Localized Field Effect of the Electron, Gravitational Constant and Short Range Forces

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Using widely accepted values of constants and measurements, a unique reformulation of the gravitational constant is proposed. Beginning with the Hubble constant H_o, generalized solutions are derived for the electrons action and local field effects. By eliminating the permeability of free space constant, the nature of the electron is tied to the gravitational constant among other well known values such as the Bohr radius, Plancks constant, the electrons mass and the cosmic background radiation, ultimately providing a widely applicable model which eliminates the necessity of the finite structure constant. A model is developed based on well established concepts of electricity and magnetism which leads to observation of repulsive effects between oppositely charged particles and attractive forces between similiarly charged particles. Causality between motion defined by the Hubble constant and gravity is established. Precise solutions to large and small scale interactions are provided using the developed concepts. With the new look at the cosmos, some possibilities arise that may provide solutions to some cosmological questions.

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I. INTRODUCTION

As technology and methods improve, the precision of measurements and telemetry improve as well. One such example is the Hubble constant, which is a centerpiece for the work presented here. Theories surpass actual knowledge and grow more complex from year to year, often times becoming more and more difficult to follow, comprehend or even evaluate. The motivation of this work is to take a step back and reevaluate fundamental properties of particles to simplify and to facilitate simplification of current models in order to shed new light on unanswered questions. The goal here is to look at the electron's role in the universe and provide a classical analysis of the electron's localized field effects on a large and small scale. It is assumed that there are two distinct and separate contributors to the electron's mass: the electric and the magnetic components. The mass contribution for the electron from the electric field will be used and assumed to be $m_{eo} = \frac{(-e)^2}{c^2 4\pi\epsilon_o r_e}$, where r_e is the electrons radius. The magnetic component is assumed to arise separately from the initial analysis, but will be derived and included in later sections. Concepts presented here do rely on the idea that the electron is an elementary particle and that non-elementary particles are a result of events separate from this particular analysis. Since the mass components are divided, the constants based on the mass of the electron must be normalized.

Even with the advances of technology, many questions and problems remain. Why is the universe expanding as the Hubble constant suggests? Why is the universe accelerating? Why is the universe flat? Where is the antimatter? What is the dark matter? What is the cosmic background radiation? The ideas presented here can possibly address some of these issues by examining the relation of the Hubble constant to the gravitational constant through the electron and examining a few of the consequential effects by developing a method of analysis that can be applied in a wide range of scenarios. Specifically, the repulsion between matter and antimatter is observed by showing that the localized magnetic potential is equivalent to the gravitational potential of the circular motion defined by the Hubble constant. After establishing the model and following the reformulation of the gravitational constant, the use of the new model is demonstrated by the derivation of electron's magnetic moment, the bohr radius, the Planck's constant, the electron's full mass, and the of the cosmic background radiation. With each step, the new model is validated and produces accurate results.

II. INITIAL VALUES AND NORMALIZATIONS

The first piece, as suggested earlier, is the Hubble constant (H_o) [8] which is defined below and used as an adopted regional value. Other constants such as r_e are generally accepted as well [7].

$$H_o = 73.29 \pm 0.11 km/s/Mpc. \tag{1}$$

$$H_o = 2.375 \times 10^{-18} rot/s. \tag{2}$$

The local value of H_o used is in the form of rotations per second and this can be seen in the model as introduced in the next section. Another point is that the Hubble constant is based on measurements of light where the change in wavelength is measured and calculated for a measure of distance. This change in wavelength implies a change in frequency. Others, such as Wendy Freedman et al, have produced results similar to the chosen value [10, 24]. As in the introduction, the mass of the electron used is defined as the electric component of mass which is used in the electron-proton ratio.

$$m_{eo} = \frac{(-e)^2}{c^2 4\pi\epsilon_o r_e} = 9.076\times10^{-31} kg. \tag{3}$$

The ratio is:

$$\frac{m_{eo}}{m_p} = \frac{1}{1842.76}, \tag{4}$$

where, mp is the mass of the proton. Traditionally, the Hubble distance is simply the speed of light, c, divided by Hubble constant, H_o. This formulation on the Hubble distance potentially ignores some important aspects of the expansion model. The model used here will be a model based on the observational facts but, some discussion of the expansion will precede the final model.

A. Constant velocity expansion

If expansion was uniform and experienced no acceleration, the Hubble constant would have never been noticed since the recession velocities would be random and a relation would not exist. This can be seen with the first model.

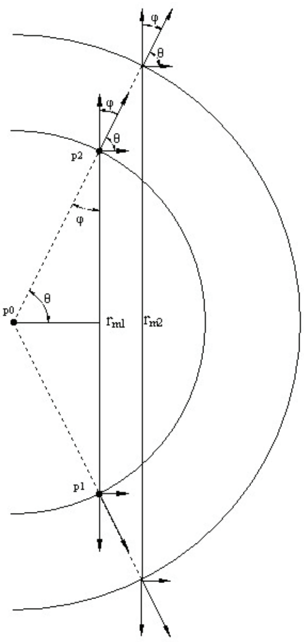

FIG. 1: Model 1 shows constant velocity expansion.

Model 1 shows a uniform constant velocity radial expansion. Point p_0 is the origin. Points p_1 and p_2 are arbitrary masses which are experiencing effects of the expansion. The velocity v_1 is what would represent the Hubble relation $v_1 = H_o r_m$ where r_m is the measured distance between the two masses at points p_1 and p_2 (earth and star, electron and positron, etc). With this model, it can also be seen that $v_1 = 2v_{max}\cos(\varphi)$. Since v_{max} and $\cos(\varphi)$ are constants,

v_1 must also be a constant. The measured distance r_m is increasing in size which would mean $v_1 = 2v_{max}\cos(\varphi)$ is not a valid equation representing the recession velocities observed through measurement. Since the constant velocity expansion model conflicts with the observations, it is concluded that there must be a separate acceleration occurring for the observations of the Hubble relation to be true.

B. Expansion with acceleration

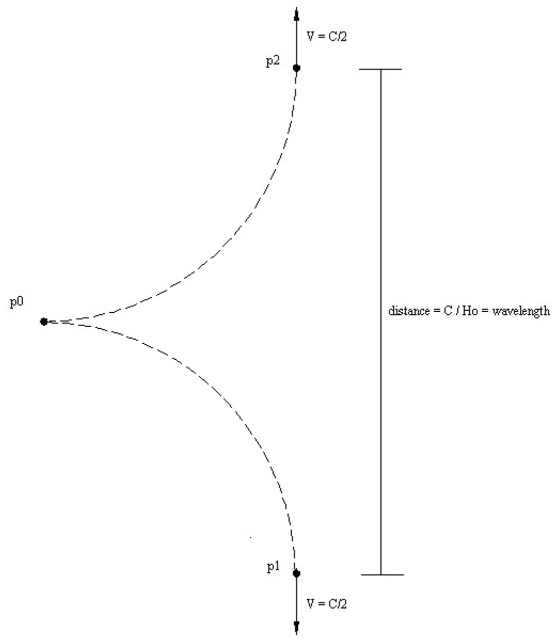

FIG. 2: Model 2 shows accelerated expansion due to angular velocity.

Model 2 shows what is observed, but from a third point of view which makes motion symmetrical between two equal masses. Two equal masses where chosen for simplicity. Thus, the view would be of earth and it's relation to an equal mass separated by some distance r_m. Using a constant velocity model, the acceleration used is a velocity vector change that results from an angular velocity.

An all Newtonian approach will be used. There are good reasons for this. One, there is evidence that the Hubble relation appears to be linear up to at least the 1000 Mpc scale [24]. Second, most measurements have been within 300 Mpc and on the outside 400 Mpc scale, the relativistic velocities measured would be well within 99% of the Newtonian value. The limits of zero to c are used as limits to demonstrate the important and most fundamental points. From the third point of view, the individual velocity components of the separation reach a maximum of c/2. Another important point to be made about the limit c is that the Hubble "constant" gives a value for this limit.

