A Quantization of Gravity

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Abstract

This is a brief description of a new look at gravity as the result of low-energy tachyons, refracting with other elementary wavicles to form the fundamental particles. It includes a calculation of the rest energy, base frequency, and other essential properties of a low-energy tachyon.

Main Article

Of the 4 known fundamental forces, only gravity extends over astronomic distances. While electro-magnetism can do so in theory, large differences in charge are not typically observed. Further, if an object a billion light years away suddenly gains mass, it affects us immediately, while a change in charge affects us a billion years later. Similarly, while the gravitational effects of black holes are readily apparent outside their event horizon, any electromagnetic effects are trapped within.

This leads to the obvious conclusion that the intermediary for electromagnetism (the photon) moves much slower than the intermediary for gravity (the graviton). The general name for wavicles (particles, waves, etc.) that move faster than light is a tachyon.

It is often convenient to separate the behavior of slow moving wavicles (tardyons) into low-energy and high-energy. Low-energy tardyons have essentially fixed "mass". High-energy tardyons have mass that varies considerably with velocity. To take an arbitrary boundary, at V=c/7 the effective mass has risen 1%. Below that velocity we have low-energy tardyons, and above it high-energy.

With tachyons, a similar differentiation is useful. Solving the Lorentz equation for velocity above that of light, the effective mass declines from infinity at V=c to 0 as V approaches infinity. For high velocities, the product of effective mass and velocity approaches a constant. At V=7c, this constant is 1% away from the actual product, so this is our boundary: low-energy tardyons are those travelling above 7c, and high-energy tardyons travel below 7c (but above c).

Taking a limit to the Lorentz equation as $V \rightarrow \infty$, we get $E_v \rightarrow E_0 ic/V$. From this we can treat the rest energy as negative and imaginary. From Planck for a photon, $E=hc/\lambda$. Solving for wavelength, $\lambda_v \rightarrow hV/E_0 i$. Again, as $\lambda\nu=V$, solving for frequency, $\nu_v \rightarrow E_0 i/h$. That is, the frequency approaches a constant. To see how this actually varies for high velocity, we can do a binomial expansion. Expanding Lorentz for frequency as a function of velocity, $\nu_v=\nu_\infty(1+c^2/2V^2+c^4/6V^4+\ldots)$. At the edge of low-energy tachyons ($V=7c$), frequency has risen 1% from the constant.

So far, we have been using symbols for the interesting values: rest energy, velocity, base frequency. In order to calculate actual values for these we need some data points. A way forward is to assume structures for known wavicles and see what values result. The easiest wavicle to look at is the photon. The relationship between its energy and wavelength are well known, across a reasonable range of values. Assuming the photon is comprised of 1 or more proto-photons and 1 or more gravitons, we can deduce some behaviors for the graviton.

The simplest arrangement of these constituents is concentric orbits with 1 proto-photon and 1 graviton. Since the graviton is assumed to be holding the photon together, it is interior and the proto-photon is exterior. Each has a share of the total energy content, and each has a wavelength matching that of the overall photon. The attraction upon the proto-photon is equal to the centripetal effect pushing outward on it. Since the graviton is also subject to centripetal effects, the proto-photon must repulse it for this scenario to work.

In order for the graviton to remain interior to the photon, and not escape the repulsive proto-photon, it must somehow be trapped. Looking at the Lorentz equation again, length also varies with velocity. The length of the proto-photon as perceived by the graviton varies with the relative velocity. If the graviton and the photon are oriented in parallel, this is the difference between the gravitons velocity and the proto-photons. If they are moving anti-parallel, the relative velocity is the sum of their individual velocities. In either case, since the graviton is traveling faster than 7c, it is greater than c.

As $V \rightarrow \infty$, $L_v \rightarrow L_0 iV/c$. Again, with the caveat of V being relative velocity, and much greater than c. Since the graviton is trapped, we can deduce that $L_v \geq \lambda_v$.

That is, the length perceived by the graviton for the proto-photon is greater than or equal to the wavelength of the graviton. From the gravitons perspective, it is trapped in a shell formed by the proto-photon. Broadening our view, we can see that each graviton in the universe is similarly trapped, between pairs of wavicles or within them. Otherwise they would zoom out of the universe.

Again focusing on our simple model of the photon, it is possible to quantify the energy content of the various constituents and the distance between them. Treating distance as small, the energy content of each piece is similar. The attraction upon the proto-photon is proportionate to the product of the mass of each, over the distance squared. The repulsion is just the centripetal effect, equal to twice the kinetic energy divided by the radius of its orbit. Since radius is wavelength over 2 pi, and total energy varies inversely with wavelength, each of these can be calculated.

