The Cosmological Constant and the Schwarzschild Proton

Nassim Haramein

The Resonance Project Foundation
PO Box 764, Holualoa, Hawai'i 96725
808-329-0070, haramein@theresonanceproject.org

Abstract: We address the ~120 orders of magnitude discrepancy between the cosmological constant (dark energy) and the vacuum fluctuation density predicted by quantum field theory and deemed the so-called *"vacuum catastrophe"*. We consider the total energy Λ of the cosmological constant in the geometry of a spherical shell universe (as a first order approximation) and find the result to be closely correlated with the total energy of the quantum vacuum fluctuations R_p enclosed within a charge radius nucleon bubble in a Schwarzschild proton approach. We discuss the implications of such a system in terms of information content and entanglement, extracting a holographic geometric solution to the Schwarzschild condition and derive the standard mass of the proton.

Keywords: cosmological constant, vacuum fluctuations, black holes, entropy, information

1. INTRODUCTION

In previous work[1] we explored black hole scale unification based on scaling relationships of organized matter in the universe which closely approximate the Schwarzschild condition from universal size to the Planck distance. In other work,[2] we demonstrate a first order approximation of a Schwarzschild condition proton interacting with the vacuum fluctuations (Planck's density[3]) and find appropriate results for the interaction time, the gamma emission frequency and the magnetic moment.

In section 2 we offer a continuation of the Schwarzschild scaling approach and find, to a close approximation, the appropriate result for the cosmological constant Λ if a charge radius proton volume bubble is inflated to the universal horizon.

In sections 3, 4 and 5 we more closely examine the structure of the proton horizon and its perturbation properties and initiate calculations describing in more detail the horizon structure. We make use of the holographic principle[4] to explore the information content and information relationships of the proton horizon relative to its volume and its external relationship to the universal vacuum fluctuations. From these considerations we extrapolate a geometric solution to the Schwarzschild condition and derive the standard mass of the proton.

In section 5, we examine the twisting and the formation of polar jets at the horizon which would arise from the application of the Haramein-Rauscher metric.[5] We discuss this in the context of parallel work being done and models of the electron as a Kerr-Newman ring singularity and associated perturbation structures. We briefly discuss as well the stability of black hole orbits as applied to the micro-world and the emerging physics describing our universe as a black hole interior.

2. The Schwarzschild Proton, the Cosmological Constant and the Vacuum Energy Density

There is a long-standing problem in physics concerning a discrepancy of some ~122 orders of magnitude between the cosmological constant Λ (dark energy) and the quantum vacuum fluctuations (Plank's density) typically denoted as the *"vacuum catastrophe"*. This inconsistency is thought to be the largest in the whole of modern physics. On the one hand early explorations of spacetime fluctuations of a quantum object predicted that the vacuum at those scales oscillates violently with infinite oscillatory modes[6] unless renormalized with the Planck cutoff and on the other hand observational measurements based on Hubble red shifts and other considerations in cosmology suggest that the approximate vacuum energy density of the cosmological constant necessary to account for the universal acceleration and termed *"dark energy"* is on the order of only $\Lambda = 10^{-29} gm/cm^3$. However, the reality of vacuum fluctuations at the quantum level is well supported by experimental results[7,8,9,10,11,12] and as mentioned above when the vacuum energy density is calculated by adding the energies $\frac{\hbar\omega}{2}$ over all field modes, an infinite value results. An analogy to the *"ultraviolet catastrophe"* is typically given to describe this problem and since the early 1900's the *"vacuum catastrophe"* has been a serious issue in modern physics. Furthermore, the analogy between the two is more than pedantic since the Planck relationship is at the base of the blackbody radiation analysis determining *fundamental units in physics* and is as well utilized as a cutoff value for the high frequency oscillation modes of the vacuum energy fluctuations at the quantum level yielding a figure of $\rho_v = 5.16\times10^{93} gm/cm^3$. This value can be obtained roughly by:

$$\rho_v = \frac{m_\ell}{\ell_p^3} = 5.16\times10^{93} gm/cm^3 \tag{1}$$

where the Planck mass, m_ℓ is $2.18\times10^{-5} gm$ and the Planck length, ℓ_p is $1.616\times10^{-33} cm$. To better represent physical structures however, this value is more appropriately estimated utilizing spherical Planck volumes $V_{\ell s} = 2.21\times10^{-99} cm^3$ so that:

$$\rho_{vs} = \frac{m_\ell}{V_{\ell s}} = 9.85\times10^{93} gm/cm^3 \tag{2}$$

In either case *a discrepancy of ~122 orders of magnitude* between the cosmological constant and the quantum vacuum energy density is found. Thereafter, it is not sufficient to merely state that the cosmological constant must be the correct value since it corresponds better to our concepts of a *"vacuum"* and our experience of it in the macro-world. Such an approach threatens the validity of all Planck units which are well established both theoretically and experimentally.[13,14] How is this to be resolved?

In our Schwarzschild proton approach we treat the proton as a Schwarzschild condition entity due to its surface horizon interaction with the violently fluctuating vacuum energy of the quantum level. We argue that such vacuum energy dynamics within the proton volume and surface area must be considered and may be the source of the strong interaction and its interaction time, the gamma ray emission of nuclei, and the so-called *"anomalous"* magnetic moment of the proton.

Here we wish to explore this approach in the context of the vacuum density of the cosmological constant and the critical limit. In further sections we utilize these relationships to extrapolate the standard mass of the proton as a consequence of an entangled universe.

We begin by adjusting the Compton radius of the Schwarzschild proton $r_P = 1.32 \times 10^{-13} cm$ utilized in reference[2] as a first order approximation, and bring it to the internationally-accepted value of the proton charge radius 0.8775 femtometers, (from Codata 2010[15]) or $r_q = 0.8775 \times 10^{-13} cm$ or approximately $r_q = 8.77 \times 10^{-14} cm$.

Thus we calculate the volume V_q of a spherical bubble of radius r_q and find $V_q = 2.83 \times 10^{-39} cm^3$. Then we derive the remaining vacuum fluctuation energy R_ρ of the quantum vacuum energy ρ_{vs} in such a volume. We first compute the number of Planck volumes $V_{\ell s}$ in a proton sphere V_q as:

$$\frac{V_q}{V_{\ell s}} = 1.28 \times 10^{60} \tag{3}$$

If we now multiply the total Planck volumes in a proton by the Planck mass m_ℓ, we obtain:

$$R_\rho = m_\ell \frac{V_q}{V_{\ell s}} = 2.79 \times 10^{55} gm \tag{4}$$

where R_ρ is the total vacuum fluctuation energy within a proton volume.

Now we expand the radius of the Schwarzschild proton to equal the radius of the universe. Since there are large variations in accepted values for a universal radius, we utilize a generally accepted value of $\sim 10^{28} cm$ to derive a universe volume of $V_U = 4.19 \times 10^{84} cm^3$ and we then calculate the change in energy density of the vacuum fluctuations for Λ at the cosmological level:

$$\Lambda = \frac{R_\rho}{V_U} = 6.65 \times 10^{-30} gm / cm^3 \tag{5}$$

The resulting change in the energy density thereafter yields a close approximation to Λ. One must consider, however, that the universal radius as given is a rough approximation typically utilized in cosmology. Therefore, we seek a way to derive the radius of the universe more precisely.

E. A. Rauscher in 1971[16,17] mentions that the universal volume relative to its mass seemed to roughly obey the Schwarzschild condition and, at the time, discussed it at length with J. A. Wheeler and others. The relationship was as well highlighted in Haramein, Rauscher and Hyson[1] in the elaboration of a scaling law for organized matter in the universe. By utilizing the mass R_ρ calculated in equation (4) as the amount of vacuum fluctuations within a proton volume we can calculate a more exact universal radius by utilization of the Schwarzschild solution to see if the result generates a consistent model and an appropriate cosmological constant, which is typically given as a crude estimate in the literature as well. Then:

$$\mathbb{R}_s = \frac{2GM}{c^2} = 4.14 \times 10^{27} cm \tag{6}$$

where G is the gravitational constant, $M = R_\rho = 2.79 \times 10^{55} gm$, and c is the speed of light. From this radius we obtain a universal volume, V_U of $2.97 \times 10^{83} cm^3$. Thus:

$$\Lambda = \frac{R_\rho}{V_U} = 9.38 \times 10^{-29} gm / cm^3 \tag{7}$$

The result is congruent with observational data and within the margin of error admissible in cosmology and demonstrates a deep relationship between the universe scale and the proton size. Furthermore, this expression confirms the validity of the Planck units and the Planck density and unifies quantum fluctuations with the cosmological constant.

Much more needs to be explored about the quantum vacuum fluctuations and the cosmological constant. For now, however, suffice to say that there has been a long-standing puzzle concerning why the large dimensionless values recur as they do when one explores the relationships of the constants used in physics. Prominent physicists such as A. Eddington[18] and P. Dirac[19,20] found clear relationships between sub-atomic particles such as the proton and the universal dimensions and thought of them as important and fundamental.

These issues relate as well to difficulties having to do with the hierarchy problem and the fine-tuning problem, where large discrepancies between theoretical models and experiments occur. In the next section we address by dimensional analysis some of these issues where relationships between the micro-world and the macro-world are elucidated and the standard mass of the proton is derived from a Schwarzschild condition. Also we demonstrate that the Schwarzschild mass can be derived with great accuracy from a simple geometric relationship utilizing the Planck units.

3. A Geometrical Derivation of the Standard Proton Mass and its Relationship to the Schwarzschild Proton and the Universe

We first consider the Planck units. In the derivations below, we utilize circular areas and spherical volumes which are critical to the accuracy necessary. Thereafter, a circular Planck area, $A_{\ell c}$ is:

$$A_{\ell c} = \pi r^2 = 2.05 \times 10^{-66} cm^2 \tag{8}$$

where $r = \frac{\ell}{2} = 8.08 \times 10^{-34} cm$.

We now compute the corresponding value for the area of a charge radius proton. The area A_q, is:

$$A_q = 4\pi r^2 = 9.68 \times 10^{-26} cm^2 \tag{9}$$

As mentioned above, the quantity R_o may be evidence of the entanglement of all particles mediated by the oscillations of the vacuum structure present from the universal level to the interior volume of the proton. In the next section we discuss how this entanglement may be a function of Planck-sized wormhole structures at the horizon due to Coreolis dynamics producing vorticity resulting in regions where the horizon vanishes generating "*holes*" and thus a network in which the interior of black holes is entangled with the rest of the universe through wormhole structures. Furthermore, such perturbations of Planck scale oscillations at the surface of the horizon leads to the holographic principle commonly used to describe the information network and entropy of black holes.[4] The holographic principle states explicitly that all the information of the interior volume of a black hole is encoded holographically on its horizon surface. Following these general guidelines we compute the number of circular Planck areas on the surface of a proton-sized sphere, $\eta_{\ell Ap}$ as:

$$\eta_{\ell Ap} = \frac{A_q}{A_{\ell c}} = 4.72 \times 10^{40} \tag{10}$$

Remarkably, if we now divide the number of Planck areas on the surface horizon of the proton, $\eta_{\ell Ap}$ into R_{ρ}, the mass of all the Plank's volumes inside the proton volume, we obtain:

$$m_H = \frac{R_{\rho}}{\eta_{\ell Ap}} = 5.91\times 10^{14}\, gm \tag{11}$$

Thus we have derived the Schwarzschild mass of a proton from the Planck units and geometry alone, without explicitly invoking the Schwarzschild equation. The relationship between the amount of Planck areas on the surface horizon of a quantum object and the vacuum fluctuations' mass/energy within the object may have far reaching implications in elucidating quantum gravity, as it seems to indicate a quantization of spacetime provided by Plank's holographic granulations, and will be utilized in the rest of our calculations. As an aside, we point out the beautiful simplicity of this derivation of the Schwarzschild condition as it is now possible for any high-school student equipped with the Planck length to extrapolate the Schwarzschild condition for any object without the use of the Schwarzschild equation and the conceptual difficulties that can arise from its use.