This is the model that will be built on, but an equivalent model that restricts the curved path of earth while the opposing mass recedes would also work and would be a closer representation of the model proposed later in subsection II B. The symmetry of this model is easier and more straight forward to work with. With this, the first thing to observe is the distance of separation required for the sum of the receding velocities between the two masses to equal the speed of light such that $v_1 = c$. This distance is defined as r_{max}.

$$r_{max} = \frac{c}{H_o}. \tag{5}$$

Taking a closer look at model 2 by rotating it by 90 degrees:

Model 3 is rotated to see the period (T) on the x axis and the amplitude on the y axis. There are two ways to immediately find the solution for r_u which is the desired "universal" amplitude which is associated with the angular velocity. The period T is defined as 2π according to the allowed harmonics of sinusoidal functions. It is with this model that the Hubble constant is effectively the rotations per second. Or alternatively for the first solution, the wavelength is used such that:

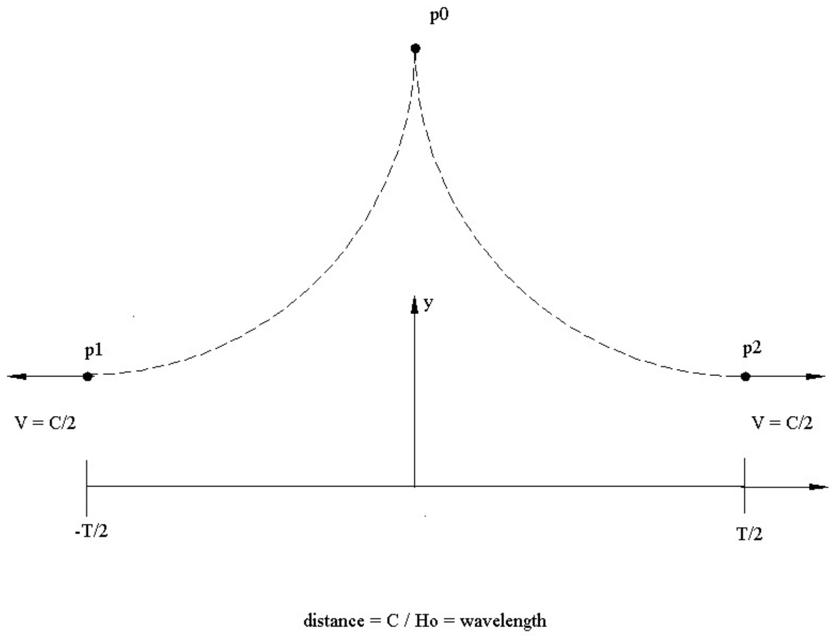

FIG. 3: Model 3 is model 2 rotated with period (T) added.

$$\lambda = r_{max} = \frac{c}{H_o} = 1.262 \times 10^{26} m. \tag{6}$$

For the harmonic:

$$\lambda = 2\pi r_{u1}, \tag{7}$$

and thus:

$$r_{u1} = \frac{c}{2\pi H_o}. \tag{8}$$

For the second solution, the specific frequency is found and used with the average velocity. This view allows one to see the propagation wave a bit easier. Now, some values can be found to calculate the angular change. First, the time needed to reach the summed velocity of the speed of light needs to be found so that the rotations per second can be determined. The time is equal to the linear distance transversed (r_m) divided by the average velocity (c/2) of the wavefront. Note that the average velocity is $v_{avg} = 2\frac{c}{4}$ due to the fact that each of the mass contribution to the average linear velocity is c/4 as both went from zero to c/2 on the x-axis. Also the rotational frequency will be equal to the inverse of the time.

$$t = \frac{d}{V_{average}} = \frac{r_{max}}{c/2} = \frac{2}{H_o}. \tag{9}$$

And the rotations per second (f):

$$f = \frac{rot}{s} = \frac{1}{t} = \frac{H_o}{2}. \tag{10}$$

For the angular velocity solution, there is a new relation that can be observed that could not be observed in model 2. That relation is the local velocity of progression along the x-axis as it pertains to the angular change and is as follows:

$$v = \lambda\nu = 2\pi r_{u1} f. \tag{11}$$

The velocity (v) is the propagation of the wave which is again c/2 or more precisely 2 times the individual average velocities of c/4.

$$\frac{c}{2} = 2\pi r_{u1} f. \tag{12}$$

Followed by appropriate substitutions,

$$c = 2\pi r_{u1} H_o. \tag{13}$$

Now, a simple rearrangement gives:

$$r_{u1} = \frac{c}{2\pi H_o}. \tag{14}$$

The concern here is to always keep in mind what is being measured and how it's being measured. Since hydrogen dominated regions produce the most abundant sources of measurable light, these are obviously the regions to focus research. The electron is the entity to be examined and since the rot/s is a measurement of a larger entity, it first needs to be normalized to the electron to find the proper rotations per second (Rot_n) associated with the electron. The normalization is to the elementary mass of the electron and the full mass will be reconstructed in a later section. Based on the fact that the Hubble measurements are obtained from hydrogen dominated regions, the total mass per molecule is approximated as one proton for the hydrogen atom. If the measurements were taken in an iron dominated region, this specific normalization would be invalid, but is not limited to being normalized from hydrogen.

$$Rot_n = \frac{\nu m_{eo}}{m_p} = \frac{H_o m_{eo}}{m_p} = 1.289 \times 10^{-21} rot/s. \tag{15}$$

$$r_u = r_{u1} \frac{m_p}{m_{eo}} = \frac{c}{2\pi H_o} \frac{m_p}{m_{eo}}. \tag{16}$$

And to consolidate further, H_n is defined as,

$$H_n = 2\pi H_o \frac{m_{eo}}{m_p} = 8.098 \times 10^{-21} rad/s. \tag{17}$$

Finalizing the substitutions to find the value of r_u gives:

$$r_u = \frac{c}{H_n} = 3.702 \times 10^{28} m. \tag{18}$$

Now the "universal" amplitude has been determined for the large scale motion of the electron. This value, r_u, will be used in the following sections.

C. Further considerations

There are multiple models that would fit the two models presented in sections II A and II B. The models presented in section II B are used in the development of this new method of analysis. One of the first systems that should come to mind that would represent the models in section II B is an outwardly spiraling system. As this is arguably the most observed process in the universe and thus the most probable source. A inwardly spiraling system would be just as valid. Again, the concern is to stay consistent and always keep in mind as to what is being measured. In the outward spiraling system, the mass will rotate about a fixed center when it's close to the center. Because any attractive forces inward are not enough to hold a mass in perfect orbit, the mass experiences an outward acceleration and thus moves away from the center. The simplest way to look at a system like this is to hold the mass at a constant velocity and rotate the velocity vector away from the center until the velocity vector points radial from the center where it obtains it maximum velocity from the center. This would produce equivalent results as before but the actual path of the mass is more complex and this is why the previous model is used in order to maintain simplicity in the calculations. The key is that the Hubble relation is maintained, the velocity is constant, and the angular rotation is constant in localized time. That is not to exclude variations on the system that would produce equivalent results. The simplest systems are used to demonstrate the effect. The following model demonstrates the angular change in velocity of a spiraling system as the mass moves radial from a defined center.

