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The Graviton: An Emergent Solution From The Equivalence of Universal Magnetic Field Intensity and Radiant Flux Density

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ABSTRACT

Measurements have shown an inverse association between natural electromagnetic intensities and irradiance from background photons. In general for every ~10^{-12} W·m^{-2} increase in photon radiant flux density there was a 1 nT decrease in intensity of the ambient static (geo-)magnetic field. Dimensional equivalence of the two quantities required the latter to be multiplied by ~10^{-3} A·s^{-1}. Assuming ~10^{79} particles universally, each with a unit charge, the rest mass of that particle would be ~10^{-65} kg or the median solution for the graviton. On the bases of the calculations and conceptual inferences, entanglement phenomena across the space-time that defines the universe could be mediated by a gravitational field whose quantized component, the mass of a graviton, when expressed as the square of the hypothetical entanglement velocity, **is** light. This velocity (10^{23} m·s^{-1}) is derivable from independent approaches that require the consideration of the universe as a single set. If this inference derived form empirical measurements is valid, then there is additional evidence that "excess correlation" and entanglement of photons anywhere in the universe is mediated by quantized components of a gravitational field that is contained within the total spatial and temporal boundaries.

Indexing terms/Keywords

graviton; entanglement; quantized gravitational fields; radiant flux densities; 10^{-12} W·m^{-2}; magnetic field-photon density equivalence; excess correlation

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INTRODUCTION

The concept of "excess" correlation between two "entangled" photons such that a change in the property of one photon is associated with a "simultaneous" change in the other regardless of the distance of separation [1] appears unlikely when c, the velocity of light in a vacuum, is considered the only upper boundary of the first derivative of the space vector. The conception becomes less challenging if one assumes there is an "entanglement velocity" that is coupled to the total set of observations which is the universe's total space. Because: 1) the increment of time (Δt) is strongly related to the increment of space (Δs) by which events are perceived or measured as integrated phenomena [2], and, 2) at least two successive increments of time are required to discern a process, the total ΔS (the universe) would be associated with only one ΔT. Consequently at the maximum ΔS there would be no process and very likely no "time" according to traditional definitions. This approach is similar to that developed by Hu and Wu [3] who suggested that gravity: 1) originates from the primordial spin process within "pre-space-time" and, 2) is the "macroscopic manifestation of quantum entanglement".

Time as a component in physical processes would only emerge when the Δs is much less than the ΔS (the total or universal set). Within the total increment of space (the universe) all processes within the present, past, and future would be contained and implicit simultaneity would exist. Only at the much smaller Δs would apparent contradictions occur such as the change in property of an entangled photon now would be associated with a simultaneous opposite alteration in its pair billions of years ago [4]. That recondite, pervasive conditions exist can be inferred from the simple relationship between the Newtonian Gravitational Constant ($6.67 \cdot 10^{-11}$ $m^3 \cdot kg^{-1} \cdot s^{-2}$) and the average density ($1.67 \cdot 10^{-27}$ $kg \cdot m^{-3}$) of matter in the universe which results in a squared frequency whose value is the estimated time of the final epoch of about 90 to 95 billion years [5,6]. This could be considered the final boundary condition for the universe. One interpretation is that the present age which is ~14% of the total time reflects the present range in the proportion (10% to 14%) of baryonic matter-energy. Consequently the dominant dark energy and dark matter are prodromal phenomena of matter and energy yet to occur [6] during the next ~80 billion years.

For this metaphor to have validity there should be a realistic and rational mechanism that can be quantitatively related across levels of discourse. One candidate is the graviton. The graviton is to the quantized expression of gravitational fields as the photon is to the quantized expression of Maxwellian electromagnetism. Although the difference between particles and fields may ultimately reflect the degree to which the optimal Δt is involved with the perspective of observation and measurement, the presence of a mediator process is still essential. If the photon is the (gauge boson) particle of exchange between quarks and leptons and $W^{\pm}$ and Z^{o} bosons are involved with weak interactions, then the graviton might be the "gauge boson" that is the quantum of the gravitational field.

In their original work Goldhaber and Nieto [7], applying an earlier version of a method to infer the rest mass of a photon, concluded that the upper limit of the rest mass of the hypothetical graviton (μ_g) would be $\leq 2 \cdot 10^{-65}$ kg. Their recent review [8] indicates there is a range to this value although the median remains the same. They also concluded that the graviton rest mass corresponded to a graviton Compton wavelength of $6.7 \cdot 10^{-4}$ R where R was the Hubble's radius (H) of the universe as defined by the quotient of c/H. A quantized unit for the gravitational field should be relatable to electromagnetism in a reasonable and quantitative manner. Previously Persinger and St-Pierre [9], by relating the superb measurements of variation in G by Vladimirsky and Bruns [10] and Quinn et al [11] to concurrent subtle changes in global geomagnetic activity and associated variations in the interplanetary magnetic field, reported a consistent inverse correlation between the two such that increases in empirical measurements of variations in G were associated with discrete decreases in concurrent electromagnetic intensities. Here I develop the argument by quantification that this inverse relationship between photon flux density and magnetic field strength generalizes across different Δts of measurement and creates the condition for the graviton to be verified as the integrating factor or at least one of the major integrating factors.

