themselves when looking for any anti-gravitational effects.

A limitation that may arise is the height of the object itself, as the gravitational field of particles affecting the object does not come solely from the bottom, but from the sides as well. The flatter the object, the less susceptible the object is to gravitational effects from its sides. A triangular or dome shape will limit these gravitational effects. And finally, the farther the object is from the surface of the gravitational source, the less influence the gravitational field has on the sides of the object.

XIII. CONCLUSION AND FUTURE SCOPE

From the results of the experiment, we saw a sufficient decline of the magnetic field with increasing speed of a relativistic beam of electrons But due to the limitations of the experimental apparatus, confirmation of these results is crucial before going forward.

As to the future scope of this paper, it will involve describing specific aspects of Particle Theory, such as the interpretations of magnetic fields and how spin works under this theory, as well as testing the possible application of increasing the screening effect using X-rays mentioned in the last section (XII) of this paper. And an approach to the strong interaction according to Particle Theory will also be studied and focused on as an alternate to chromodynamics.

And finally, what we can see at least in a theoretical sense by postulating that atomic particles are collections of even smaller indivisible particles with a varying screening effect is that all the equations derived from the Schwarzschild metric can be obtained effortlessly using this concept. And once again, under Particle Theory, gravity can be treated as a force again, possibly removing the divide between GR and quantum mechanics.

REFERENCES

[1] J.L. Cervantes-Cola, S. Galindo-Uribarri, George F. Smoot, "The Legacy of Einstein's Eclipse, Gravitational Lensing," *Universe*, Vol.**6**, Issue.**1**, pp.**5**, **2020**

[2] E. S. Abers, "Quantum Mechanics," Pearson Eduction Inc., **USA**, pp. **414-415, 2004**.

[3] W. Greiner, "Relativistic Quantum Mechanics (Wave Equations)," *Springer-Verlag,* **USA**, pp. **44-45, 2000**.

[4] D. Martinez, "Dark Matter as Point-like Singularities: Alternative to Dark Halo Model," *International Journal of Scientific Research in Physics and Applied Sciences*, Vol.**8**, Issue.**3**, pp.**41-47**, **2020.**

AUTHORS PROFILE

Dino Martinez is B. Sc. in Physics from Florida International University and is currently working as an Independent Researcher.