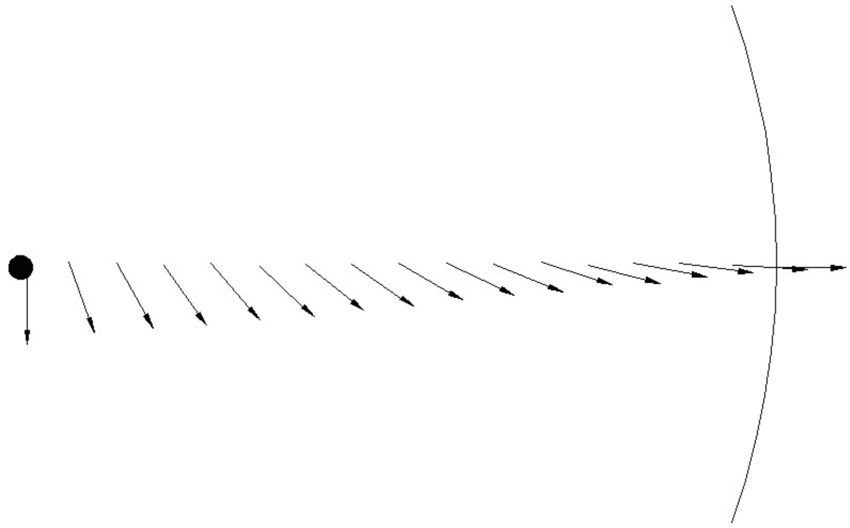

FIG. 4: Example of the velocity vectors as the mass spirals out from the center.

In a system like in Fig. 4, two randomly chosen masses within the circle will produce the same relation of recession velocity to distance of separation as each mass will show from the center. With a constant velocity, the angular rotation of the velocity vector allows the increased velocities to be observed as two masses become separated by greater distances. Thus, any point within the circle is indistinguishable from the true center. It produces the same result that a typical expansion or inflation model must demonstrate and that is the relation that the Hubble constant defines for velocity versus distance which any model worth consideration must demonstrate. Although, the results do not produce linear results near the outer limits but do produce a more regular transition before that. On the scale of 10^{28}m, the limits of human perception and measurement would certainly produce linear results, just as in calculus where the shape of a circle is approximated by infinitesimally small lines. Current measurements for the Hubble relation which peak out around 400 Mpc would be 0.03% of the scale and would cause a deviance on the scale of 10^{-7}. Thus, no deviation from linearity could be detected with current techniques.

Thus, the Hubble "Constant" does demonstrate that an expansion and acceleration exists but it can be achieved with a constant magnitude velocity. This model does allow for a stable universe if new mass is created in the center and is allowed to begin its journey outward and lost to the cooling of space on the outer edges. This would explain why the lightest elements, such as hydrogen rich Population I stars, are at the center of an expanding system where the heavier iron rich stars are on the outer rim [23]. Otherwise, if momentum was not ruling, gravity would dictate that the iron (Fe) would be in the center of a collapsing system. Wherever the generation of atomic matter such as an electron occurs, there would be energies in the gamma ray region of the electromagnetic spectrum. This type of emission does, in fact, occur in the galactic cirrus and so-called black holes. In this event, there is constant creation and annihilation and matter occasionally escapes in a radial orbit and the antimatter counterpart would be ejected perpendicular to the plane of rotation. It would later annihilate with matter after sufficient cooling. Instead of a black hole at the center of the galaxy, a suggested model is to begin with a "matter recycler". A "matter recycler" would reclaim matter either after annihilation or by providing the energy for annihilation and re-releasing it as hydrogen. This would provide a stable and relatively constant distribution of matter as the larger atoms are recycled.

Defining a center on the cosmic scale would be difficult. One approach would be to use the parallax method with star density. For example, the Milky Way shows obvious clustering of stars in this galaxy which might hold clues. By first observing where the greatest density exists and secondly choosing several well placed references, a clever analysis might reveal the direction to the center of the galaxy or at least reduce the possibilities. If the references reveal enough information over time and multiple measurements, the distance from the center would be revealed along with the motion of this solar system relative to the center of the galaxy. All this has been done.

The average pitch angle of the spiral arms for the Milky Way is known to be about $\theta = 12 \pm 1\,\mathrm{deg}$ or $\theta = 0.2094\mathrm{rad}$ [16]. Also, the estimated distance of the sun from the center of the galaxy is approximately $r_{gc} = 27,700\mathrm{ly}$ or $r_{gc} = 2.621 \times 10^{20}\mathrm{m}$. The model proposed is that the evolution from the center was from a perfect circular orbit and the effective pitch angle is constantly evolving. The orbital velocity of the earth around the galactic center is estimated to be $v_{earth} = 2.17 \times 10^5\mathrm{m/s}$. The assumption is that the maximum velocity is the tangent of the pitch angle of 12deg, but for comparisons to the Hubble Constant, the velocity needed is the velocity radial to the center reference. The velocity outward from the center would be $v_r = 2.17 \times 10^5 \tan(\theta)\mathrm{m/s}$ or $v_r = 4.613 \times 10^4\mathrm{m/s}$. The averaged angular momentum would be the difference between the changes in pitch angle divided by the averaged time needed for the earth to traverse the distance $r_g c$. The solution follows:

$$H_{earth} = \frac{1}{2\pi}(\theta - \theta_o)\frac{v_r}{r_{gc}}. \tag{19}$$

$$H_{earth} = 5.87 \times 10^{-18} rot/s. \tag{20}$$

The exact values are extremely difficult to ascertain for the velocity, the distance from the center and the true value of pitch angle but it is very close to the rotation defined by the Hubble constant ($H_o = 2.375 \times 10^{-18}\mathrm{rot/s}$). Because it is believed that the earth's trajectory is a spur and is in a much more circular orbit than the spiral arms of the galaxy, this puts the value in the right neighborhood. The range of pitch angles examined for the average of 12 degrees mostly fall between 4 and 28 degrees and thus Hubble constant definitely fits within the true error bars of this model which would put earth's pitch at an angle of about 7.7 degrees by this averaged view. This is a key point to validate this model because it shows that the motion in the proposed model based on the Hubble constant matches what is actually happening within the local galaxy. The Hubble relation is observed for various galaxies relative to our own galaxy, but the same values are observed locally in the Milky Way galaxy. By observing the rotational velocity locally, it can be seen that a rotational velocity does create an acceleration between masses that produces accelerations of similar value to the acceleration defined by the Hubble Constant. The true value would be what is occurring in a local time frame and would include additive effects such as rotation around the sun, rotation around the galaxy center, and the rotation around a possible universal center. Most of the additive effects could be ignored due to small additions to the overall sum. All of these planer rotations could have another rotation perpendicular to the plane, but the important values will relate the earth to the rest of the cosmos. The fact that what is observed locally also occurs between galaxies suggests that the governing laws are fairly consistent in creation and annihilation throughout the universe. Even though all the parameters fit perfectly with the Hubble motion, the constant velocity model was most likely overlooked due to the fact that observers were looking for support for an expansion to validate the Big Bang Theory instead of considering all the possibilities such as the constant velocity model proposed.

