Journal of Modern Physics, 2020, 11, 1330-1360
https://www.scirp.org/journal/jmp
ISSN Online: 2153-120X
ISSN Print: 2153-1196

The Mind-Brain Problem Bose-Einstein Statistics, Temperature, Heat, Entropy God and Other Elementary Particles

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How to cite this paper: Christensen Jr., W. J. (2020) The Mind-Brain Problem Bose-Einstein Statistics, Temperature, Heat, Entropy God and Other Elementary Particles. *Journal of Modern Physics*, **11**, 1330-1360.
https://doi.org/10.4236/jmp.2020.119084

Received: August 16, 2020
Accepted: September 14, 2020
Published: September 17, 2020

Abstract

The purpose of this research is to apply the Einstein's principle of relativity to solve the mind-brain problem and to generate all Standard Model Particle masses. Our approach is somewhat analogous to the dualistic idea of Descartes. Instead of a pineal gland, wherein the brain interacts with the mind, we propose during the developmental stages of the human fetus the tiny brain begins to communicate with the smallest structures of spacetime. This interaction occurs as the fetus brain begins to emit thermodynamic low heat energies, which are then absorbed into the smallest structures of spacetime saturating the interstices of the fetus brain. Think of these heat-energies like Morse code instructions. Since these kinds of interaction involve spacetime, with brain matter-energy, and that our main guiding principle is that of relativity, our research resulted in a general relativistic wave equation, wherein the n-valued heat-energies emitted by the brain-field-matrix $B_{\mu\nu}$, is identified as the energy momentum tensor of general relativity. The spacetime mind-matrix ($M_{\mu\nu}$) is likewise identified as the Riemannian curvature matrix. Together they form a general relativistic expression given by: $M_{\mu\nu} + p_{\mu\nu}M = cB_{\mu\nu}$. Here c represents the combined general relativistic constants. By detaching the energy momentum tensor $B_{\mu\nu}$ from the general relativistic wave equation, converting it to an operator, and then combining the time component with the Bose-Einstein equation, resulted in a brain temperature function capable of calculating precise heat-energies emitted by the brain during the formation of the fetus mind. As the fetus brain becomes more complex, it further organizes the mind. At some point self-aware consciousness is evoked within the spacetime mind. The same equation (*relabeled to distinguish it from the mind-brain equation*) can be applied to generate all Standard Model Particle masses.

Keywords

Mind-Body Problem, Thermodynamics, Heat Energy, General Relativity, Particle Mass Problem, Hydrogen Spectra, Consciousness, God Particle, Neuro-Fields, Spacetime Mind, Neuroscience, Neurotrophins

1. Introduction

The purpose of our research is to apply Einstein's principle of relativity to solve the: 1) Mind-brain problem; 2) Why particles have the mass that they do; 3) And finally to classically derive the hydrogen spectrum as a function of the electron's mass variance—not based on the electron's orbiting radius.

In our previous research, we had attempted to solve the particle-mass problem, then to apply it to derive the hydrogen spectrum, as a function of the bound electron's mass. Our starting point was Einstein's Principle of Relativity. Hence, necessarily we applied the general relativistic wave equation to our developmental ideas. Since we were considering tiny particles, we applied the general relativistic equation on the smallest structures of spacetime. Guided by Heisenberg's oscillator success in the development of quantum theory, we proposed these tiny spacetime structures to be that of graviton oscillators. This resulted in an n-valued energy momentum tensor—from which elementary particle mass could be precisely generated. However, at the time, we had not yet understood how to limit the infinite number of possible n-values, which appeared in the energy momentum tensor. In this way our previous particle mass results were not practically constrained—more problematic, the energy momentum tensor contained no measurable variables that could provide a statistical range of expectation values for predicting particle mass. To resolve this matter, in our current research, we detached the energy momentum tensor from the general relativistic wave equation, turned it into an operator, and then combined the time component of the operator with the Bose-Einstein statistical equation. This resulted in a temperature equation capable of producing a statistical range of possible elementary particle masses for a given accelerator or spacetime temperature.

Because Einstein had stipulated fundamental approaches to science must necessarily be able to provide a unified foundation on which the theoretical treatment of all phenomena could be based, we sought to apply our general relativistic approach to various other underlying questions of nature. This led us to the mind-brain problem, which continues to stump physicists and neuroscientists to present day. Overall, our approach became somewhat analogous to the cartesian dualistic idea of Descartes. Instead of a pineal gland, wherein the brain interacts with the mind, we propose during the developmental stages of the human fetus that its tiny brain begins to interact with the smallest structures of spacetime. This interaction occurs as the fetus brain grows in complexity and begins to emit thermodynamic emissions of low heat-energies. In turn these energies are absorbed into the elemental structures of spacetime saturating the interstices of the fetus brain. Think of these discrete heat-emissions like Morse code instructions. Since these interactions involve spacetime with brain matter-energy, and that our main guiding principle is that of relativity, our research resulted in a general relativistic wave equation that can be applied to the mind-brain problem, as well as applied to calculate all Standard Model particle masses, including those not yet discovered.

2. Elementary Particle Mass and Mind-Brain Problem

To begin our three-fold discussion on: 1) Why do particles have the mass that they do; 2) Solution to the mind-brain problem; 3) And to classically derive the hydrogen spectrum as a function of bound electron mass variance—not on the electron's orbiting radius, we begin with the publication by Einstein and Rosen, entitled "The Particle Problem in the Theory of General Relativity [1]". As they wrote in 1935:

"*In spite of its great success in various fields, the present theoretical physics is still far from being able to provide a unified foundation on which the theoretical treatment of all phenomena could be based. We have a general relativistic theory of macroscopic phenomena* (*ours concerns microscopic phenomena that will require new understanding about the nature of tiny spacetime*), *which however has hitherto been unable to account for the atomic structure of matter and for quantum effects, and we have a quantum theory, which is able to account satisfactorily for a large number of atomic and quantum phenomenon but which by its very nature is unsuited to the principle of relativity* (*this principle requires that the equations describing the laws of physics have the same form in all permissible frames of reference*). *Under these circumstances it does not seem superfluous to raise the question as to what extent the method of general relativity provides the possibility of accounting for atomic phenomena* (*they literally mean the atom*). *It is to such a possibility that we wish to call attention in the present paper in spite of the fact that we are not yet able to decide whether this theory can account for quantum phenomena. The publication of this theoretical method is nevertheless justified, in our opinion, because it provides a clear procedure characterized by a minimum of assumptions, the carrying out of which has no difficulties to overcome than those of a mathematical nature.*"

Though Einstein and Rosen's work never came to fruition, their foundational efforts provided a pathway to discover a general relativistic solution to atomic phenomena. Modification, however, was required, simply because at the time Einstein and Rosen really only knew about the atom as consisting of the electron, proton, and neutron. Soon, Einstein's atomistic approach was made untenable with the discovery of each and every new particle, to which quantum field theory had successful answers for.

But then something quite remarkable happened just before general relativity faded into obscurity. It experienced an unexpected revival during the 1960's, so much so that Kip Thorne referred to these years as the golden age of general relativity [2] [3] [4]. Shortly thereafter, it was realized the premier particle theory based on quantum fields, could not account for the composition of dark matter, the most abundant material in the universe. Nor could it make sense of how to combine gravity with quantum physics. Suddenly, we were not in Kanas anymore, but instead taken deeper into the mysteries of the cosmos. What all this implied is that Einstein and Rosen's 1935 conceptual framework deserved another cosmological look.

In our general relativistic approach, a modification was required to account not only for dark matter particles, but for all elementary particles as described by the Standard Model of Particle physics. This we accomplished by applying a microscopic spacetime metric to the general relativistic wave equations and proposing that the gravitational free field was comprised of oscillating gravitons. In that way, we were adhering to the principle of relativity. Moreover in doing so we had discovered our approach could account for a much wider range of phenomena than could be explained by quantum physics. Such a wide-range application was requirement laid out in Einstein's 1935 paper.

Because we were considering developing our research on the tiniest structures of spacetime—microscopic spacetime, we were guided by the successful oscillator approach that Heisenberg applied to the electromagnetic free field [5]. Likewise, to the microscopic gravitational free field we applied graviton oscillators. This physical restriction applied to the general relativistic equations, provided enough of a constraint to build a classical Lagrangian and spacetime metric. When the metric was acted upon by the relativistic wave equations it resulted in an n-valued energy momentum tensor. Once converted to an operator and temperature function, it was applied to provide solutions to: The mind-brain problem: why elementary particles have the mass values they do; and finally to provide a classical approach to the hydrogen spectral lines. In the next section, we consider the mathematics to our approach.