QUANTITATIVE RELATIONSHIP BETWEEN MAGNETIC FIELD STRENGTH AND PHOTON POWER DENSITY

Vares and Persinger [12] recorded the minute-to-minute variations in the geomagnetic field measured by a magnetometer that was less than 0.5 m from an analogue photomultiplier tube (PMT). They found that for every approximately 1 nT increase in the variation of geomagnetic intensity the photon radiant flux density decreased by about 10^{-12} $W \cdot m^{-2}$.

Persinger et al [13] measured the second-to-second changes in the earth's magnetic field above plates of (about one million) melanoma cells and the numbers of photons emitted around the cells (as measured by a digital photomultiplier unit) and found a similar inverse relationship. They found that between 250 and 300 s or a change of ~ 0.5 to $1.5 \cdot 10^{-12}$ $W \cdot m^{-2}$ were required for a shift of ~1 nT. Hence for every 1 nT increase in the strength of the adjacent geomagnetic field the photon flux density decreased by ~10^{-12} $W \cdot m^{-2}$.

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A similar effect was recently (years 2013 through 2015) measured for the relationship between the day-to-day steady-state "local" geomagnetic field intensity and average daily "spontaneous" shifts in background photon flux density. The correlation between the vertical (z) component of the earth's magnetic field (which has been decreasing over the last few years) in Ottawa, Ontario and the PMT measures here in Sudbury, Ontario for this period of 1,538 days was -0.70. Regression analyses indicated that for every 1 nT decrease there was an increase of 0.058 units of the PMT. Given the standard error of the estimate this would be equivalent to between 2 and $3 \cdot 10^{-12}$ $W \cdot m^{-2}$. Partial correlation analyses between the PMT measures, z component and time (days) indicated that when any of the other variables was first accommodated the correlation between the remaining two variables was still between 0.30 and 0.32. Hence the effect was not completely shared time.

GRAVITON PREVALENCE AND ENTANGELMENT VELOCITY

The relationship between magnetic field intensity and photon flux density can be equated by $(kg \cdot A^{-1} \cdot s^{-2}) \cdot (A \cdot s^{-1}) = kg \cdot s^{-3}$. In other words the magnetic flux density in Tesla multiplied by a measure of current fluctuation per unit time produces a quantity that is equivalent to Watts per meter squared. Assuming the above values for magnetic field intensity and radiant flux density for photons, $2.9 \cdot 10^{-3}$ $A \cdot s^{-1}$ or between 2 and 3 mA per s would be required to balance the equation.

If the upper limit of the range for this "transform" of the temporal current quantity of 3 mA per is assumed to reflect a universal relationship, then salient solutions are obtained. A valid Eddington's Number of $1.58 \cdot 10^{79}$ particles [14] in the universe each with a unit charge of $1.6 \cdot 10^{-19}$ A·s would result in the total value of $2.53 \cdot 10^{60}$ A·s. When divided into $2.9 \cdot 10^{-3}$ $A \cdot s^{-1}$ the resultant value is $1.14 \cdot 10^{-63}$ s^{-2} or $3.28 \cdot 10^{-32}$ s^{-1}.

The equivalent energy from multiplying this frequency by Planck's constant ($6.6261 \cdot 10^{-34}$ J·s) would be $2.17 \cdot 10^{-65}$ J. This appears to be a very small amount of energy. However if there is unity within the total set ΔS, that is $m^2 \cdot s^{-2} \sim 1$ [15], then the equivalent mass would be $2.17 \cdot 10^{-65}$ kg. This is within the range of the estimated upper boundary for the rest mass of a graviton of $\leq 2 \cdot 10^{-65}$ kg calculated by Goldhaber and Nieto [7]. This theoretical particle (spin 2) has been hypothesized to be the quantum unit of gravitational fields.

This convergence elicits a critical question. Is the relationship between magnetic field variations and photon flux density coupled by a variable that actually reflects the basic unit of a quantized gravitational field? The simple product of the square of the entanglement velocity ($\sim 10^{23}$ $m \cdot s^{-1}$) would be 1 to $2 \cdot 10^{-65}$ kg· ($\sim 10^{46}$ $m^2 \cdot s^{-2}$) or 10^{-18} J to 10^{-19} J. This is the range of the visible wavelength for light. If this is valid then the entanglement phenomena across the space-time of the universe is mediated by a gravitational field whose component, the graviton, when expressed as a form of entanglement velocity, **is** light.