3.1 The Standard Mass of the Proton

Essentially, in the above we have mapped the internal volume mass/information to the surface Planck structure of the horizon such that one Planck area holographically expresses all the information of one Schwarzschild proton mass represented by the equivalent amount of particles entangled to one Planck area. Although the reader may have difficulty developing a clear picture of this holographic entanglement the picture will clarify with the aid of the next few calculations and the next sections.

Continuing in the spirit of the holographic principle we now seek to estimate the number of protons in the universe to confirm the relationship of the event horizon Planck areas to the rest of the particles in the universe. While this value could be obtained in cosmological literature where it is commonly given as $\sim 10^{80}$ protons, values vary widely from $\sim 10^{78} to \sim 10^{83}$ due to uncertainties in the estimates of the average density of our universe and its radius. Furthermore, most estimates utilize the standard mass of the proton to derive the amount of particles in the universe. Employing these values, therefore would introduce some levels of circularity in our calculations which are seeking to derive the standard mass of the proton from an entangled Schwarzschild proton mass independently.

Having gained some confidence from the geometric dimensional analysis extrapolation of both the cosmological constant and the Schwarzschild condition of a black hole, we now look for a geometric way to derive the number of particles in the universe directly from the proton geometry. While in equation (11) we obtained the

Schwarzschild condition by dividing the amount of Plank areas on the surface event horizon of the proton $\eta_{\ell Ap}$ by the mass of all the Planck volumes within the volume of the proton, we now divide $\eta_{\ell Ap}$ by the combined Planck volumes $V_{\ell s}$ in the interior of the proton V_q. Clearly, the combined Planck volumes $V_{\ell s}$ will be equivalent to the proton volume V_q. Thereafter, we obtain:

$$N_p = \frac{\eta_{\ell Ap}}{V_q} = 1.67 \times 10^{79} \tag{12}$$

which may be as accurate in its prediction as equation (11). Furthermore, this value falls satisfactorily between the low and high estimates of particle numbers in the universe generally established.

Now that we have extrapolated the number of particles N_p independently we divide this value into m_H the geometric mass of the Schwarzschild proton to determine the entangled contribution of all protons on each other and we obtain:

$$m_{ip} = \frac{m_H}{N_p} = 3.55 \times 10^{-65}\, gm \tag{13}$$

the portion of mass influence per proton, m_{ip} obtained if the mass of one Schwarzschild proton were distributed equally over all the other protons in the universe.

Finally, when we map the holographic influence m_{ip} of all these other protons onto the surface horizon of one proton by multiplying m_{ip} by the number of circular Planck areas on a proton holographic surface, $\eta_{\ell Ap}$ it yields:

$$m_{ip}\, \eta_{\ell Ap} = 1.672295215 \times 10^{-24}\, gm \tag{14}$$

where the standard measured mass of the proton is typically given as $1.672621777 \times 10^{-24} gm$, a deviation from our value of 0.02%. of the standard rest mass of the proton! Here the Codata 2010[15] values were utilized for all units and constants.

We note that the argument can be significantly simplified by bypassing equation (13) and (14). Instead we write:

$$\frac{R_\rho}{N_p} = 1.672295215 \times 10^{-24}\, gm \tag{15}$$

Here we obtain the same result as equation (14) for the standard mass of the proton by taking R_ρ (the amount of vacuum fluctuations in a proton volume, or in accordance with equation (6) what would be the mass of the universe) and dividing it by the number of particles extracted geometrically N_p. This clarifies the argument as it is simply the mass of the universe divided by its number of particles, both extrapolated geometrically from vacuum fluctuation quantities.