3. Mathematics of the Complex Spacetime Metric

In our general relativistic approach to solving three fundamental questions, we proposed the smallest structures of spacetime to be founded upon the particle-oscillator idea proposed by Heisenberg in 1925 (*charged ball on a spring*) which he intended to quantize the free electromagnetic field. Applied to gravity, these oscillators are identified as spin-2 gravitons capable of being excited into n-valued energy states. Due to self-interaction with the gravitational field, the behavior and effect on spacetime itself, may be expressed and determined through the general relativistic metric $g_{\mu\nu}$, as we will argue subsequently.

Because the approach proposed here is classical (*but leading to discrete energy values*), this allows us to develop and apply a classical Lagrangian describing a field of oscillating particles from which we can then construct the spacetime metric. Classically the Lagrangian for a field of oscillating particles is well known in many different sources.

$$L = \frac{1}{2}\left(T_{ij}\dot{\eta}_i\dot{\eta}_j - V_{ij}\eta_i\eta_j\right) \tag{1}$$

here η_i represents small deviations from the generalized coordinates q_{0i}, which are expressed by the equation: $q_i = q_{0i} + \eta_i$. The η's subsequently become the generalized coordinates for the equations of motion, wherein the kinetic energy has only diagonal components:

$$T_i\ddot{\eta}_i - V_{ij}\eta_j \quad (\text{no sum over } i) \tag{2}$$

For a complete review see the work of J. B. Marion S. T. Thornton [6]. The solution to this expression has the form of normal coordinates given by:

$$\eta_i = C_k \mathrm{e}^{-i\omega_k t} \tag{3}$$

To simplify matters, let the coefficients C_k be set equal to one; let negative one-half be introduced into the natural exponent. These small changes will bring forth greater clarity to the construction of the spacetime oscillating metric but not really affect the physical results. Applying Rayleigh's principle to the individual coordinate frequencies ω_k (*representing oscillating spin*-2 *gravitons*), reduces the infinite number of frequencies to their fundamental mode of oscillation ω—one having the greatest intensity [7]. This implies the average kinetic energy $\langle T\rangle$, is equal to the average potential energy $\langle U\rangle$. Combining these concepts and mathematics, allows construction of a general relativistic basis—from which the spacetime metric is immediately determined to be:

$$g_{\mu\nu} \equiv e_\mu \cdot e_\nu = \mathrm{e}^{i\omega t}\delta^\mu_\nu = \mathrm{e}^{i\omega t}\eta_{\mu\nu} \tag{4}$$

Noting the cyclic behavior of the metric—suggests n counting numbers be introduced into natural exponent. In that regard, we select n^2 for reasons that will be discussed in subsequent sections. However, the most important reason, is that this approach actually works to yield precise particle masses once the metric is acted on by the general relativistic wave equation:

$$g_{\mu\nu} = \mathrm{e}^{n^2(i\omega t)}\eta_{\mu\nu} \quad (n = 0,1,2,3,\cdots) \tag{5}$$

It is significant to note that when $n = 0$, spacetime metric reduces to the flat Minkowski metric:

$$g_{\mu\nu} = \mathrm{e}^0\eta_{\mu\nu} \to \eta_{\mu\nu} \tag{6}$$

This condition is necessary if gravitons are to act as long-range force carriers. It also permits physical understanding of what microscopic spacetime is undergoing, as will be discussed in subsequent sections.

4. The Energy Momentum Tensor

After a straight-forward general relativistic calculation on the spacetime oscillator-metric [8] [9], (*where partial time derivatives results in the metric generating constant values*: $g_{\mu\nu,0} = i\frac{\omega}{c}g_{\mu\nu}$; *whereas spatial derivatives result in zero values*.

$g_{\mu\nu,i} = 0$), an energy momentum tensor is produced:

$$T_{\mu\nu} = \frac{n^2 c^4}{16\pi G} \begin{bmatrix} -\frac{3}{2}\frac{\omega^2}{c^2} & 0 & 0 & 0 \\ 0 & \frac{1}{2}\frac{\omega^2}{c^2} & 0 & 0 \\ 0 & 0 & \frac{1}{2}\frac{\omega^2}{c^2} & 0 \\ 0 & 0 & 0 & \frac{1}{2}\frac{\omega^2}{c^2} \end{bmatrix} \tag{7}$$

Because the approach taken in our general relativistic work was applied to microscopic spacetime, wherein the graviton behaves like tiny harmonic oscillators (*analogous to the electromagnetic quantum field development by three important leaders*, *namely*: *Max Born*, *Werner Heisenberg and Pascual Jordan* [10]) it will be more beneficially comprehensive to discuss some history on the development of the graviton oscillator: After the tremendous success of quantum field theory, Wolfgang Pauli, and Marcus Fierz set out to develop an analogous way to quantize the gravitational field [11]. It is referred to as massive gravity. Unfortunately, it was soon realized their approach could not replicate general relativity as they let the mass of the graviton go to zero (*necessary for long range gravitational forces*). But all was not lost. In the 1960's Richard Feynman sought to quantize the gravitational field starting with massless gravitons. Step-by-step he built the gravitational Lagrangian based on a linearization of the spacetime Lagrangian up to third order [12]. Once he completed his linearization program, he in turn compared it to a linearized Einstein's general relativistic equation up to third order (*massless fields only*) [13]. The calculation of which, is straightforward but *rather* tedious as the British might say. That was a good first-step, but it came to naught until in the 1990's when John Fang, Walter Christensen Jr., and Martin Nakashima [14] [15], advanced Feynman's quantum approach with gravitons interacting with other massless spin-particles through a consistency formulation that John Fang had developed prior and published in some very fine journals [16].

Having now established a historical-line of research on the gravitational field comprised of massless graviton oscillators, by reexamining our n-valued energy momentum tensor (*calculated directly from the spacetime metric—representing microscopic spacetime graviton oscillators*), it now becomes apparent that whenever $n > 0$, by different processes these microscopic gravitons were energized into higher n-states. Analogous to bound electrons, when these energized gravitons transition down into lower energy states they will emit discrete amounts of gravitational energy (*hinting toward dark matter processes*). We further understand that n-valued gravitons also form into classes or subgroups having their unique group attributes. This is key in explaining and solving a wide-variety of fundamental questions. In particular, why particles have the mass values they do, or to calculate the precise heat energies emitted from the facilitating brain resulting in the formation of the substrate mind or applied in the derivation of the hydrogen spectral lines as a function of bound electron mass.

5. Comparative Details of Geometry and Particles

What Pauli and Feynman provided is not so much a quantum link to classical gravity, but that spacetime can be interpreted as both geometric and particulate in nature. From our microscopic viewpoint, graviton particles are foundational to a general relativistic understanding of nature at the microscopic level and geometry to macroscopic spacetime, but either view is applicable anywhere in spacetime.

In microscopic spacetime, the resulting n-valued energy momentum tensor converted to a mass-temperature operator, describes the possible range of n-valued particle mass-energies emitted by these oscillatory gravitons at a given spacetime temperature. From Einstein's own words, he makes the connection between his geometric point of view and particles in spacetime as a kind of hybrid of particle geometry [17] [18]:

"These solutions $g_{\mu\nu}$ involve the mathematical representation of physical space of two identical sheets, a particle being represented by a bridge connecting these sheets."

Before closing this section we mention some additional characteristics of the energy momentum tensor.

1) First, though the covariant and contravariant energy momentum tensors are identical mathematically, upon inspection of their transformation equation we recognize they physically represent different spacetimes:

$$T^{\mu\nu} = g^{\mu\alpha} g^{\nu\beta} T_{\alpha\beta} = \mathrm{e}^{\left(-2n^2 i\omega t\right)} \eta^{\mu\alpha} \eta^{\nu\beta} T_{\alpha\beta} \tag{8}$$

It is apparent that whenever the continuous variable time, or the discrete variable n advances in the natural exponent, though the covariant variable remains fixed, the contravariant energy momentum tensor is cyclic. The interpretation being while the covariant energy tensor produces real n-valued mass particles, the contravariant energy tensor produces real or complex particle masses—ordinary and antimatter particle mass. Stepping back and reflecting on this result, this is just what one might have anticipated from the oscillatory nature of microscopic spacetime gravitons in that there is only a small window in which antimatter can be produced without being annihilated by ordinary matter. This provides the reason antimatter is rare throughout the cosmos.