III. ENERGIES, FORCES AND LOCALIZATION

With the needed distance to the center of rotation, the energies and forces involved can now be considered. The following observations are trivial but are helpful for building the final solution. The first consideration is the electric energy and the electric force, focusing on the electron and a counter test charge of a positron.

$$E_E = \frac{e(-e)}{4\pi\epsilon_o r_u} = -6.219 \times 10^{-57} Nm. \tag{21}$$

$$F_E = \frac{e(-e)}{4\pi\epsilon_o r_u^2} = -1.670 \times 10^{-85} N. \tag{22}$$

With this alone, the two particles would simply fall into each other and annihilate to release radiation. On the other hand, if the test electron was rotating about some point as suggested by the determination of r_u, a magnetic field would be associated with it. Determining the magnetic energy and the magnetic force take a little more work than the electric counterparts. First, the magnetic dipole needs to be determined. The measured value of the electrons magnetic moment is well known, but it should be pointed out that the value of the electrons measured magnetic dipole is a value obtained from an electron extracted from its atomic environment and not necessarily obtained from pair production alone. This will be examined in a subsequent section as the model is constructed and the appropriate equations are developed. To determine the electron's magnetic moment, one has to consider the localized magnetic flux. Using Biot-Savart law, the magnetic field can be determined and works quite well with small systems where the observer is separate. On this scale, however, the observer is not separate from the system and the localized effects are not nominal. To begin the calculations, the magnetic dipole is determined with the velocity equal to the speed of light (c). This next formulation is appropriate for the model of holding one electron in place and allowing the second to have the velocity $v_{max} = 2(c/2) = c$. The magnetic moment is defined as,

$$\mu_\mu = IA. \tag{23}$$

$$\mu_\mu = \frac{-ec}{2\pi r_u}\pi r_u^2. \tag{24}$$

$$\mu_\mu = \frac{-ecr_u}{2}. \tag{25}$$

Next, the localized contribution of the electron is determined using a ratio of the cross section of an electron to an area covered by the electron's orbit about r_u.

$$\mu_{e\mu} = \frac{-ecr_u}{2}\frac{\pi r_e^2}{\pi r_u^2}. \tag{26}$$

$$\mu_{e\mu} = \frac{-ecr_e^2}{2r_u}. \tag{27}$$

Now that the magnetic dipole has been established, the magnetic energy and force can be considered with the test positron.

$$E_B = \frac{\mu_o \mu_{e\mu} ec}{2\pi r_u^2}. \tag{28}$$

$$E_B = \frac{\mu_o ec}{2\pi r_u^2}(\frac{-ecr_e^2}{2r_u}). \tag{29}$$

$$E_B = -\frac{\mu_o e^2 c^2 r_e^2}{4\pi r_u^3}. \tag{30}$$

And the force is:

$$F_B = -\frac{\mu_o e^2 c^2 r_e^2}{4\pi r_u^4}. \tag{31}$$

With the large value of r_u the values of E_B and F_B are quite small compared to E_E and F_E. Thus, the net result would be the same and the pair would annihilate. A novel effect lies in the local effects of the magnetic dipole. It begins with the magnetic force equation for the electron when considered with the test charge of the positron.

$$E_{Blocal} = \frac{\mu_o \mu_{e\mu} ec}{2\pi r_e^2}. \tag{32}$$

$$F_{Blocal} = m_{eo}a = \frac{\mu_o \mu_{e\mu} ec}{2\pi r_e^3}. \quad (33)$$

At this point, it is important that eliminations are not made to reduce the formula to the simplest form as substitutions are made. Moving forward with substitutions:

$$m_{eo}a = \frac{\mu_o ec}{2\pi r_e^3}(\frac{-ecr_e^2}{2r_u}). \quad (34)$$

Rearranging gives:

$$m_{eo}a(4\pi r_e^3) = \frac{-\mu_o e^2 c^2 r_e^2}{r_u}. \quad (35)$$

The following equality is used for substitution:

$$\mu_o = \frac{4\pi m_{eo} r_e}{e^2}, \quad (36)$$

normalized with $\frac{m_{eo}}{m_e}$.

This relation is true because of how the constant is obtained. One first needs to realize that it is simply a slope to an equation. By using an electron and subjecting it to various conditions, a line can be drawn between the points to determine the slope. This slope results in a ratio of the limits associated with what is being measured. In this case it's an electron.

$$m_{eo}a(4\pi r_e^3) = \frac{-e^2 c^2 r_e^2}{r_u}(\frac{4\pi m_{eo} r_e}{e^2}). \quad (37)$$

$$m_{eo}a\frac{4\pi r_e^3}{4\pi m_{eo} r_e} = \frac{-e^2 c^2 r_e^2}{r_u}(\frac{1}{e^2}) \quad (38)$$

$$a\frac{4\pi r_e^3}{4\pi m_{eo} r_e} = (\frac{1}{m_{eo}})\frac{-e^2 c^2 r_e^2}{r_u}(\frac{1}{e^2}) \quad (39)$$

Reducing the respective equalities to a simpler form, results in the following equation:

$$a\frac{r_e^2}{m_{eo}} = -\frac{c^2 r_e^2}{m_{eo} r_u}. \quad (40)$$

Substituting r_u to define a new constant where,

$$r_u = \frac{c}{H_n} \quad (41)$$

$$g = a\frac{r_e^2}{m_{eo}} = -\frac{H_n c r_e^2}{m_{eo}} \quad (42)$$

This equation is a translation of the masses action relative to the magnetic force such that $F_{Blocal} = g\frac{m_{eo}^2}{r_e^2}$. The force involving the electrons will look the same between the mass adjusted magnetic force and the regular magnetic force equation. It should be noted that for equation (40), a generalized solution would be have $r_u = r_g$ where r_g is the distance to the center of rotation and n_q for n charges, if charges are used in the system being analyzed. The cross section $r_{elem(tary)}$ is the radius of the elementary particle and m_{elem} is the mass of the elementary particle. In addition, the sign and magnitude of the equation would be dependent on the charges of the particles involved. The value is fixed only for this analysis and would need the variables to obtain generalized forces and accelerations. The cross sections and velocities (v) would vary as well for various fundamental particles. Such that:

$$g = \pm \frac{n_{e1} n_{e2} v^2 r_{elem}^2}{m_{elem} r_g}, \tag{43}$$

where r_g is the parameter that relates physical distance of separation between the particles to the orbital radius.

Most importantly, it should be noted that the value is negative. For a test positron's action on an electron, the equation would be negative. For a test positron's action on a positron, or for a test electron's action on an electron, the equation is positive.

IV. MAGNETIC POTENTIAL OF THE LOCALIZED DIPOLE

A similar treatment of the magnetic potential incurred to derive mass relations to the action of the potential. First, the base equations are defined.

For a specified volumetric sum of a field, the potential energy is:

$$W_B = \frac{1}{2\pi} \oint B^2 d\tau, \tag{44}$$

where B is the magnetic potential.

$$B = \frac{\mu_o}{4\pi} \frac{ec}{r^2}. \tag{45}$$

The magnetic potential will be formulated with a magnetic dipole and the cross-sectional method is applied to the magnetic dipole to produce the follow,

$$\mu_{eu} = \frac{-ecr^2}{2r_u}. \tag{46}$$

Substitutions can now be done.

$$B = \frac{\mu_o}{2\pi} \frac{\mu_{eu}}{r^3}. \tag{47}$$

$$B = \frac{\mu_o}{4\pi} \frac{-ec}{r_u r}. \tag{48}$$

$$W_B = \frac{1}{2\mu_o} \oint (\frac{\mu_o}{4\pi} \frac{-ec}{r_u r})^2 r^2 \sin\theta dr d\theta d\phi. \tag{49}$$

$$W_B = \frac{1}{2\mu_o} \frac{\mu_o^2 e^2 c^2}{16\pi^2 r_u^2} \oint sin\theta dr d\theta d\phi. \tag{50}$$

$$W_B = \frac{\mu_o e^2 c^2}{32\pi^2 r_u^2}(r - (-r))(1)(2\pi) + C. \tag{51}$$

$$C = 0. \tag{52}$$

$$W_B = \frac{\mu_o e^2 c^2}{8\pi r_u^2} r. \tag{53}$$

Now that the volumetric potential energy has been determined for an arbitrary spherical irradiative volume, r is set to r_e or $r = r_e$ because it is the electron that is of interest because it's an elementary particle.

$$W_B = \frac{\mu_o e^2 c^2}{8\pi r_u^2} r_e. \tag{54}$$

At this point, the gravitational potential for the circulating electron is considered for the same orbit as for W_B.