3.2 Is this argument circular?

The accuracy of the result certainly makes one suspect that some level of circularity was introduced somewhere. However, we have taken great care to make sure that the standard mass of the proton was nowhere introduced. Let us go through the argument once more. From a proton charge radius of $8.775\times10^{-14}cm$ we derived it's surface area as $9.676184\times10^{-26}cm^2$ and divided it by the Planck area of $2.051538\times10^{-66}cm^2$, taken from the diameter of a Planck length of $1.616199\times10^{-33}cm$ with a radius of $8.080995\times10^{-34}cm$, to compute the maximum amount of information bits allowable on a surface, as defined by the holographic principle, and obtained $4.716551\times10^{40}bits$. Then we extrapolated the number of particles in the universe from the division of that number of bits by the volume of the proton, $2.830284\times10^{-39}cm^3$, which is consistent with the holographic approach, and obtained 1.666459×10^{79} of particles. We then calculated the Schwarzschild mass of the proton geometrically and obtained $5.908578\times10^{14}gm$ by dividing the surface number of bits by the mass of vacuum fluctuations inside the volume of a proton of $2.786811\times10^{55}gm$, which was obtained by extrapolating the number of Planck sphere volumes $(2.210462\times10^{-99}cm^3)$ in the volume of the proton which results in 1.280404×10^{60} Planck spheres per proton volume, and then multiplying it by the Planck mass of $2.176510\times10^{-05}gm$. We then divided the geometric Schwarzschild mass of the proton by the number of particles to distribute the Schwarzschild mass over all protons and obtained $3.545589\times10^{-65}gm$. One could think of this last calculation as the holographic *"influence"* of one other particle of the Schwarzschild mass on one Planck area. Finally, we multiply this mass of $3.545589\times10^{-65}gm$ by the number of holographic bits on the surface horizon of the proton to represent the influence of all other protons and obtain a proton mass of $1.6722952159\times10^{-24}gm$ which is within a deviation of 0.02% of the measured mass.

Lastly, in equation (15) we offered a simplification by dividing the total vacuum fluctuations within the proton by the number of particles in the universe to also obtain the standard proton mass which is likely a more appropriate description of the physics at work.

Clearly, nowhere in the process was the standard proton mass implicated, nor were any values such as the mass of the universe or the number of particles *“cherry-picked”* in order to obtain the final value. Indeed, all variables were extrapolated by topological relationships in agreement with the holographic principle, thus rendering the argument self-consistent and non-circular. Furthermore, it is extremely unlikely that these results would be coincidental considering the accuracy of the predictions both for the Schwarzschild condition and the proton mass. Moreover, these geometric relationships render the universal size, the cosmological constant and the number of particles in the universe all in agreement with generally accepted values in cosmology. It could be contemplated that through this approach we may achieve some of the most accurate predictions for these cosmological values considering the precision with which this method estimates both the Schwarzschild mass and the proton mass.

However, one should examine the Planck units and the constants that they are derived from to insure that they have no relationship to the standard mass of the proton, as well, as these are the only units involved.

Let's first examine the Planck length which is derived by $\ell_P = \sqrt{\frac{\hbar G}{c^3}}$ where $\hbar$ is the reduced Planck constant given by $h = \frac{E\lambda}{c}\, and\ \hbar = \frac{h}{2\pi}$ where E is the energy and λ is the wavelength and c is the speed of light which comes from experimental measurements. The constant G is from the gravitational force expression: $F = G\frac{m_1 m_2}{r^2}$ and is typically derived from experiments like Cavendish's torsion experiment and more recently using optical interferometry and is unrelated to the mass of the proton. The same is true for the Planck mass which typically expressed as $m_P = \sqrt{\frac{\hbar c}{G}}$. Therefore all extrapolations in the argument and constants utilized are free of any reference to the standard mass of the proton.

4. Holography, Fractals, Wormholes and Black Holes

In sections 2 and 3 we show explicit relationships between the energy vacuum fluctuations defined as Planck oscillations in the interior and at the surface of an event horizon of a Schwarzschild proton and the universal scale Schwarzschild condition. Here we will attempt to get a clearer picture of the network structure generated by these relationships.