We now recognize that it is within the construction of the general relativistic equations, at the microscopic level of spacetime, that something unexpected and fundamental is occurring. In the case of the energy momentum tensors, the covariant and contravariant energy tensors display the superposition condition. They either support particle production or act against each other. In this way, together they either generate completely real energies, whenever $\mathrm{e}^{\left(-2n^2 i\omega t\right)} = 1$. Under these conditions, the covariant and contravariant energy tensors are equivalently given by:

$$T^{00} = T_{00} \tag{9}$$

If this condition is not met, say when $e^{-2i\omega t} \approx 1$, and when $n \neq 0$, then spacetime generates a mixture of complex spacetime energies meaning the transitioning gravitons give off complex energies forming both real particle mass or antimatter. Over time, antimatter is nearly annihilated by ordinary matter, but ordinary matter has the advantage whenever $e^{\left(-2n^2 i\omega t\right)} = 1$.

2) We point out that the energy momentum tensors produce conserved quantities:

$$T^{\mu\nu}{}_{;\nu} = T_{\mu\nu;\nu} = 0 \tag{10}$$

3) Finally, we put the energy tensors in the form of n-valued rotational kinetic energy operators, which supports our oscillator spin-2 graviton approach. This is done by defining the moment-of-inertia I and angular frequency ω, in the following way:

$$I \equiv \frac{nc^2}{8\pi G}\begin{bmatrix} -\frac{3}{2} & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 \\ 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & \frac{1}{2} \end{bmatrix}; \text{ and } \tilde{\omega}^2 \equiv \begin{bmatrix} \omega^2 & 0 & 0 & 0 \\ 0 & \omega^2 & 0 & 0 \\ 0 & 0 & \omega^2 & 0 \\ 0 & 0 & 0 & \omega^2 \end{bmatrix} \tag{11}$$

Inserting these matrices into their respective Linear operators T and adding the together, results in the following expression which clearly reveals oscillatory motion:

$$T \equiv \frac{1}{2} I \tilde{\omega}^2 \left(n^2\right) \tag{12}$$

6. Energy Momentum Tensor Properties and Operator

Why is it when the covariant and contravariant spacetime metrics are complex, the resulting energy-momentum tensor is completely real? The mathematical reason is due to how Einstein constructed his relativistic wave equation—to ultimately be founded upon pairs of spacetime metrics. When the metrics are complex, the binary relationship between the covariant and contravariant spacetime metrics in combination are completely real—upon close inspection of the complex pairs given immediately below, the reason is made clear:

$$g_{\mu\nu} g^{\alpha\nu} = e^{n^2(i\omega t)} \eta_{\mu\nu} e^{-n^2(i\omega t)} \eta^{\alpha\nu} = \eta_{\mu\nu} \eta^{\alpha\nu} \tag{13}$$

Since the general relativistic wave equation, always acts on pairs of spacetime metrics, and when these pairs represent oscillating gravitons (*harmonic oscillations in general are necessarily complex*), they combine to become completely real. When acted on by the general relativistic wave equation they naturally generate an n-valued, real, energy momentum tensor $T_{\mu\nu}$:

$$T_{\mu\nu} = \frac{n^2c^4}{16\pi G}\begin{bmatrix} -\frac{3}{2}\frac{\omega^2}{c^2} & 0 & 0 & 0 \\ 0 & \frac{1}{2}\frac{\omega^2}{c^2} & 0 & 0 \\ 0 & 0 & \frac{1}{2}\frac{\omega^2}{c^2} & 0 \\ 0 & 0 & 0 & \frac{1}{2}\frac{\omega^2}{c^2} \end{bmatrix} \tag{14}$$

1) Note that the $\frac{1}{c^2}$ factor shown inside the energy momentum tensor matrix, arises from taking partial time derivatives. These factors are very necessary to maintain correct units on both sides of the equation (*where* $\frac{\omega^2}{c^2} \to \frac{1}{m^2}$, ω *has units of hertz and c has units of m/s*).

2) Due to the matrix structure of the energy momentum tensor, and because of the success of matrix mechanics, we are motivated to detach the energy momentum tensor from the general relativistic wave equation and identify it as a linear operator generating n-valued energies. To prove its operator nature, let T represent either the covariant or contravariant energy momentum tensors. Let N and M represent a 4 × 4 energy momentum matrices representing T. Clearly by matrix addition holds: $T[M]+T[N]=T[M+N]$. Furthermore, scalar multiplication on matrices holds and so: $T[\alpha N]=\alpha T[N]$. QED the energy-momentum tensor has the form of a linear operator.

3) Of special note, the multiplicative scalar nature of linear operators permits multiplication of either the covariant or contravariant energy momentum operator by a second positive integer n. Hence: $T \to nT = T'$. Under scalar multiplication, a new linear operator is produced. This supplies a secondary way to apply n^2 the energy operator, which in turn indicates the spacetime natural exponent must express n^2. The best reason is the cyclic nature of the graviton oscillators requiring a cyclic spacetime metric works.

7. Graviton Energy Levels

In this section, we develop the operator time component so as to enable one to calculate the n-value graviton energy states produced during transition and emittance of elementary particle mass (in subsequent sections we will be concerned with brain heat-energies necessary for the formation of the mind constructed from microscopic spacetime and its attributes of consciousness, memory, and self-awareness). Since the operator is constructed from the energy momentum tensor, for purposes of continuity we apply the same symbolism for now:

1) The time component of the energy-momentum tensor with its coefficients is given by the following relationship:

$$T_{00} = -\frac{3}{2}\frac{n^2\omega^2c^2}{16\pi G} \tag{15}$$

To simplify this formula into a more calculable form, we begin with those astronomical observations of dark matter, to obtain the graviton number density N_D. We may do this from our assumption that all elementary particles occur during excited gravitons transitioning into to lower energy states through the emission of various n-valued particle mass-energies. This process must, by assumption, include all dark matter processes, including those having gravitational effects on spiral galaxies, as observed by Vera Rubin and others [19] [20]. In particular, let us consider those observed dark matter values (*comprised of excited gravitons*) as measured within our own Milky Way Galaxy—which is entirely permeated by dark matter, assumed to be comprised of low n-valued excited gravitons [21]. Too low to transition through the emission of elementary particle masses [22]. Hence, graviton mass near $n=1$ as researched by Goldhaber-Nieto and others [23]. From many careful observations that helped to determine dark matter density, it is approximately given to be: (10^{-27} kg/m^3) [24] [25]. This value is about four orders smaller than reported in the in the 2018 Review of Particle Physics [26]. Nevertheless, as a proper starting point, it is reasonable to apply this density value during development of the energy operator. Afterward, when the operator is fully constructed, we will precisely calibrate against known particle masses.

2) The next step in advancing the energy-operator, first requires a precise determination of the mass of a ground-state graviton $n=1$, in order to determine the number density of gravitons in the Milky Way Galaxy (*not the mass density above*). Depending on the method provided by Goldhaber-Nieto and others [27], graviton mass ranges from: 10^{-69} kg → 10^{-55} kg. We chose a value somewhere midrange: 10^{-58} kg [28] [29]. Again, we emphasize, once we complete our mass-energy equation, we can precisely calibrate it against fundamental constants and at least one known particle mass-energies to a high degree of precision. If this seems perplexing, recall that in high school and college laboratories students use a meter stick to predict nanometer spectral line wavelengths emitted from hydrogen gas using two metersticks with only millimeter accuracy. Our method allows for far greater precision during the calibration process of our energy equation. (*Note also after developing the operator energy equation*, *we will combine it with the Bose-Einstein equation in a subsequent section to limit the possible n-valued energy-masses*). Ultimately, the validation for our approach, is that is works.