$$W_{gravity} = G\frac{m_{eo}^2}{2\pi r_u}. \tag{55}$$

The results of the two potentials W_B and $W_{gravity}$ turn out to be equal. Substituting the full equations for W_B and $W_{gravity}$

$$W_B = W_{gravity}. \tag{56}$$

$$\frac{\mu_o e^2 c^2}{8\pi r_u^2} r_e = G\frac{m_{eo}}{2\pi r_u}. \tag{57}$$

The equation can represent either the action between two similar charges such as two electrons or two positrons such that $(-e)^2 = (e)^2$. This equality can be reduced to an even simpler form using the method in the previous section and the result is simply a multiplication of *pi*.

$$G = \frac{\pi H_n c r_e^2}{m_{eo}}. \tag{58}$$

As mentioned before, the function/constant G has been derived for the action between two similarly charged or similarly polarized components. For systems which are oppositely polarized or oppositely charged, an appropriate use of positive and negative charges is needed such that $(-e)e = -(e)^2$. The end result of this system is that the variable of gravitation is then negative.

$$G = -\frac{\pi H_n c r_e^2}{m_{eo}}. \tag{59}$$

Thus,

$$G = \pm\frac{\pi n_{e1} n_{e2} c^2 r_{elem}^2}{m_{elem} r_u}. \tag{60}$$

And finally,

$$G_{calc} = 6.6732 \times 10^{-11} Nm^2/kg^2. \tag{61}$$

$$G_{meas} = 6.6731 \times 10^{-11} Nm^2/kg^2. \tag{62}$$

At 99.998%, the differences between the calculated and the measured values are well within the error of H_o alone.

V. SHORT RANGE FORCES AND ENERGIES

Up to this point, the interactions considered have been on an enormous scale. The short range interactions need to be considered and they do produce novel effects. Again, simplification of the problems is the goal of this analysis. The interactions to be explored are the electron-positron and the electron-proton interactions. As in earlier sections, the positron is treated the same as the electron except with an opposite charge. Thus, the magnetic dipoles and subsequent masses are omitted and assumed to arise through a separate process which will be derived. Two primary processes are explored: pair production and proton interactions; which leads to the reconstruction of the electrons mass to validate the initial separation

A. Pair production: Short range forces and energies

The first short range exploration is pair production. As seen earlier, the effect between two electrons is a net attractive force due to the angular acceleration and the effect between an electron and the positron pair is a net repulsive effect when they travel along the same curved path. The components needed for the creation of the electron-positron pair will need a repulsive energy/force greater than or equal to the attractive force between the opposing charges. Since the repulsion is dependent on the anti-alignment of the magnetic dipoles, it's worth taking the time to consider why the alignment occurs. Ignoring the magnetic moments that elementary charged particles must possess and obtain upon their creation, opposite charges attract and unless they are on a direct course toward each other they will tend to curve toward each other. Using the left hand rule for the positive charge and the right hand rule for the negative charge, once quickly determines that the anti-alignment occurs quite naturally and absolutely when oppositely charged particles race toward each other. Thus, the following equations are constructed in order to find a viable amplitude of $n_e = 1$:

$$E_E = E_G or F_E = F_G \tag{63}$$

Here is a good time to introduce a convention to make basic formulations easier. For representative purposes, G will be used as a constant with a subscript representing the velocity used, such as G_c would represent the gravitational parameter defined by the velocity c. Also noted is the gravitational parameter will be negative for the following example since it represents the interaction between a positive and negative charge.

$$E(-e) = -G_c \frac{1}{r_g} m_{e^-} m_{e^+} \frac{1}{r}. \tag{64}$$

Expanding:

$$\frac{1}{4\pi\epsilon_o} \frac{e(-e)}{r} = -\frac{\pi c^2 r_e^2}{m_{eo}} \frac{1}{r_g} m_{e^-} m_{e^+} \frac{1}{r}. \tag{65}$$

Since the result will leave the particles with magnetic dipole addition of masses, the masses are approximated to be the known values for the masses of the electron and positron. Because the center of spin is exactly in the middle of the two particles, the mass adjusted radius (r_g) of motion determining the repulsion which is the radius of the harmonic wavelength ($1/(2\pi)$), is one half of the separation of attraction / repulsion and thus,

$$r_g = \frac{r}{(2)(2\pi)} \tag{66}$$

$$\frac{1}{4\pi\epsilon_o} \frac{e(-e)}{r} = -\frac{\pi c^2 r_e^2}{m_{eo}} \frac{4\pi}{r} m_{e^-} m_{e^+} (\frac{1}{r}). \tag{67}$$

Again, r_g is the parameter that relates physical distance of separation between the particles to the orbital radius. The distance r is the physical distance of separation between the particles and since the mass adjusted rotational center is in the middle, it was divided in half. Also, it was divided by 2π because the energy of the full rotation is needed to overcome the electric potentials, so in reality the equation is multiplied by the value 2π as it is summed for a full orbit, but is kept with distance parameter to show how it relates to the wavelength.

The power of this equation lies in what r is. It is the radius that defines the harmonic which tells the linear distance of separation (λ) after separation, otherwise known as the wavelength. Solving for r:

$$r = (\frac{\pi c^2 r_e^2}{m_{eo}} \frac{4\pi}{1} m_{e^-} m_{e^+})/(\frac{e^2}{4\pi\epsilon_o}). \tag{68}$$

$$r = 5.596 \times 10^{-13} m. \tag{69}$$

$$\lambda_{u1} = 2\pi r. \tag{70}$$

$$\lambda_{u1} = 3.516 \times 10^{-13} m. \tag{71}$$

The value of the wavelength is remarkably close to the value associated with the wavelength derived from the "light" energy of the electron or from the magnetic dipole moment of the electron. The derived result suggests that the pair production event occurs at a lower energy but alone, there would be no incentive for this to occur and stay separated. A secondary process is necessary to allow the pair production to occur in a stable manner, thus proton capture is introduced into the system. Proton capture would introduce two variables; the first piece is the "capture" of the electron and the second piece is the escape of the positron. Effectively, the electron will be held while the positron spins off and thus, $r_g = r/(2\pi)$. Since the value of the extracted electron is wanted, the 2π multiplier is also needed for electron-proton interaction. The proton affects both pieces but the solution is for the electron or the positron and not for the collective system. For the electron, the total electric potential attraction to the positron must equal the repulsion plus the additional repulsion of the proton on the positron. The electric potentials are approximated to cancel and thus, do not need to be added. The proton mass is chosen to be $m_p = 1.6726 \times 10^{-27}$kg, the electron and positron mass is approximated to be the full known masses $m_{e^-} = m_{e^+} = 9.1095 \times 10^{-31}$kg and the Bohr radius is $r_b = 5.292 \times 10^{-11}$m. During the pair production process, the electric potential relative to the proton cancel for the sum between the positron and the electron. After the pair production is finished, the electric potential is needed for evaluating the final extraction of the electron.