The entanglement velocity emerges when properties that represent the entire universe are considered. In one approach [16] the solution of $2.84 \cdot 10^{23}$ $m \cdot s^{-1}$ was obtained by setting the product of the space-time metric of a closed symmetry (a circle), that is $2\pi r$, $4\pi r^2$, $4/3\pi r^3$, and $2\pi rf$, or $21.3\pi^4 r^7 f$ equal to a comparable dimensional aggregate which was $G^2 \cdot m^2 \cdot d \cdot t^3$ where G was the Newtonian Gravitational Constant ($6.67 \cdot 10^{-11}$ $m^3 \cdot kg^{-1} s^{-2}$), m was the estimated mass of the universe ($2.38 \cdot 10^{52}$ kg), d was the width of the universe ($8.86 \cdot 10^{26}$ m) and "t" was the duration of the universe ($4.06 \cdot 10^{17}$ s). The resulting diffusivity term, called the "entanglement velocity", was $2.84 \cdot 10^{23}$ $m \cdot s^{-1}$. A second approach [17] based upon the ratio of the energy equivalence of the total universe expressed as potential difference over its length and its magnetic field value near the final epoch resulted in a value with the same order of magnitude.

I suggest that the predominance of "entanglement" effects within photons and the apparent restriction to quantum levels (the electron shell changes) occurs because this is the locus of the transformation. The visible and near-visible light range, the classic photon, is the solution for energy of the rest mass of the graviton when multiplied by the square of the entanglement velocity. The connection between the graviton and light could be considered fundamental if one assumes the validity of the statement by Megidish et al [18] that "entanglement between spatially separated quantum systems is one of the most distinctive results of quantum mechanics". The occurrence of discrete packets of energy coupled to shifts in electron shells particularly within the visible and para-visible wavelengths defines this domain.

THE GRAVITATIONAL ENERGY OF A PHOTON AND LIGHT

If the photon is as intricately related to gravity as indicated in the previous section, then the rudimentary application of the Newtonian relationship should exhibit the effect once quantum level dimensions were accommodated. Assuming the upper limit of the rest mass of a photon to be $\sim 2 \cdot 10^{-52}$ kg [20] and the distance between any two rest values is the smallest known unit, Planck's Length ($1.62 \cdot 10^{-35}$ m) and G is $6.67 \cdot 10^{-11}$ $m^3 \cdot kg^{-1} \cdot s^{-2}$, the force acting between any two upper limit rest mass photons would be $10.18 \cdot 10^{-45}$ N.

When distributed across the length of the universe, ~10^{26} m, the energies occur within the range of 10^{-19} to 10^{-18} J. This range of values constitutes the energies associated with photons within the visible and adjacent ultraviolet and infrared spectrum. In other words the phenomenon of light or visible photons would only emerge if the Planck's Length-level gravitational forces between photons were distributed over a distance that would define the universe as described by Hu and Wu [3]. Such a relationship would require a process of diffusivity, such as the entanglement velocity, that could accommodate such distances. This inference is consistent with Rowlands' [19] conclusion that gravitational force is "intrinsically non-local and not limited to the speed of light transfer".

In one of Penrose's [21] original manuscripts concerning nonlinear gravitons and the "curved twister space" he developed the mathematics to suggest that a single graviton involves both curvature and the nonlinearities of Einstein's version of relativity. The involvement of an (ultimately closed) circular geometry moving in one direction (a helix) around an infinite but bounded perimeter is important because as recently shown by Fickler et al [22] single photons with helical phase structures could carry a quantized amount of orbital angular momentum. They assumed there is no theoretical upper limit for the numbers of quanta of orbital angular momentum that can be transferred by a single photon and hence the probability is very high that entanglement between two particles with high quantum numbers was possible. Their data supported this supposition. It may be relevant that Mach's principle, that the (angular) momentum of any particle is affected by the (angular) momentum of all particles in the universe, is consistent with this approach.

CONCLUSIONS

The graviton as a quantized description of the fundamental unit of a gravitational field exhibits a non-zero mass whose magnitude has been estimated. For the equivalent energy to emerge within the primary domain of discrete quantum energies that are frequently exhibited by shifts within electron shells, the upper limit of the non-zero mass must be multiplied by the square of what has been termed the "entanglement velocity". One interpretation of this relationship is that the substrate for entanglement or excess correlations between photons is contained within an intrinsic diffusivity within which the graviton is immersed.

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Author' biography with Photo

Michael A. Persinger, Ph.D. is a Full Professor at Laurentian University in Sudbury, Ontario, Canada. He is affiliated with a number of different programs including Biomolecular Sciences, Behavioural Neuroscience and Human Studies as well as the Quantum Molecular Biology Laboratory where he is examining the relationship between 10^{-20} J events within the brain and complex functions. Dr. Persinger and his colleagues have experimentally demonstrated the validity of Cosic's Molecular Resonance Recognition Model, Bokkon's Cerebral Photon Field Hypothesis and the efficacy of proton driving patterned magnetic fields that inhibit the growth of cancer cells but not normal cells. He is an interdisciplinary scientist whose primary goal is to integrate the physical sciences, social sciences and humanities according to their fundamental operations. Within the last 50 years he has published more than 500 technical articles in variety of areas that range from Astronomy to Zoology. His present experiments are focused upon understanding the relationship between the structure of space and distribution of energy, the shared dimensional equivalence of quantized gravitational and electromagnetic fields, and the empirical demonstration of an intrinsic entanglement velocity.