3) We now have enough information to compute the graviton number density:

$$N_D = \frac{1.0\times10^{-27}\ \mathrm{kg/m^3}}{1.0\times10^{-58}\ \mathrm{kg/graviton}} = 1.0\times10^{31}\ \mathrm{graviton/m^3} \tag{16}$$

By dividing the covariant or contravariant energy tensors by N_D, the energy associated with each single graviton, is computed:

$$\hat{T}_{00} = \frac{T_{00}}{N_D} = n_2^2\left[\frac{\left(\frac{3}{2}\omega\right)\left(\frac{c^4}{16\pi G}\right)\mathrm{J/m^3}}{1.00\times10^{31}\ \mathrm{grav/m^3}}\right] \tag{17}$$
$$= n^2E = n^2\left(1.586418216\times10^{-28}\right)\mathrm{J/grav}$$

where ω, is the graviton angular frequency given by: $\left(\omega = 2\pi\nu = 2\pi\left(1.000000\times10^{-12}\ \text{s}^{-1}\right)\right)$, with $\left(c = 299792458\ \text{m/s}\right)$ and where $\left(G = 6.67428(67)\times10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2\right)$.

here $\hat{T}_{00}$ acts as a temporary energy functional providing us with the means to calculate n-valued gravitational energy emitted during graviton transition from higher to into lower energy states. This is analogous to electron transition, but instead of electromagnetic spectral emission, we have particle matter emission—hinting toward dark matter processes. By dividing the $\hat{T}_{00}$ equation through by c^2, it becomes a mass operator able to generate the particle mass. At $n = 1$, we can calculate the mass of the graviton (at $n = 0$, the graviton mass goes to zero). Hence the mass operator m in SI units becomes:

$$\hat{m} = \frac{\hat{T}_{00}}{c^2} = \frac{1.586418216\times10^{-28}\ \text{J}}{\left(299792458\ \text{m/s}\right)^2} = 1.765128317\times10^{-45}\ \text{kg} \tag{18}$$

We recognize that the mass operator coefficient (*not its order of magnitude*) is nearly equivalent to the conversion factor eV/c^2 during conversion factor from electron volts into SI units of kilograms mass (*determined from the NIST of fundamental constants*[1], *which is derived from the 2018 CODATA recommended values*). This value was determined to be: $1.78266190711\times10^{-36}$. Since this conversion factor is developed from fundamental understanding, we take heed and calibrate our result with the well-established factor (*keeping the operator order of magnitude*). We now have a mass operator as a function of n capable of generating all elementary particle masses in SI units:

$$\hat{m} = n^2\frac{E}{c^2} = n^2\left(1.782661907\times10^{-45}\ \text{kg}\right) \tag{19}$$

The question is, does operator actually work? The last thing that needs to be done is to find some way to limit the range of n-values. First we apply the mass operator to the three, well measured Boson masses to determine if indeed the mass operator can generate these experimentally determined masses to a high degree of precision.

8. Application of the Mass Operator

In this section we test the mass operator to see if it can generate the three boson masses expressed in the Standard Model of Particle Physics. We discover that these masses can be generated to a high level of precision. In Appendix A we show the mass operator is able to produce all elementary particle masses of the Standard Model. This is enough to prove approach is on the right track, but we will need to limit the infinite range of n-values. This we can do by combining the mass operator with the Bose-Einstein equation to produce a practical temperature function. We begin with the W-boson mass.

[1]NIST URL address:
https://physics.nist.gov/cgi-bin/cuu/Convert?exp=0&num=1&From=ev&To=kg&Action=Convert+value+and+show+factor

1) The **W-boson mass** is given to be the 2018 ATLAS Collaboration [30] to be 80.370 ± 0.019 GeV/c^2. Or 80.370 × 10^9 eV/c^2.

We next apply the conversion factor of 1.78266190711 × 10^{-36} kg/eV/c^2 (CODATA 2014), to obtain an SI mass value of: 1.4327 (25375) × 10^{-25} kg. We now apply our energy operator equation to calculate the kilogram mass value for the W-boson, then compare to the observed value.

$$\begin{aligned}\hat{m}_W &= n^2\frac{E}{c^2} = (8964931679)^2\left(1.782661907\times10^{-45}\text{ kg}\right)\\ &= 1.4327(25375)\times10^{-25}\text{ kg}\end{aligned} \tag{20}$$

The theoretically derived mass value for the W-boson is in precise agreement with the experimentally determined W-boson mass.

Note: Though the n-value may feel uncomfortable large, actually it become pleasing upon realizing, as requirement by Einstein, any correct foundational theory must be able to account for a wide-range of phenomena. In our microscopic spacetime approach, in addition to accounting for all elementary particles discovered, and those yet to be, in addition our approach precisely accounts for a solution to the mind-brain problem. This is done by the general relativistic equation applied to particle mass solution, but now applied to the mind-brain problem, in which our approach can precisely determine the heat energies emitted by the brain during formation and growth of the spacetime mind, including the generation of consciousness, storage and retrieval of memories, and the ability to perceive oneself.

Moreover by joining n-value is required in these two realms of physics. The answer will convert our operator formula into a temperature function. This we do by combining it with Bose-Einstein statistical equation.

2) Next, we compute the **Z^0 boson mass**, having an experimentally determined Z-boson rest mass [30] of 91.1875 ± 0.0021 × 10^9 eV/c^2. Applying the conversion factor of 1.78266190711 × 10^{-36} kg/eV/c^2, we obtain: $m_Z = 1.6255(66)\times10^{-25}\text{ kg}$).

We compare this experimentally determined mass value for the Z-boson to theoretical Z-boson mass value [31]:

$$\begin{aligned}\hat{m}_Z &= n^2\frac{E}{c^2} = (9549218074)^2\left(1.782661907\times10^{-45}\text{ kg}\right)\\ &= 1.6255(66)\times10^{-25}\text{ kg}\end{aligned} \tag{21}$$

An exact match.

3) Next we refer to the experimentally determined rest mass [31] of the Higgs Boson nicknamed the *God particle*: $M_H = 124.97 \pm 0.24\times10^9\text{ eV}/\text{c}^2$. Applying the conversion factor of 1.78266190711 × 10^{-36} kg/eV/c^2 (CODATA 2014), we obtain a Higgs particle mass of: $m_H = 2.227792585\times10^{-25}\text{ kg}$. We now compute the theoretical mass value from the mass operator:

$$\begin{aligned}\hat{m}_H &= n^2\frac{E}{c^2} = \left(1.117899817\times10^{10}\right)^2\left(1.782661907\times10^{-45}\text{ kg}\right)\\ &= 2.22(77925857)\times10^{-25}\text{ kg}\end{aligned} \tag{22}$$

An exact match [32]. We are definitely on the right track.

9. Bose-Einstein Statistics and Curved Spacetime Temperature

If our microscopic approach is to gain predictive capabilities, it must be able to restrict the infinite number of n-values generated by the graviton energy-mass functionals. To acquire such a limitation, we turn to the Bose-Einstein energy distribution function (*chemical potential set to zero*), given by:

$$f(\varepsilon)=\frac{1}{e^{\varepsilon/\kappa T}-1} \quad (23)$$

here ε is the graviton energy (spin-2 boson), the Boltzmann constant $\kappa = 1.38064857\times10^{-23}\ \text{J/K}$, and T is the temperature.

If we apply a calculus form of the Bose-Einstein equation to the smallest levels of spacetime, in particular to the microscopic region where graviton quanta is being emitted during graviton transition in the formation of elementary particle mass, then we may assume κT to equivalent to the energy of the mass of the particle being created—in a tiny spacetime region having temperature T. That is, for each fixed temperature the range of graviton energy is given by the linear particle energy to spacetime temperature relationship:

$$\hat{T}^{00}=\Delta\varepsilon=-\kappa\Delta T+\frac{1}{A} \quad (24)$$

This provides us with a spacetime energy-temperature scale, which can be calibrated against any particle accelerator temperature in the production of elementary particle mass. It this way, it provides a predictive methodology for particle mass creation from spacetime itself, based on Bose-Einstein statistics and its temperature variable. The derivation of this result is as follows:

Here we derive boson graviton energy (*equal to elementary particle mass*) as a function of temperature from the Bose-Einstein distribution function. Where $f(\varepsilon)=\frac{1}{e^{\varepsilon/\kappa T}-1}$, and represents the probability a boson particle will have energy ε, which, upon transitioning to lower graviton states, is emitted in the form of particle mass. The exponent $e^{\varepsilon/\kappa T}$ is dependent upon the energy of the bosons at temperature T. We begin by integrating the Bose-Einstein distribution function over all energies, at fix temperature T. The integration of this probability must equal one. That is:

$$A\int_{E_0}^{E_f} f(E)\,\mathrm{d}E \sim 1 = A\int_{E_0}^{E_f}\frac{1}{e^{E/\kappa T}-1}\mathrm{d}E$$

$$A\left(E_0-E_f\right)+A\kappa T\left[\ln\left|e^{E_f/\kappa T}-1\right|-\ln\left|e^{E_0/\kappa T}-1\right|\right]=1 \quad (25)$$

(*where we made the substitution* $u=e^{E/\kappa T}-1$), and A is the normalization constant with proper units to make the probability be unitless.

$$\left(E_0-E_f\right)+\kappa T\left[\ln\left|e^{E_f-E_0/\kappa T}\right|\right]=\frac{1}{A} \quad (26)$$

The energy change in the natural exponent: $\Delta E = E_f - E_0$, must be equal to the energy based on the temperature of the microscopic region of spacetime. Hence: $\kappa T = \Delta E$. Thus

$$\begin{aligned}&\left(E_0 - E_f\right) + \kappa \Delta T\left[\ln\left|\mathrm{e}^{\frac{\Delta E}{\Delta E}}\right|\right]\\&= E_0 - E_f + \kappa T\left[\ln\left|\mathrm{e}^{1}\right| = E_0 - E_f + \kappa \Delta T\right] \approx \frac{1}{A}\end{aligned} \tag{27}$$

Simplifying and solving the energy during energetic graviton transition, we have:

$$\hat{T}^{00} = \Delta\varepsilon = -\kappa\Delta T + \frac{1}{A} \tag{28}$$

We note the equation is linear and provides us with predictive capability. Secondly the equation is a generalization of the classical relationship between temperature and the average kinetic energy per gas molecule—but in our case energized gravitons.