The electric potential between the electron and the proton equals the repulsion created from pair production between the electron and positron plus extraction of the electron from the protons environment, thus, the following represents the equation with the protons addition.

$$E(-e) = -G_c \frac{2\pi}{r} (m_{e^-} m_{e^+}) \frac{1}{r} + (-G_c \frac{2\pi}{r} (m_{e^+} m_p (\frac{1}{r_b}))). \tag{72}$$

In the expanded form,

$$\frac{1}{4\pi\epsilon_o} \frac{e(-e)}{r} + \frac{\pi c^2 r_e^2}{m_{eo}} \frac{2\pi}{r} (m_{e^+} m_p) \frac{1}{r_b} = -\frac{\pi c^2 r_e^2}{m_{eo}} \frac{2\pi}{r} (m_{e^-} m_{e^+}) \frac{1}{r}. \tag{73}$$

Reducing to a simpler form to solve for r:

$$r = -(\frac{\pi c^2 r_e^2}{m_{eo}} \frac{2\pi}{1} (m_{e^-} m_{e^+}))/(\frac{\pi c^2 r_e^2}{m_{eo}} \frac{2\pi}{1} (m_{e^+} m_p) \frac{1}{r_b} - \frac{1}{4\pi\epsilon_o} \frac{e(-e)}{1}). \tag{74}$$

$$|r_u| = |r| = 5.955 \times 10^{-14} m. \tag{75}$$

And solving for the wavelength gives

$$\lambda_u = 2\pi |r_u| = 3.742 \times 10^{-13} m \tag{76}$$

The absolute value is the value used for the wavelength and distances since the direction of spin is not of concern for this solutions. This value for the wavelength is closely associated with the electrons dipole moment and with the Planck constant. The calculated energy per frequency is 97% in agreement with the Planck constant.

$$\frac{E}{\nu} = \frac{m_{e^-}c^2}{1}\frac{\lambda}{c}. \tag{77}$$

$$\frac{E}{\nu} = 1.023 \times 10^{-34} Js = (0.97)\frac{h}{2\pi}. \tag{78}$$

The magnetic moment of the electron is similar.

$$\mu = \frac{-ec\lambda}{2} = -8.986 \times 10^{-24} J/T = (0.97)\mu_{e^-}. \tag{79}$$

The 3% deviance may imply a tertiary process which is most likely a result of the extraction process of the electron from the nucleus.

B. Proton interaction: Bohr radius validation

The second close range interaction to be examined is the proton-electron interactions. The formulations are similar as before, but the proton is held stationary. Since the proton is held stationary, $r_g = r/(2\pi)$. As in the pair production model, all of the effects need to be included and that is the addition from the magnetic moment obtained upon pair production such that $r_\mu = -5.955 \times 10^{-14}$. The radius (amplitude) effectively becomes the wavelength for the next equation since the electron has been separated from it's positron counterpart. First to be defined is the radial energy of the electron obtained from pair production.

$$E_{e^-e^+} = -G_c\frac{2\pi}{r_\mu}(m_{e^-}m_{e^+})\frac{1}{r}. \tag{80}$$

In the expanded form,

$$E_{e^-e^+} = -\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi}{r_\mu}(m_{e^-}m_{e^+})\frac{1}{r}. \tag{81}$$

Now, adding the electrons energy to the atomic scenario such that the repulsive effect of the magnetic component is equal to the electric component. The magnetic moment derived from pair production would be a repulsive factor toward the proton but there is a higher order law that takes place. The spin direction around the proton will first try to counteract the magnetic moment of the electron. Thus, it ends up on the "attraction" side of the equation with the electric potential.

$$E_{e^-e^+} + E_E = E_{e^-p}. \tag{82}$$

$$-G_c\frac{2\pi}{|r_\mu|}(m_{e^-}m_{e^+})\frac{1}{r} + E(-e) = -G_c\frac{2\pi}{r}(m_{e^-}m_p)\frac{1}{r}. \tag{83}$$

In the expanded form,

$$-\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi}{|r_\mu|}(m_{e^-}m_{e^+})\frac{1}{r} + \frac{1}{4\pi\epsilon_o}\frac{e(-e)}{r} = -\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi}{r}(m_{e^-}m_p)\frac{1}{r}. \tag{84}$$

Solving for r:

$$r = (\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi}{1} m_{e^-} m_p)/(\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi}{|r_u|}(m_{e^-} m_{e^+}) + \frac{e^2}{4\pi\epsilon_o}). \tag{85}$$

$$r_{Bohr} = r = 5.292 \times 10^{-11} m. \tag{86}$$

Solving for the wavelength gives:

$$\lambda_b = 3.325 \times 10^{-10} m. \tag{87}$$

Interestingly, the amplitude is the radius known as the Bohr radius and is within 5.6×10^{-3}% of the defined value: $r_b = 5.2920 \times 10^{-11}$m. At first glance higher "integer" orbitals are achieved with additions of protons or neutrons, but the lowest orbital is the first to be filled due to the addition of a charge. For example, an additional neutron would cause the electron to prefer the next highest orbital, but an additional proton would keep the first electron at the first tier of orbitals. One needs to be careful here, the solution is not as straight forward as it seems. Additive mass effects are a concern for the equation and electric potential can be expanded as well. Fortunately if the mass is known, the magnetic dipole does not necessarily need to be known becuase it should be acounted for within the mass. The fact that r_b is the value of the amplitude instead of the wavelength makes sense because the amplitude is what the radius should be for a stationary circular orbit; whereas the wavelength represents a linear distance which occurs when an orbit is unfolded. The derivation of the Bohr radius using this method was a result of two iterations of the theory which uses a two component denominator. The two piece denominator surviving two iterations with extremely accurate results severely reduces the probability that this is a random mathematical event, thus validating the method.

C. Tertiary effect: total energy

The solution to the tertiary effect is obtained simply by rehashing the previous equation. The $E_{e^-e^+}$ component is no longer needed to describe the system. The solution desired is the electrons energy once it has be extracted from the atomic state, thus the magnetic effects are split between the charges. The most common choice is the hydrogen atom and thus the magnetic effects for the electron are one half of the total.

$$E_{sum} = E_{electric} + \frac{1}{2} E_{magnetic}. \tag{88}$$

$$|E_{sum}| = |E_{electric}| + \frac{1}{2}|E_{magnetic}| = |E_E| + \frac{1}{2}|E_{e^-p} + E_{e^-e^+p}|. \tag{89}$$

Totaling the energy gives,

$$|E_{sum}| = |E_{r_b}(-e)| + \frac{1}{2}|G_c m_e(\frac{2\pi}{r_b})[\frac{m_p}{r_b} - \frac{m_p}{|r_\mu|}]|. \tag{90}$$

In expanded form,

$$|E_{sum}| = |\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{r_b}| + \frac{1}{2}|\frac{\pi c^2 r_e^2}{m_{eo}}(m_e m_p)(\frac{2\pi}{r_b})[\frac{1}{r_b} - \frac{1}{|r_\mu|}]|. \tag{91}$$

Absolute values are used to avoid any handedness in the final solution which would be negative in value. The goal now is to associate this value with the Planck constant (h) and to do this, the orbital radius is recognized as the wavelength such that it reflects the potential involved in the distance of separation as the orbit is not unfolded as in previous examples, thus the 2π operator is not involved. Also, conversion of the wavelength to the frequency is required. The relation of the wavelength to the frequency is:

$$\lambda = r_b = \frac{c}{\nu}. \tag{92}$$

Transferring the wavelength (r_b) to the left hand side in the full energy equation and reorganizing,

$$|E_{sum}|r_b = |\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{1}| + \frac{1}{2}|\frac{\pi c^2 r_e^2}{m_{eo}}(m_e m_p)(\frac{2\pi}{1})[\frac{1}{r_b} - \frac{1}{|r_\mu|}]|. \tag{93}$$

And substituting the frequency for the wavelength,

$$\frac{|E_{sum}|c}{\nu} = |\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{1}| + \frac{1}{2}|\frac{\pi c^2 r_e^2}{m_{eo}}(m_e m_p)(\frac{2\pi}{1})[\frac{1}{r_b} - \frac{1}{|r_\mu|}]| \tag{94}$$

Moving the constant c to the right hand side,

$$\frac{|E_{sum}|}{\nu} = |\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{c}| + \frac{1}{2}|\frac{\pi c^2 r_e^2}{m_{eo}}(m_e m_p)(\frac{2\pi}{c})[\frac{1}{r_b} - \frac{1}{|r_\mu|}]|. \tag{95}$$

$$\frac{|E_{sum}|}{\nu} = 6.624 \times 10^{-34}. \tag{96}$$

This sum of the energies is equal to the value that Planck's constant.