Let us begin by noting that the surface event horizon of the Schwarzschild proton has an amount of Planck area on the order of $\sim 10^{40}$. However, the argument suggests that the horizon reflects an entanglement with $\sim 10^{80}$ particles. Considering that the Planck surface area is the minimum surface on which information encodes, then one proton horizon can only be connected through wormhole *"hairs"* or *"strings"* to $\sim 10^{40}$ particles or approximately half the orders of magnitude of the total number of particles. Therefore, the calculation clearly suggests that there is a network of connections in which one particle entangles with a first iteration of particles of $\sim 10^{40}$ others and each one of them in turn is connected to another $\sim 10^{40}$ particles. As a side note, these iterations resemble fractal networks and may be essential to identify a fundamental structure and may as well be related to the earlier work of Lindquist and Wheeler on Schwarzschild cells.[21] Of course, these string network relationships would obey a specific tiling structure of the Planck areas and the Planck volume packing on the surface and internal to the horizon. Considering that recent evidence has shown tetrahedral structures to be the most efficient packing geometry[22,23,24,25,26] we would expect the wormhole network to have a tetrahedral/octahedral tiling. Some of these network iterations may have already been detected in large scale mapping where we find supercluster distributions that seem to organize in very specific geometric patterns, namely tetrahedrons and octahedrons.[27,28]

When we examine our argument in more detail, we find that the Schwarzschild geometric solution is extrapolated from a relationship of the number of Planck areas on the surface of the event horizon to the internal fluctuations of the vacuum structure. Yet, in a wormhole entangled universe this internal value is shared across all the other particles' internal volumes and is behind the horizon. However, protons sharing the high vacuum density in their interior through wormhole structures have an attraction, proton to proton, equivalent to the Schwarzschild condition or $\sim 10^{40}$ times higher than the external gravitational environment. One can visualize this better by realizing that in equation (11) where R_ρ is divided by $\eta_{\ell Ap}$ the internal vacuum fluctuation of the proton has essentially been shared through the wormhole network with the number of particles directly connected to the initial one (first iteration) to generate the Schwarzschild mass. Therefore, the shared holographic value is the Schwarzschild condition of the proton and thus the protons will experience a gravitational force of that magnitude.

However, the vacuum fluctuation density at the universal level on the outside of the event horizon of the proton is, of course, distributed across all particles, therefore, R_ρ is distributed across all particles as in equation (15) to result in the standard mass of the proton; the one we measure.

4.1 The Holographic Grain Size of Spacetime

Typically the spacetime grain size is estimated in holographic theory by dividing the number of surface Planck areas on the universal sphere into the volume of the universe. Of course, in our argument, the resulting volume is the proton radius. In 2009, articles were published reporting that the GEO600 gravity wave detector interferometers were detecting a strange noise of unknown origin. Craig Hogan, Director of the Fermilab Center for Particle Astrophysics, contacted the group with the novel idea that based on the holographic principle, the universe should have a "grain size" on the order of $10^{-14}\,cm$. We note that this is the correct order of magnitude for the proton size. Hogan predicted that their interferometers should be able to detect a particular noise spectrum corresponding to that grain size. Remarkably, the GEO600 "mystery noise" seems to be well correlated with the grain-size prediction.[29] However, some concerns have been raised mentioning that Hogan's calculations failed to account for the self-focusing capacity in the interferometer's laser beams.[30] More recently, Hogan and Fermilab are in the process of constructing a high precision interferometer, the Holometer, to refine the measurements.[31,32]

5. Other Research of Interest

In this section we will discuss other work parallel and supportive of the Schwarzschild proton approach and which are complementary to our results. Few details will be given as some of these other models are extensive and beyond the scope of this paper. Therefore, this should be considered as reference material. However, current physics is being written in accordance with these discoveries which are important to consider in the context of this research.

5.1 New Models for the Black Hole and the Black Hole Electron

While we have been developing a black hole model of the proton, known to us only recently, Dr. Alexander Burinskii of the Russian Academy of Science, who received a First Award in the 2009 Essay Competition of the Gravity Research Foundation, has developed similar models for the electron based on the Kerr-Newman and the Kerr-Schild solutions, which describe black holes with mass, spin, and charge.[33] In one of his papers,[34] he develops a model for black holes applicable at all sizes and especially for modeling subatomic particles like the electron and the proton. His results help us to complete the Schwarzschild proton picture.