Next, we insert the n-valued corrected energy functional ($\hat{T}_{00} = n^2\left(1.602176621\times 10^{-28}\right)\text{J/grav}$) into the left-hand side of Equation (28) above (representing microscopic region of spacetime having Temperature T:

$$E_0 - E_f = -\left(\tilde{T}^{00}\right) = -n^2\left(1.602176621\times 10^{-28}\right) = -\kappa\Delta T + \frac{1}{A} \tag{29}$$

Assuming $1/A$ is negligible we solve for ΔT.

$$\Delta T = \frac{n^2\left(1.602176621\times 10^{-28}\right)}{1.38064852\times 10^{-23}} = 1.1605\times 10^{5}\left(n^2\right) \tag{30}$$

This represents the change in microscopic spacetime temperatures that excite gravitons into higher n-values and that subsequently transition by emitting elementary particle mass. The importance of this equation is that once the temperature is calibrated to some experimental particle collider temperature, the n-values can be ascertained. In this manner the temperature equation will provide a way to predict those measured particle masses. This includes those yet to be discovered particles.

10. Dark Matter Explanation

The most pressing issue for particle physicists to understand, is what comprises dark matter? Even though it accounts for more than 85% of all the matter in the universe, we know little about its composition or dynamics. What we do know, is that it expresses no electromagnetic attributes. The main way we have come to know of its existence, was through its gravitational effects upon galactic dynamics—in short, dark matter keeps the spiral in spiral galaxies. As Einstein stipulated, fundamental approaches to science must be able to explain a wide-range of phenomena. Our microscopic spacetime approach can also be applied to the question of the nature of dark matter and dark energy.

Though others have tried to explain it nonconventional terms [33], they only achieved to complicate our understanding; moreover, it violates the sacred principle of Occam's razor, which states given two theories accounting for the same phenomena, choose the simpler one; and ours is the most elegant for it begins with general relativity, and then is shown to encompass and account for a wide range of phenomena far beyond dark matter. Furthermore, because dark matter does not emit or absorb electromagnetic radiation, and only attracts matter, we conclude that dark matter is strictly a gravitational phenomenon—the simplest of all assumptions. In that way only general relativity is to be considered, rather than, for example, a modification to Newtonian dynamics (*MOND*) [34], which Newtonian theory and gravity is already a subset of relativity.

Because dark matter is abundant throughout the cosmos, and that all observed phenomena expressed by dark matter is gravitational in nature, that it is thought of to be particle in nature by many, then this fits exactly into our general relativistic approach founded upon microscopic spacetime. Moreover in our approach we have shown through mathematical calculation, every Standard Model particle mass precisely matches experimental mass values, and that our assertion these masses arise during graviton transitioning, dark matter can be no exception to other fundamental particles. Furthermore, because we will apply graviton transitioning in the next section to solve the mind-brain problem, and as Einstein stipulated any theory based on the principle of relativity must be able to account for a unified foundation on which the theoretical treatment of all phenomena could be based, to which our graviton transition theory does, we conclude these distinct realms reliant upon the same graviton transitioning are made distinct by their own class of n-valued particles emitted from gravitons. And for the case of dark matter, these particles belong to the class of particles which neither emit or absorb electromagnetic radiation, or which are involved with electromagnetic forces.

One important proof of the existence of dark matter is evidenced by measuring spiral galaxy rotation curves, studied in detail by Vera Rubin [35] [36], followed by numerous other astronomers and astrophysicists [37] [38] [39] [40] [41]. The founding credit to the discovery of dark matter, belongs to the astronomer Fritz Zwicky (*apropos referred to as the father of dark matter*) [42]. It was Zwicky who first realized upon studying the Coma Cluster (*containing over* 1000 *identified galaxies*), that the individual galaxies within, were moving too fast to keep from flying apart. This implied some kind of invisible matter was keeping the galaxies held together. The irascible Zwicky referred to this unidentifiable phenomenon as "dunkle Materie" (*dark matter*). His dunkle Materie took another three decades before dark matter was observed widely and accepted. Today it is observed in various other ways, such as through gravitational lensing and the primordial cosmic background radiation formation.

For purposes of clarity, we restate our explanation for the origin and properties of omnipresent dark matter. What we are proposing is that dark matter particles are created in the identical way as are all other elementary particles—that is during the transitioning of gravitons into lower energy states, through the emittance of particle mass-energy. Moreover, each type of particle belongs to its own n-valued class. For example leptons belong to one class, whereas quarks and bosons another. And so it is with dark matter particles. Each of these classes of particles expressing overlapping attributes such as mass and spin, yet each a distinct class of particle. Hence electrons belong to the n-valued class of charged particles, whereas dark matter and neutrinos do not. The implications being graviton transitions lead to a new classification schemata for elementary particles.

There is more to understand. How do gravitons become excited in the far reaches of empty space? First off, space is never completely empty. Hence graviton excitement occurs, however slight and however low in n-valued energy states. The real manufacturers of higher, n-valued graviton excitations occurs near galactic centers. The power station for dark matter. The city of dark lights. To understand this, let us consider a typical spiral galaxy (*rather than elliptical or irregular*). At the heart of such galaxies lies a black hole [43]. Just outside the black hole exists what is referred to as the radius of influence. It is there the gravitational potential is the dominant dynamical factor for graviton excitation. Gravitational potential is synonymous with energy that can be converted as energy is made to do. It can be converted to kinetic energy, or to graviton excitations. Within the black hole's radius of influence, graviton excitation occurs abundantly. Transition into lower energy states producing n-valued particle mass-energy, in turn influences the dynamics of the entire cosmos. For example, it results in dark energy particles fluxing from galactic centers which in turn causes galactic accelerations, the rate of which is greater than first measured. A recent posting in Scientific American Space by Clara Moskowitz states:

The universe appears to be ballooning more quickly than it should be, even after accounting for the accelerating expansion caused by dark energy… The puzzling conflict—which was hinted at in earlier data and confirmed in the new calculation—means that either one or both of the measurements are flawed, or that dark energy or some other aspect of nature acts differently than we think … One of the most exciting possibilities is that dark energy is even stranger than the leading theory suggests. Most observations support the idea that dark energy behaves like a "cosmological constant," a term Albert Einstein inserted into his equations of general relativity and later removed (*analogous to our energy operator idea discussed in this paper*). This kind of dark energy would arise from empty space, which, according to quantum mechanics, is not empty at all, but rather filled with pairs of "virtual" particles and antiparticles that constantly pop in and out of existence … An alternative explanation for the discrepancy, however, is that the universe contains an additional fundamental particle beyond the ones we know about (*all of which is consistent and supportive with our graviton transition approach presented in this research*) [44].

It is in these galactic regions of influence near massive black holes, that microscopic spacetime comprised of oscillating gravitons, is continually being energized, to which they transition downward emitting dark matter particles at an enormous rate, which fluxes symmetrically outward. This is an ongoing process maintaining a dark halo, which spherically saturates every galaxy throughout the cosmos, and is responsible for the observed galactic rotation curves [45]-[50]. The continual outward flux of dark matter causes each galaxy to accelerate away from each other. For instance flux from our Milky causes outlying galaxies to be accelerated away and for the Milky Way Galaxy to in turn be accelerated way from these surrounding galaxies (*not all equal distant*). In this way there is no need for a big bang theory to explain the observed the redshifted galaxies through the expansion of spacetime itself.

In the next section we apply the same general relativistic graviton transition mechanism to solve the mind-brain problem.