$$\frac{|E_{sum}|}{\nu} = (0.9996)h. \tag{97}$$

This is in excellent agreement to the known values. Of course, the final extraction of the electron from the proton leaves the electron with half of the energy which gives the final mass of the electron as it is known. This fact also affects the constants which have been determined by measuring the effects of the electron. Also, it's extracted form the obit of r_b which gives the wavelength $\lambda_b = 2\pi r_b$ which gives

$$m_e = m_{eo} + \frac{h\nu_b}{2c^2} = m_{eo} + \frac{1}{2}\frac{hc}{\lambda_b}\frac{1}{c^2} = m_{eo} + \frac{h}{2}\frac{1}{2\pi r_b}\frac{1}{c}. \tag{98}$$

Which is equivalent to

$$m_{e^-} = m_{eo} + \frac{1}{2}[\frac{e^2}{4\pi\epsilon_o} + \frac{1}{2}(G_c 2\pi m_{e^-} m_p)(\frac{1}{|r_\mu|} - \frac{1}{r_b})]\frac{1}{2\pi r_b}\frac{1}{c^2}. \tag{99}$$

$$m_{e^-} = m_{eo} + \frac{1}{2}[\frac{e^2}{4\pi\epsilon_o} + \frac{1}{2}(\frac{\pi c^2 r_e^2}{m_{eo}} 2\pi m_{e^-} m_p)(\frac{1}{|r_\mu|} - \frac{1}{r_b})]\frac{1}{2\pi r_b}\frac{1}{c^2}. \tag{100}$$

$$m_{e^-} = m_{eo} + 3.322 \times 10^{-33} kg = 9.1096 \times 10^{-31} kg \tag{101}$$

Again, this is in very close agreement with measured values. Each calculation is also well within any standard deviation of error. This model demonstrates how the mass of the electron as it is known depends on how it is obtained and once again affects any constants that are determined measuring effects on any charged particle.

TABLE I: The values of the Bohr energy levels and the energy calculations of the new model.

n	$E_{Bohr}(J)$	$E_{calculated}(J)$
1	2.18×10^{-18}	2.18×10^{-18}
2	5.45×10^{-19}	5.44×10^{-19}
3	2.42×10^{-19}	2.42×10^{-19}
4	1.36×10^{-19}	1.36×10^{-19}
5	8.71×10^{-20}	8.71×10^{-20}
6	6.05×10^{-20}	6.05×10^{-20}

D. Correlation to the Bohr Model

Yet another point of validation arises through the equivalence to the Bohr model. Many are aware of the predicted energy levels of the Bohr model,

$$E = -\frac{Z^2 e^4 m}{8n^2 h^2 \epsilon_o}. \tag{102}$$

The real amount of energy needed to maintain the electron in the desired orbital is the repulsive energy. This repulsive energy is the energy that is required to counteract the electrical energy. The equation is the same as above except that functionally, all of the magnetic components of the electron have been moved to the right side of the equation and the electric component is on the left. The effects are seen as light from a decoupled state such that the magnetic energy is split between charges. Also of important note is the variable n is included in the equations. Before, n was set to one for the base radius.

$$E_E = \frac{1}{2}(E_{e^-p} - E_{e^-e^+}). \tag{103}$$

$$\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{r} = \frac{1}{2}[G_c \frac{2\pi m_{e^-}}{nr}(-\frac{m_p}{nr} + \frac{m_{e^+}}{n|r_\mu|})]. \tag{104}$$

In an expanded form,

$$\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{r} = \frac{1}{2}[\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi m_{e^-}}{nr}(-\frac{m_p}{nr} + \frac{m_{e^+}}{n|r_\mu|})] \tag{105}$$

Again, use the absolute value to avoid directionality.

$$E_{repulsive} = |\frac{1}{4\pi\epsilon_o}\frac{e(-e)}{r}| = |\frac{1}{2}[\frac{\pi c^2 r_e^2}{m_{eo}}\frac{2\pi m_{e^-}}{nr}(-\frac{m_p}{nr} + \frac{m_{e^+}}{n|r_\mu|})]|. \tag{106}$$

As seen in Table 1, the novel model presented here is in excellent agreement with another foundation of modern theory. This piece is interesting because of the value n. It's well known that there is a variable energy state of the electron in the atomic state, but what is interesting here is that the equations suggest that the energy states can also be altered by manipulating the magnetic state of the electron obtained upon pair production. Also, there is a well defined repulsive force.

E. CBR

The final piece needed to validate this model is the cosmic background radiation or CBR for short. Although all unexplained data does not necessarily need to fit within a particular model, CBR does need to be explained since it's traditionally used as evidence for the big bang model. This model does require a certain amount of energy to occur. In the outwardly spiraling model, there is an amount of energy required to be present to in the presence of the proposed motion. A rotational model is logical since it's a well known effect that microwave energy causes a rotation in matter. The torque arm or r_g is given by the atom to be r_b.

Using hydrogen for the model, the electron is at $n = 1$ for the Bohr radius as established earlier. The torque arm potential for this is as follows:

$$Er = -G_c \frac{1}{r_b} m_{e^-} m_p \tag{107}$$

This potential is present in every hydrogen atom in its ground state. The energy needed for the torque is determined by dividing the potential by the distance to the center of rotation and thus,

$$E = -G_c \frac{1}{r_b} m_{e^-} m_p (\frac{1}{r_u}). \tag{108}$$

And the energy density required for action based the electron such that it's based on a known elementary particle with fundamental parameters,

$$\frac{E}{V} = -G_c \frac{1}{r_b} m_{e^-} m_p (\frac{1}{r_u}) \frac{3}{4\pi r_e^3}. \tag{109}$$

The equation is not exact because the potential does change within the distance of r_e but it's quite small when it's relative to the scale of r_u. This is in fact the same energy density observed from the CBR and this can be determined by treating the electron with this energy density as a black body. The photon energy required to be present for this motion is as followsz:

$$\frac{4\pi^5 k^4}{15(hc)^3} T^4 = | - G_c \frac{1}{r_b} m_{e^-} m_p (\frac{1}{r_u}) \frac{3}{4\pi r_e^3} |. \tag{110}$$

Solving for T gives,

$$T = 2.71K. \tag{111}$$

Of course, the source is not at the center of the rotation defined by r_u, but is most likely a result of changes in momentum from an orbit around the galactic center or some repulsive source from the galactic center such as antimatter. Thus, the energy can be determined from the motion. This is tremendously useful information. For example, a spacecraft that is traveling at high velocities could capture real time data on the CBR to determine how its own motion will effect it's interaction with other matter that is known to be acting within known parameters. Exact values would be a local phenomenon and observations on the large scale would be averages. Because the CBR relates exactly to the energy density needed to provide the torque for the rotation validates the original derivation of the motion as a cyclic pattern.