Using d as distance between layers, $F_g = Gh^2c^2/4\lambda^2 d^2 c^4$, and $F_c = 2\pi hc^2/2\lambda^2$. Taking these as balanced, we can simplify to $d^2 = Gh/4\pi c^3$. This comes to 1.14286×10^{-35}m, which is Planck's distance (L_P) over radical 2. If the graviton and the tardyon are similar in size, this is the diameter of each, for the simple model.

If our simple model were the only possible choice, our problem would be solved. However, it is possible to show that a similar solution can be generated for any plausible piece count to the photon. With piece count of P_γ the general form becomes $d^2 = Gh/2P_\gamma \pi c^3$. Due to Pauli's Exclusion Principle, not all pieces are the same amount of energy (not all can occupy the 1s orbitals), so we need a P^*_γ. This is the number of pieces normalized to account for higher energy orbits. So $d = L_p/\sqrt{P^*_\gamma}$. We will need to find another data point.

The next simplest wavicles are the family of negatively charged leptons. The electron, muon, and tauon have reasonably well known properties. The photon was generated with 1 or more zero rest mass proto-photon(s) which had a spherical orbit, and surrounded an imaginary rest mass graviton in a spherical orbit. The leptons, by contrast, have a proto-lepton with real rest mass, charge, spin, and other properties that need to be accounted for.

The simplest set of assumptions generates a tiered structure for the charged leptons similar to the photon with a central graviton (or set thereof), with a proto-lepton above, then possibly additional layers above. A plausible construction has the additional layers resembling a photon, with 1 or more proto-photons at the surface. The proto-lepton has a 2s type orbit in the electron, a 3s in the muon, etc.. As with the photon, these structures resemble soap bubbles, with all the mass at the surface, and forces pushing inward and outward in balance.

Fortunately, it was possible to show the total number of pieces P_l comprising the charged leptons was not more than 12. A complete solution space for the combinations totaling fewer than 15 pieces was generated, and in all cases only those whose graviton layers contained exactly 2 gravitons gave plausible results. Those with 1 graviton had too much centripetal effect to hold together, those with 3 or more collapsed inward. Those with an odd number of gravitons had huge angular momentum, those with even none (from the gravitons). From Compton's scattering, an effective radius of the electron of 386.16 femtometers can be deduced. Only a few solutions gave an effective radius of that size. (Effective radius is the distance from the center of mass to the proto-lepton layer. Since the proto-lepton has rest mass, the center of mass in the structure is between the center of volume and the current position of the proto-lepton). The simplest solution with Compton's effective radius has P^*_l of 12 and P^*_γ of 12. Surprisingly, the effective radius did not depend on the rest mass assumed, so that has to be calculated from angular momentum. This eventually gave E_0 for the proto-lepton of 48.21 KeV.

With a P^*_γ of 12, it is possible to calculate the full panoply of properties for the graviton. L_0 (or distance between the center of the proto-matter and the center of the graviton at closest approach) is $L_p/\sqrt{12}$ or $4.66*10^{-36}$ meters. If the graviton and the proto-matter wavicles are the same size, the graviton has a rest mass of –$i*2.66*10^{29}$ eV, giving a base frequency of $6.43*10^{43}$ cycles per seconds. This eventually proved untenable. The graviton is a member of a class of tachyons, each of which is likely to be the same size. From studies of 2 of the others, the diameter is less than 10^{-58} m. This means the L_0 we calculated is the radius of the proto-matter wavicle. From this radius and the known relationship between radius and energy the proto-matter in a 1fm radius photon are moving relative to the graviton about $6.7334*10^{20}$ c, or more practically the gravitons are moving at that velocity. This gives the graviton a rest energy of $–i*1.1072*10^{28}$ eV, and a base frequency of $2.6773*10^{42}$ cycles per second. The angular momentum of each of the 1fm orbiting graviton is then $1.1072*10^{22}$ MeV*fm/c, and varies nearly directly with radius, except when it gets to the high-energy zone, about 10^{-34} m in radius.

This solution has assumed the gravitational attraction within a sub-atomic particle is identical to that between. However a simple examination shows that not to be the case. Within a single structure, the graviton's orbit is tangent everywhere to the orbit of the proto-matter it is attracting. Between 2 particles, it is only tangent when the proto-matter is near the point where the line connecting the 2 particles crosses the proto-matters orbit. This means the G calculated is many orders of magnitude less than the G within a particle, so the size calculated is much too small.