11. The General Relativistic Mind-Brain Non-Linear Equation

In the following sections of this manuscript, we will address the mind-body problem. As with Rene Descartes, our approach is a dualistic one, wherein we propose the mind and brain to be distinct from each other, yet intimately related. Descartes went even further to propose the mind and body are able to exist without the other [51]. We leave that possibility open, and instead focus on the way the mind and brain are interrelated and act upon each other. What is argued here, is that the brain is a special organ whose main function is to facilitate the human mind—where consciousness, memory, and self-awareness are spacetime evoked into existence. This is a living, nonlinear relationship equivalent to the general relativistic equation, which is intended to specifically express heat energies emitted by the brain resulting in the formation of the mind out of that microscopic spacetime that saturates the brain.

To understand this mind-brain phenomena in greater detail, let us begin by considering the human fetus at its earliest stages of growth. What we argue is that the fetus brain has been preprogramed genetically to emit low heat-energies during gestation inside the womb (*this undoubtedly is in combination with neurotrophins—a family of proteins that induce the development and function of neurons*). The purpose of these coded heat-energies is to begin development and formation of the fetus mind out of microscopic spacetime that immerses the brain. As the fetus brain matures, discrete heat-energies are emitted and absorbed by the microscopic spacetime comprised of massless oscillating gravitons saturating the interstices of the emerging fetus brain. As it grows ever more complex, and ever more capable of exciting a certain class of n-valued gravitons with heat energy, the developing spacetime mind grows ever more intricate. Think of these brain heat-energies as a kind of Morse Code emitted for purposes of sending information during the construction and organization of the interior of the house of the mind. A special place wherein soon consciousness, memory, and our self-awareness will come alive distinct from the brain, yet both integral to the other; one mutually affecting the other.

Because the physics and mathematics for the mind interacting with brain are identical to general relativity (*applied on microscopic spacetime*), to distinguish application of the general relativistic equation in solving the mind-brain problem, we relabel the energy-momentum tensor $T_{\mu\nu}$ as $B_{\mu\nu}$ to indicate the matter-energy brain-field matrix. Likewise for the Riemannian tensor $R_{\mu\nu}$ and its contracted form *R*, they are relabeled to become $M_{\mu\nu}$, and *M*, so as to represent the spacetime-mind matrix. Finally we relabel the spacetime metric $g_{\mu\nu}$ to $p_{\mu\nu}$, and consolidated the general relativistic constants into one constant c, with that understanding that the general relativistic wave equation for the mind-brain is given by:

$$M_{\mu\nu} + p_{\mu\nu}M = cB_{\mu\nu} \tag{31}$$

This is a non-linear relationship in which the mind, can to some extent, alter brain circuitry at the microscopic level of spacetime. Note that nonlinear equations are nearly impossible to solve for in most applications. This is because changing one variable changes all others, and all others in turn change the one. However, these problems are greatly simplified through various constraints, which are either mathematical or physical in nature. A simple example of applied constraints with profound results, is the one in which planets are constrained to move along ellipses about the Sun. This was first proposed by Johannes Kepler (1571-1630) in his published work on the three laws of planetary motion based on empirical data. Ellipses were enough information to allow Isaac Newton to solve for the first fundamental force in nature—the gravitational force computed by Newton to be a one over squared distance law. A law that governs the motion of all celestial bodies. This was followed some years later by the second fundamental force, Coulomb's electrical force.

Nonlinear equations, however, are much more difficult to solve for. That would be the case for our general relativistic approach in solving the mind-brain problem had it not been for constraining the general relativistic equations to act on microscopic spacetime, which we proposed to be comprised of oscillating gravitons. A simple assumption resulting in great understanding.

12. Gravitational Field Interaction with the Fetus Brain

Because we are applying general relativity to solve the mind body problem on microscopic spacetime, and that we have already developed an energy operator, in the preceding sections that enable the calculation of the class of n-valued gravitons (*which were excited for any number of reasons*, *for instance during particle collisions to which the excited gravitons subsequently transition to lower energy states by emitting an array of other subatomic particles*), we now extend this microscopic spacetime approach to discrete low heat-energies emitted by the brain during formation of the fetus mind.

Recall in a preceding section, the energy operator was combined with the

Bose-Einstein statistical equation, to produce temperature function able to calculate the statistical range of n-values of excited spacetime gravitons. We now apply this equation to account for the formation of the mind and its wonder of consciousness, memory, and the awareness of self. Before we do, let us know something about the brain before we try to calculate something about that five-pound organ. The neuroscientists, doctor, and Nobel Laurate, Sir Charles Sherrington (1857-1952) [52] [53] [54] expressed the brain-mid more beautifully in his writings in the enchanted loom [55]:

"*The brain is waking and with it the mind is returning. It is as if the Milky Way entered upon some cosmic dance. Swiftly the head mass becomes an enchanted loom where millions of flashing shuttles weave a dissolving pattern, always a meaningful pattern, though never an abiding one; a shifting harmony of sub patterns.*"

13. Memory and Entropy

It was a steam driven world of locomotives and belts attached to factory long shafts turning machinery into action. It was before James Clerk Maxwell learned the secrets of electricity and magnetism, what light was made of and how to generate current to light up our dark world. It was a time when engineers and scientists discovered a strange new energy called heat. It was the time of the Industrial Revolution. When industry was booming, and J. M. W. Turner was right there painting a modern steam tugboat pulling the retired HMS Temeraire toward her last berth to be broken up. A warship that had once sailed under the flag command of Admiral Nelson at the Battle of Trafalgar.

It was during the fires of industry that heat energy was scientifically explored by Count Rumford (1798) and by then by James Prescott Joule (1843). In 1875 physicist Ludwig Boltzmann formulated a more precise connection between entropy S and molecular motion expressed by the equation: $S = k\ln[W]$. Here, the k is the famous Boltzmann's constant and $[W]$ represents the number of possible states the motion of molecules could occupy.

But what does all this have to do with solving mind-body problem? Just after the end of the Industrial Revolution, in 1867 to be more precise, James Clerk Maxwell wrote a letter to P. G. Tait. In that letter Maxwell presented a statistical thought experiment which could violate the Second Law of Thermodynamics [56] (*It was Rudolf Clausius who in* 1850 *had laid the foundation for the second law of thermodynamics by examining the relation between heat transfer and work*). But the Second Law was no ordinary law. It is foundational to thermodynamics, and remains of fundamental importance to this very day—in the same way as do the three classical laws of Newton. It is a law of entropy, heat, and temperature—yet it has evolved into something so much, much more. If it had been anyone else but James Clerk Maxwell (*who is held in such high regard scientific community and considered equal to Newton and Einstein*), his challenge to the Second Law of Thermodynamic challenge would not have given anyone considered the idea. Instead stirred the imagination of the most prominent physicist, scientists, and mathematicians over the next 150 years. These include such scientific luminaries as: W. Thomson (*Lord Kelvin*) [57]; J. Poincare [58]; M. Planck [59]; L. Szilárd [60]; H. Leff [61]; J. von Neumann [62]; G. Gamow [63]; M. Born [64]; N. Wiener [65]; D. Bohm [66]; L. Brillouin [67]; M. N. Saha [68]; R. Feynman [69]; Bell [70]; K. R. Popper [71]; C. H. Bennett [72]; S. W. Hawking [73]; R. Landauer [74]; R. Penrose [75]; W. J. Christensen Jr. [76] [77] and a whole vast list of others.

Basically, two schools of thought formed from Maxwell's challenge based on what is referred to as Maxwell's demon. Those who sided with Maxwell, argued the Second Law could be violated. Those who didn't, argued it could not be. Each year one side or the other has won the argument. Until the following year the arguments presented are more sophisticated, more subtle and all the while advancing a deeper understanding of nature and its very mysteries.

Then in 1929 came the strange twist to entropy, when a physicist named Leo Szilárd connected entropy to a bit of memory, through the following equation:

$$S = k \ln 2 \tag{32}$$

here S represents a small change in entropy, k is the famous Boltzmann's constant, which has units of energy per temperature, in SI units Joules per Kelvin.

[As a side-note C. E. Shannon is typically considered to be the "Father of Information Theory" [78]. Yet, in some sense, the previous equation indicates that Leo Szilárd is the originator of information theory. What is interesting is through entropy has advanced through arguments based on Maxwell's demon has advanced into information theory wherein computer scientists have applied it to solve some fundamental issues in the development of computers (*including Nobel Laurate Richard Feynman*). Entropy has branched out into neuroscience and is currently being applied as means in measuring intelligence [79] [80]. Moreover, given that entropy was a way to connect microstates to macro-phenomena, that entropy is deeply involved with information systems, and with the forefront of neuroscience [81] [82], this makes the Second law of Thermodynamics describing the relationship between entropy, heat and temperature now memory and intelligence, a necessary tool for solving the mind-brain problem. Especially given that the approach argued in this manuscript is founded upon a spacetime mind comprised of n-valued microstates of gravitons undergoing oscillatory motion.]