VI. DISCUSSION

In previous sections, a developed theory of interactions was provided which was demonstrated to be extremely accurate on both the large and small scale. With one equation very similar to the Newton's gravity, high precision results can be produced for short and long range interactions between neutral and charged systems when used properly. It provided results for gravity, repulsive forces between oppositely charged particles, and attractive forces between like charged particles. That equation is

$$E = G_o \frac{1}{r_g} \frac{m_1 m_2}{r}, \tag{112}$$

where,

$$G_o = \pm\frac{\pi n_{e1} n_{e2} v^2 r_{elem}^2}{m_{elem}}. \quad (113)$$

The method produces the same results as the magnetic potential calculation does but the ratios within the constant allow a new equation that incorporates the idea that the energy gained from magnetic interactions produces a mass effect or addition. This mass equivelent is substituted for the magnetic dipole interactions which produces the inverse cubed effect. The fact that the electrons properties are a result of how it is obtained and measured has been recognized by this method. When this mass adjusted magnetic potential is coupled with the electric potential, it proves to be even more useful. Because it produces the exact same results as the foundations of modern physics, it validates the formulation of segmenting the underlying qualities of the electron. Presented in earlier sections are simpler examples of the utility of this system. It could be more complicated as the distance from the center or rotation (r_g) varies. The two models above were either of equal masses or one mass outweighed the second mass to the point it could be estimated as stationary which makes the calculations that much easier. Also, many additions such as effects of the proton magnetic moment have been ignored because of their relatively small additions and for the purpose of demonstrations of how it is formulated. These possible additions could easily account for small inaccuracies. This theory of gravity being the result of a localized magnetic field effect of a large scale angular acceleration generates as many questions as it does possibilities. One such possibility is that gravity is not a true constant and changes over time and distance as indicated by $1/r_u$ and H_o. The Hubble constant would simply be a modifier that demonstrates both the regional linearity of the shifting magnitude of the gravitational "constant" and the independence of the electron radius (r_e) which effects gravity by the square of the radius (r_e^2). It should be noted that if the rate of expansion is truly increasing, this "constant" would change less that 1% over several billion years and it would be difficult to measure any such change. On the other hand, if the expansion is simply an observed constant angular velocity, the gravitational constant would be a true constant. Many correlations have been demonstrated between gravity and electromagnetism, such as the similarities between linear plane gravitational waves and plane electromagnetic waves [15]. One of the most significant reasons that one should assume that gravity is of electromagnetic origins is that the action of gravity is at the speed of light and the speed of light is governed by the same laws that govern the laws of electricity and magnetism. If gravity were independent of electromagnetism, there would be no reason to obey the maximum speed limit of light. Again, what is being measured is of concern. The problem of detection would be equivalent to attaching a detector to an electron and trying to measure the field generated as it accelerates. This, of course, would result in the detector showing no change in the field produced by the electron because the electron is the reference point where the detector is experiencing the same acceleration as the electron. Whereas an observer or detector separated from the electron would clearly observe a field generated by the electrons acceleration. The detector needs to have a separate and proper point of reference to observe the acceleration. Also noted is the change in the sign of the equation when a test positron is used in place of an electron. A scenario in which the electron and positron are traveling together along the same curved path, the positron would experience a force opposite that an electron would experience. This effect is similar to two parallel currents or the opposite curls of opposing charges in a bubble chamber. Thus if antimatter and matter were traveling together along the same arched path, the electron in the atomic (neutral) state is observed as a net attractive force to another electron's charge and the positron in its atomic state would be observed as repulsion to and electron's charge by simply forcing the electron and positron curve in opposite directions. Thus, matter and antimatter cannot exist together naturally since they would be forced in opposite directions. This difference between matter and antimatter is what the gravitational constant represents. This solution is based on an extremely fundamental concept of electricity and magnetism. This suggests that equal amounts of antimatter and matter exist, but were forced apart in their neutral states due to masses relation to the defined polarities. Because antimatter and matter pairs are created in an environment where they are effectively traveling together, this would also suggest antimatter would be problematic to work with due to heightened decay rates from the opposing forces and this is observed [3]. Continued antimatter decay studies should show this. Differences between the pairs might not always show that the component defined as antimatter may be the component with advanced decay rates. Symmetry and which charge is the central core will affect the rates. This theory would also suggest possible anomalous accelerations based on the velocities, curvature radius and whether it is matter or antimatter interactions. The resulting accelerations would vary greatly. The ideas are based on well verified results of electricity and magnetism. The new part is the variability of the equation to make it useful from gravity on the large scale all the way to the atomic scale.

The results derived indicate that the action which causes gravity also has repulsive effects between oppositely charged entities. On a relative large scale, these repulsive and attractive effects follow an inverse square law; but certain variations on the model also produce a force that follows the inverse cubed law on a small scale such that similarly charged particles experience an attraction and oppositely charged particles can experience a repulsive effect. Once the effective inverse cube law takes effect, the repulsive effects can override the attractive forces and visa versa.

This effect is what gives opposing charges stable "orbits" and thwart annihilation. This inverse cube effect can be seen when r_g is in terms of r or more simply; it can be seen when r_g is expressed in terms of distance separating the systems in the force equation. This method was used in the pair production model. This can occur due to the three dimensional particle-like nature of the particle which results in a pi multiplier. The inverse cube law can explain abherent effects typically associated with dark matter. Also, the effects which are associated with gravity are easily relatable to other known effects and constants such as the permeability and permittivity of vacuum, the Bohr radius, the Bohr orbital energy levels, the Planck constant, the CBR and the masses of particles. Because this new model fits the most fundamental aspects of modern physics, this new model should work within any system which is based on these fundamentals.

By developing a model based on fundamental electrodynamics and relating the localized field effect of the electron to the effects of gravity, the Bohr radius and the electrons measured mass, it was demonstrated that matter and antimatter repel each other if they are traveling together along the same curved path. Again, this is similar to the effect that a bubble chambers uses. Having simplified the cosmic model by eliminating a constant from the equations, the question of "where is the antimatter," has been answered and it brings up the question of the necessity of dark matter since the causality of gravity was related to the motion defined by the Hubble constant. Rather, gravity is not resisting the expansion but is a direct result of the motion associated with the Hubble expansion or more appropriately the Hubble Motion. These ideas do not invalidate any known data or observations, nor does it invalidate the idea of dark energy but it does bring into question previous interpretations of some scientific observations. Because this new model can answer questions about antimatter and "dark" matter, it shows an advantage over the model. The only way to reduce the imposed limits would be to reduce the kinetic energy or temperature. Reduced velocities would lower both the positive and negative gravitational forces ultimately reducing the effects to being purely based on the electrical potential. Logically, this could not happen because the electric potentials create motion maintaing the inverse cube limits and thus a singularity could not occur in this situation and when it does, it simply produces photons in the annihilation event. Because, a singularity is not possible by this model, this might also suggest a more energetically favorable solution to the universe over the Big Bang, a theory which is, energetically, the most unfavorable model. This would be evidence against the Big Bang along with other possible evidence such as the anisotopy and cool spots matching voids. Although it's not clear if antimatter could be directly observed from a telescope, evidence of zones of separation of matter and antimatter might be detectable if any exist close enough to be observed. Annihilation radiation sources would be a good place to start and plasmas are prevalent at the borders of voids[17, 23]. Also, this model provides an explanation as to why gravitational forces appear to be stronger than normal without the proper matter present by invoking energies provided by the inverse cube law outlined in previous sections. It could also explain the flatness of space without the presence of dark matter by providing a repulsive anti-matter to prevent a more spherical distribution associated with electromagnetic effects. Also, this provides a conventional explanation for the abundance of positron near the center of the galaxy [9] and predicts that it should be there. All this is to say that this model fits well into a steady state universe model. Also, expansions of this model onto the molecular scale might be able to produce a more accessible source of validation by observing energy differences in preferred orbital levels of atoms and the neutron rich counterpart. The structure of the proton should be elucidated first so that the proper field effects can be accounted for. Also if a non-solar centric system can be found and measured, it might be found that it deviates from the Hubble relation. By non-solar centric, it is implied that the region is not dominated by Hydrogen. However, it has been found that iron rich systems have an angular rotation which is faster than the non-iron rich counter parts [1] and are pushed outwardly more quickly which would support the antimatter repulsion scheme. This momentum conservation might simply be the cause of the rotational velocity and thus the source of the Hubble motion. But one likely possible source of the rotation would be the abundance of antimatter near the galactic center which would cause normal matter to rotate outward such as the equations describe. The positron repulsion would not explain many observed phenomenon but the model outlined in this work does allow a more pervasive effect which will not be discussed in this work. Although this model already predicts the correct results for several systems large and small, continued validation on the small and large scale would be ideal. Future development should include more accurate renditions by replacing the equations based on the electron with equations based on values defining smaller elementary particles. Additionally, expansions on the pervasive repulsive effects need to be expanded.

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