As 90% of the mass of the visible universe is Hydrogen, I will arbitrarily assume the adjustment for the gravitational constant should be based on the fraction of the time the proto-matter in the proton is aligned correctly. Unlike the simple ring structure of the leptons, the proton in our model is a diquark/monoquark pair with a photon-like shell at the equator caused by the net charge. Of the 5 rings comprising this structure, 2 (containing the proto-quark(s)) are buried and only rarely accessible (when the line connecting the 2 particles passes through the central junction point more or less on the z-axis). The other 3 rings are typically involved in any gravitational interaction. The charge ring has 3 proto-matter bits (proto-photons) and the 2 color rings each have just 1 proto-gluon. A particular graviton pair can be tangent to 1 or 2 of these rings. If it is just tangent to 1 color ring, it has 1 chance per orbit of bumping into a proto-matter bit. If to 2 color rings, it has 2 chances. If it is tangent to the charge ring, 3 chances. And if it is tangent to the charge ring and a color ring 4. Keeping it interesting, the 2 color rings are elliptical, and of different sizes from each other. On a more positive note, the frequency of the graviton being virtually constant means we don't need to compute separate probability functions for the 2 frequencies.

The best analysis of this 3-dimensional probability function is beyond my skill, but a simple examination suggests the most probably configurations average 3 chances in an orbit. This means the relative force within the particle is the circumference of the proton divided by 3 times the tangent length of the proto-matter. Taking a limit to the infinite series this produces a diameter of about $4.46*10^{-32}$ m. The current estimate of the circumference of the proton is $5.29 * 10^{-15}$m. The sum of the 3 cross section arcs is $3.68*10^{-23}$m. The revised G is the new ratio times the original G, or about $1.44*10^{8}$ as much, which is $9.59*10^{-3}$ m^3/kg sec^2. This revised G is for use within particles only. A probability function will need to be derived for each case between particles.

Proton Radius:	8.407E-16	Proto-Photon Diameter:	9.33113E-36
Basis	**Input D**	**Half Arc Length**	**Output D**
-37	1.000000E-37	9.168969E-27	1.153503E-30
-36	1.000000E-36	2.899483E-26	6.486626E-31
-35	1.000000E-35	9.168969E-26	3.647698E-31
-34	1.000000E-34	2.899483E-25	2.051251E-31
-33	1.000000E-33	9.168969E-25	1.153503E-31
-32	1.000000E-32	2.899483E-24	6.486626E-32
	4.462879E-32	6.125310E-24	4.462879E-32
-31	1.000000E-31	9.168969E-24	3.647698E-32
-30	1.000000E-30	2.899483E-23	2.051251E-32
-29	1.000000E-29	9.168969E-23	1.153503E-32
-28	1.000000E-28	2.899483E-22	6.486626E-33
-27	1.000000E-27	9.168969E-22	3.647698E-33
-26	1.000000E-26	2.899483E-21	2.051251E-33
-25	1.000000E-25	9.168969E-21	1.153503E-33
-24	1.000000E-24	2.899483E-20	6.486626E-34

From the revised radius, the other properties of the graviton can also be deduced. With þ (the frequency ratio of proto-matter to graviton) of 1, the frequency is $6.72*10^{39}$ cycles per second. Velocity at 1 fm is $1.41*10^{17}$c. This gives a rest energy of $-2.32*10^{25}$ *i* eV.

The rest energy of the proto-matter can be calculated from the relevant constituents: charge bits and color bits, each of which have significant kinetic energy. See the Particulate Nature of Sub-Atomic Matter for details.

Looking slightly deeper, several explanations exist why the graviton attracts the other wavicles, but in turn is repulsed by them. Probably the simplest is to assume this it is the result of wave on wave refraction. When a wave moves through another wave, each wave is slowed and bent. Slowing a tardyon decreases the energy, causing attraction. Slowing a tachyon increases the energy, causing repulsion. This also explains the “strong” force binding quark/diquark pairs together. Each is moving through the surface of the other, mutually refracting. Similarly the electro-magnetic force is the result of the photon-like structures that surround charged matter refracting on the surfaces, between them when the charges are opposite, and around them when they align. The weak interactions occur when proto-matter is shattered in the course of a collision and reformed with different infra-matter constituents.

An additional assumption involves the simplification used to calculate centripetal force. Dirac’s Law assumes centripetal force is proportionate to rest mass, while relativity and experience show that it is instead proportionate to relativistic mass. So $F_c=m_vV^2/r$, which is equal to $2E_K/r$. Since E_K, the kinetic energy, is readily available it can be used for all 3 types (tardyons, tachyons, and luxons). The E_K used is explicitly the real portion of the difference between energy at the velocity and rest energy, as the rest energy is imaginary in the case of the tachyons.

It is also worth noting that acceleration for the 3 types (tardyons, tachyons, and luxons) differ greatly. Accelerating a tardyon (that is: adding to the linear momentum) increases its velocity, and increases its mass (mass only increases slightly for low-energy tardyons). Accelerating a tachyon (again adding to the linear momentum) reduces its velocity, while increasing its mass. Accelerating a luxon (anything that travels at the speed of light at all times) just increases its mass. Very high energy tachyons and tardyons (with V between .99c and 1.01c) act like luxons, with very little change in velocity and a large change in mass. In each case the kinetic energy increases with the increase in linear momentum.