14. Calculating Minimal Brain Heat Energies

To make a brain heat energy calculation as easy as possible, let us consider that during formation of the human fetus, its emerging brain begins to interact with microscopic spacetime. The result being the starting origin of the fetus mind. Since we have already established entropy is connected to memory and intelligence—*belonging to the mind-brain*, and that entropy is also intimately related to heat energy, it must be that the facilitating brain is able to interact with microscopic spacetime (*during evocation of memory and intelligence*) through its emission of low heat energies. Think of these heat-energy like Morse code. As the brain of the fetus grows in complexity, it releases increasingly intricate heat-energies that are absorbed into that microscopic spacetime saturating the interstices of tiny fetus brain—possibly saturating its entire nervous system. In turn a certain n-valued class of gravitons are energized into higher energy-states to form the substrate mind. Specifically, the emerging fetus brain (*encoded by genetic information*), emits heat energies that excites gravitons into n-valued class-types, which are further grouped into specific patterns. As the fetus brain continues to grow more intricately, the brain emits ever more complex heat energies. This process continues until the basic spacetime substrate of the mind is completed, yet always in flux with the brain. As the process progresses even further, at some point consciousness awakens in the mind. Only then can memories be stored into the spacetime mind, or accessed, by the facilitating brain.

Since this interaction is a non-linear one (*as spacetime and matter energy is with general relativity*), and that our mind-brain solution is founded on the principle of relativity, the implications being, as the brain alters the spacetime mind, the mind alters the carnal brain. This leads us to solve the mind-brain problem through the general relativistic wave equation. Representing the matter-brain field matrix by the tensor $B_{\mu\nu}$ and the spacetime-mind matrix by the tensor $M_{\mu\nu}$, the mind-brain general relativistic relationship between the two is given by:

$$M_{\mu\nu} + p_{\mu\nu} M = cB_{\mu\nu} \tag{33}$$

Let us now calculate the lowest possible heat-energy emitted by the brain in terms of equivalent mass, so it can be compared to the least massive Standard Model Particle masses. This we do by setting $n = 1$, to determine the lowest discretized heat-energy from the mass-energy operator:

$$\hat{m}_{heat} = n^2 \frac{E}{c^2} = (1)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) = 1.782661907 \times 10^{-45}\ \text{kg} \tag{34}$$

As a comparison to the smallest particle mass of the Standard Model, let us compare calculated minimal brain-heat particle mass to the equivalent heat-energy to the Electron Neutrino mass limit given by: $m_{\nu_e} \le 2.20\ \text{eV}/\text{c}^2$. We begin by converting electron volts (eV/c^2), into kilograms:
$\left(2.20\ \text{eV}/\text{c}^2\right)\left(1.782661907 \times 10^{-36}\right) = 3.921856195 \times 10^{-36}\ \text{kg}$. Comparing this SI heat-energy to its equivalent mass value, to our theoretically calculated electron neutrino mass value:

$$\begin{aligned} m_{\nu_e} &= n^2 \frac{E}{c^4} = (46904)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) \\ &= 3.921829841 \times 10^{-36}\ \text{kg} \end{aligned} \tag{35}$$

We immediately recognize the lowest possible heat-energy equivalent emitted by the brain, is many magnitudes smaller than any Standard Model particle. This indicates that to empirically validate the existence of the spacetime mind, will require an indirect proof or discovery of an upper limit of n-valued emitted heat energies from the brain causing excitation and transition of these spacetime mind gravitons.

15. Classical Quantum Example

Finally, we can apply our mass operator to the Coulomb electric force to reproduce the spectral lines for hydrogen gas. This allows the process of emission lines. Beginning with Coulombs force law [83], and replacing the electron mass with the mass operator $m_e \to n^2(m_e)$, implies the bound electrons it interacts with spacetime to gain mass, which during transition to lower energy states emits the gained mass in terms of discrete electromagnetic energy, observed as spectral lines. This makes more relativistic sense than quantum orbitals and is completely in that in the with our approach where ultimately all matter is generated from microscopic spacetime, including the matter in the atomic nucleus. The Coulomb force for bound electrons is now written as:

$$F_e = kZ\frac{q^2}{r^2} = m_e a \to n^2(m_e)a \tag{36}$$

Above the mass of the electron is given by: $m_e = 9.1093829140 \times 10^{-31}$ kg (*see Appendix A mass of an electron*), which is the ground-state mass of a single electron. Also we set $Z = 1$ for the atomic number of the hydrogen atom.

Because our approach is classical, we apply centripetal acceleration to determine the minimum orbiting radius of an electron. Where $a_c = \frac{v^2}{r}$. Inserting centripetal acceleration into Coulomb's force law and setting $n_1 = 0$, we have the relationship:

$$k\frac{q^2}{r^2} = n^2(m_e)\frac{v^2}{r} \tag{37}$$

We now solve the n-valued atomic hydrogen energy levels. By rearranging terms, we have:

$$k\frac{q^2}{rn_2^2} = m_e v^2 \tag{38}$$

From this result, we immediately understand the kinetic energy of the orbiting electron about the hydrogen nucleus, to be:

$$K = \frac{1}{2}m_e v^2 = \frac{1}{2}k\frac{q^2}{n^2 r} \tag{39}$$

By the Virial Theorem the total energy is half the potential energy, and so the total n-valued energy is:

$$E_n = K + U = \frac{1}{2}k\frac{q^2}{n^2 r} - k\frac{q^2}{n^2 r} = -\left(\frac{1}{2}k\frac{q^2}{r}\right)\frac{1}{n^2} \tag{40}$$

To determine r_0, the distance between the nucleus and electron, and given $\left(\frac{1}{2}k\frac{q^2}{r}\right) = 2.18 \times 10^{-18}$ J, we solve for the well-known atomic separation distance

r_0:

$$r_0 = \left(\frac{1}{2} k \frac{q^2}{2.18 \times 10^{-18}\ \text{J}}\right) \approx 1.05 \times 10^{-10}\ \text{m} \tag{41}$$

Our assertion in our research is that the spectra is not a function of r-orbitals producing spectral lines, but instead due to n-valued bound electron mass variance. Inserting the result for r_0 into the energy equation above, yields the possible spectral energies for the hydrogen atom:

$$E_n = -\frac{2.18 \times 10^{-18}\ \text{J}}{n^2} \tag{42}$$

Given $E = hc/\lambda$, this immediately leads to the line spectrum formula for a hydrogen atom:

$$\Delta E_n = -\frac{13.6eV}{n_2^2 - n_1^2} \tag{43}$$

where $n_1 > n_2$ are integers, h is Planck's constant, c is the speed of light, R is Rydberg's constant. From a general relativistic point-of-view, it makes far more sense that atomic spectral energies are derived from n-valued mass-energy, rather than the electron's radii or velocity, as Bohr by the arbitrary assumption for quantized angular momentum.

What this shows is that the early foundations of quantum mechanics can be derived from the more fundamental classical principles of general relativity applied to microscopic spacetime. Such an approach is also strongly connected to special relativistic result concept, in that matter and energy are interrelated fundamentally, whereas electron distances from the nucleus are not. That is to say, as the electron that gains discrete energy-mass, upon transitioning to a lower energy states, the electron releases part of its mass as electromagnetic energy in the form of spectral lines—for example the Lyman, Balmer, and Paschen spectral series. In theory, this approach can be applied to any atom.

16. Discussion and Conclusions

In this paper, we applied the principle of relativity to microscopic spacetime to solve three fundamental problems: 1) The particle-mass problem; 2) The mind-brain problem 3) And a new classical approach to calculating the discrete spectral lines emitted by the hydrogen atom as a function of bound electron mass.

In conclusion, our approach accounts for a wide range of phenomena as Albert Einstein stipulated any foundational theory must. The first of which, was to be show the calculation all Standard Model Particle masses resulted from our approach. Next we calculated the lower bound heat energy the facilitating brain is able to emit along with other n-valued heat energies. It is these genetically coded heat-energies generated by the brain, which in turn are absorbed by a volume of microscopic spacetime filling the interstices of the atomic brain that ultimately evokes consciousness, awareness of self, free will, and the capability to store and retrieve vast amounts of memory in real time. Finally, the approach taken in this work provides an alternative to calculate the hydrogen spectral lines as a function of bound electron mass. Taken together, our general relativistic approach developed from microscopic spacetime, offers greater significant results than does quantum physics.

Acknowledgements

Appreciation goes to Hubertas von Bremen for checking the correctness of application of the Bose-Einstein equation to the temperature function allowing us to limit the n-values that are statistically possible during graviton excitation and transition. Special appreciation goes to art historian Natalie R. Valle [84], and her profound insights into aesthetic perspectives of symmetries as related to science and to our adventures with the world-famous adventurer, Scarlet Rembrandt. To my amazing sons Cleo and family, Walter and family. For family is born from the womb of stardust, our consciousness from the smallest spacetime elements of the mysterious cosmos, of which all of us are part of.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix A

In this Appendix, we calculate the remaining Standard Model Particle Masses.

Three Lepton Mass Calculations:

1) Electron rest mass reported in the CODATA 2014 [85]: $m_e = 9.10938356(11)\times 10^{-31}\ \text{kg}$. The calculated theoretical mass is:

$$\begin{aligned} m_e &= n^2 \frac{E}{c^4} = (22605286)^2 \left(1.782661907\times 10^{-45}\ \text{kg}\right) \\ &= 9.109383718\times 10^{-31}\ \text{kg} \end{aligned} \tag{44}$$

Here we have a small discrepancy in the uncertainty of the electron mass value between experiment and theory. Taking the largest uncertain value for experiment permitted, the difference being: 0.000000048.

2) Tau Lepton mass reported CODATA 2014 is given to be $m_\tau = 3.16747(29)\times 10^{-27}\ \text{kg}$. The theoretically calculated Tau Lepton mass is computed to be:

$$\begin{aligned} m_\tau &= n^2 \frac{E}{c^4} = (1332974259)^2 \left(1.782661907\times 10^{-45}\ \text{kg}\right) \\ &= 3.167469998\times 10^{-27}\ \text{kg} \end{aligned} \tag{45}$$

The Muon Lepton mass (*within experimental uncertainty*) is a precise match with the experimentally determined Tau mass.

3) The Muon Lepton mass is provided by CODATA 2014 to be 1.883531594 (48) × 10^{-28} kg. The theorectically calculated Muon mass is computed to be:

$$\begin{aligned} m_M &= n^2 \frac{E}{c^4} = (325051341)^2 \left(1.782661907\times 10^{-45}\ \text{kg}\right) \\ &= 1.883531590\times 10^{-28}\ \text{kg} \end{aligned} \tag{46}$$

The muon mass result (*within experimental uncertainty*), is precidse match with the experimentally determined mass.

Three Neutrino Mass Calculations

Though all neutrino masses are very approximate, nevertheless we will calculate their theoretical mass and compare to the approximate experimental mass.

1) We begin with the Electron Neutrino mass limit [86] of: $m_{\nu_e} \le 2.20\ \text{eV}/\text{c}^2$, we will apply GUP to understand experimental to theoretical correspondence. We begin by converting from eV/c^2, to kilograms: $\left(2.20\ \text{eV}/\text{c}^2\right)\left(1.782661907\times 10^{-36}\right) = 3.921856195\times 10^{-36}\ \text{kg}$.

Calculating the theoretical neutrino mass value, we have:

$$\begin{aligned} m_{\nu_e} &= n^2 \frac{E}{c^4} = (46904)^2 \left(1.782661907\times 10^{-45}\ \text{kg}\right) \\ &= 3.921829841\times 10^{-36}\ \text{kg} \end{aligned} \tag{47}$$

This is almost and exact match. From the success of those preceding theoretically determined mass values, we assume the correct value for neutrino mass is given from theory to be:

$$m_{\nu_e} = 3.921829841\times 10^{-36}\ \text{kg} \tag{48}$$

2) The approximate experimental Muon Neutrino mass is:

$m_{\nu_\mu} \le 0.17\ \text{MeV}/\text{c}^2$. Converting to kilograms:

$$m_{\nu_\mu} = \left(0.17\ \text{eV}/\text{c}^2\right)\left(1.782661907 \times 10^{-30}\right) = 3.030525242 \times 10^{-31}\ \text{kg} \quad (49)$$

Theoretical mass value of Muon Neutrino is:

$$\begin{aligned} m_{\nu_\mu} &= n^2 \frac{E}{c^4} = \left(13038404\right)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) \\ &= 3.030524865 \times 10^{-31}\ \text{kg} \end{aligned} \quad (50)$$

This is almost and exact match. From the success of those preceding theoretically determined mass values, we assume this is the correct value for neutrino mass or lower n^2 value.

3) The approximate experimental mass for Tau Neutrino is:

$m_{\nu_\tau} \le 15.5\ \text{MeV}/\text{c}^2$; converting to kilograms:

$$m_{\nu_\tau} = \left(15.5\ \text{eV}/\text{c}^2\right)\left(1.782661907 \times 10^{-30}\right) = 2.763125956 \times 10^{-29}\ \text{kg} \quad (51)$$

Theoretical mass value of tau neutrino is:

$$\begin{aligned} m_{\nu_\tau} &= n^2 \frac{E}{c^4} = \left(124498996\right)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) \\ &= 2.763125957 \times 10^{-29}\ \text{kg} \end{aligned} \quad (52)$$

Which is a match for the tau neutrino between experiment and theory.

Three Heavy Quark Mass Calculation

1) Top Quark has an experimentally determined mass value [87] of 173.34(± 0.76) GeV/c^2. Applying the conversion factor of 1.78266190711 × 10^{-36} kg/eV/c^2 (CODATA 2014), we obtain the experimental Top Quark mass of 3.09006615 × 10^{-25} kg.

The calculated theoretical values are given by:

$$\begin{aligned} m_T &= n^2 \frac{E}{c^2} = \left(1.316586496 \times 10^{10}\right)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) \\ &= 3.09006615^{-25}\ \text{kg} \end{aligned} \quad (53)$$

Which is a precise match between experimentally determined mass and theoretically determined Top Quark mass.

2) The Charm Quark is approximately given to have a mass value [88] of: $M_C = 983.7(5.6)\ \text{MeV}/\text{c}^2$. Applying the conversion factor of 1.78266190711 × 10^{-36} kg/eV/c^2 (CODATA 2014), we obtain the experimental

$$M_C = 1.753604518 \times 10^{-27}\ \text{kg} .$$

We now calculate the theoretical value for the Charm Quark:

$$\begin{aligned} m_C &= n^2 \frac{E}{c^2} = \left(991816515\right)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) \\ &= 1.753604517 \times 10^{-27}\ \text{kg} \end{aligned} \quad (54)$$

Experiment and theory are in complete agreement, with uncertain tolerances for Charm Quark mass.

3) The Bottom Quark mass is approximately given to have a mass value of 4.195 GeV/c^2 or 7.4782667 × 10^{-27} kg.

The theoretically computed value is:

$$m_B = n^2 \frac{E}{c^2} = (2048169915)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) = 7.4782667 \times 10^{-27}\ \text{kg} \quad (55)$$

Which shows the Bottom Quark experimental mass is in complete agreement with theory.

Three Light Quark Mass Calculation

1) Up Quark mass is approximately given to have a mass value of $M_{UQ} = 2.130(41)\ \text{MeV}/\text{c}^2$ or $3.797069862 \times 10^{-30}$ kg.

The calculated theoretical Up Quark mass is calculated to be:

$$m_U = n^2 \frac{E}{c^2} = (46151923)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) = 3.797069856 \times 10^{-30}\ \text{kg} \quad (56)$$

Experiment and theory are in complete agreement, with uncertain tolerances for Up Quark mass.

2) The Down Quark mass given experimentally to be:

$M_{DQ} = 4.675(56)\ \text{MeV}/\text{c}^2$ or

$$M_{DQ} = 8.333944(44) \times 10^{-30}\ \text{kg}.$$

The theoretically calculated value is:

$$m_{DQ} = n^2 \frac{E}{c^2} = (68373971)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) = 8.333944255 \times 10^{-30}\ \text{kg} \quad (57)$$

Which shows experiment are theory for Down Quark mass, are in complete agreement with allowed tolerances.

3) The Strange Quark experimental mass given to be: 92.47(69) MeV/c^2 or $1.648427465 \times 10^{-28}$ kg.

The theoretically computed value is:

$$m_{SQ} = n^2 \frac{E}{c^2} = (304088802)^2 \left(1.782661907 \times 10^{-45}\ \text{kg}\right) = 1.648427457 \times 10^{-28}\ \text{kg} \quad (58)$$

Which shows experiment are theory for Down Quark mass, are in complete agreement with allowed tolerances.