Burinskii shows that one of the best descriptions of the electron, by Paul Dirac, can be extended using the Kerr-Newman and the Kerr-Schild solutions which utilize Cartesian coordinates. As a result, the Dirac electron acquires the extended spacetime structure of the Kerr-Newman geometry. The electron can then be described as a ring singularity with the Compton radius of the electron and the gravitational and electromagnetic fields represented as twistors, which describe vortices. This Dirac–Kerr-Newman vortex model of the electron behaves the same as the more familiar Dirac electron, having a gyromagnetic ratio of 2, for example.

Ordinarily, black holes have event horizons, boundaries surrounding the singularity lying at its center. However, in a black hole with angular momentum and spin, as well as charge, it is possible to have a singularity without event horizons. For example, if the sum of the square of the angular momentum density and the square of the charge is very much greater than the square of the mass, i.e. $\left(a^2 + q^2 \ >> \ \mathrm{m}^2\right)$, then a singularity will fail to develop horizons and will be *"naked"*.

Burinskii models the electron as a spinning "naked" ring singularity with Compton radius. The orbits of this Kerr-Schild singularity are stable when the spin velocities are near the speed of light, in part, because the rapid spin cancels Hawking radiation.[35,36] In fact "*A near extremal black hole (i.e. $a* \sim 1$) has the temperature near zero.*"[37] The use of a ring singularity allows electrons to be extended entities with real spin. By incorporating a gravitational term, Burinskii accounts for the self-containment of the electron charge elements (a substantial issue in the standard model) in a manner similar to our approach in the Schwarzschild proton where we show that the strong force may be gravity. Furthermore, Burinskii's electron model has the appropriate angular momentum, Compton radius, magnetic moment and gyromagnetic ratio. Burinskii also incorporates holographic projections in his descriptions of the Kerr-Schild solution and twistors.[38] Below we include a figure showing the geometry of the Kerr-Schild solution. Note the ring around the "hour-glass" shapes; this is the ring singularity.

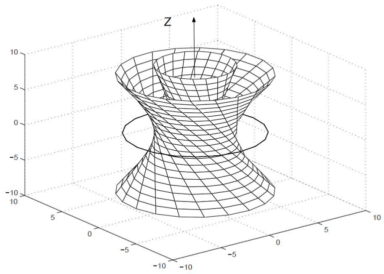

Figure 1. The Kerr singular ring and congruence. Note the ring singularity and the two-sheeted twistor configuration (after Burinskii[33])

5.2 GEONS

GEON's or Gravitationally Extended entities, were developed by Dr. John Wheeler and are similar to some earlier work by Einstein[39] along the same lines. Wheeler thought objects with a sufficient number of photons would form a stable object with the trait of "*mass without mass*" and that, further, one could have lines of charge originating and terminating in wormholes so that one could have "*charge without charge*". He called this field of study "*Geometrodynamics*".[40,41] Significantly, Wheeler's GEON's were formulated without spin or charge.

From about 1960 to 1970, Dr. Elizabeth Rauscher extended Wheeler's concepts to model subatomic particles with some success.[42] However, the masses derived for stable GEON's were many orders of magnitude larger than subatomic particles. We initiate the resolution of these issues in the sections above and by incorporating spin and charge, Burinskii's singular ring Kerr-Newman solution generates an extended particle-like electron, a stable "*microgeon*" of subatomic size.

5.3 The Information Paradox, Wormholes and Hairy Black Holes

A black hole is generally thought to be mostly isolated from the rest of the universe. For example, it was long thought by Hawking and others that the information represented by the mass/energy falling into a black hole was lost forever, leading to the so-called *"black hole information paradox."* After some 30 years, Hawking changed his position to one in which the information can be recovered. From our research we have also concluded that the event horizons of black holes were likely dynamic, turbulent, and connected to the universe outside, interacting with the external spacetime through feedback mechanisms characterized by vorticity producing holographic interference patterns and *"holes"* at the horizon. Dr. Burinskii has also concluded that the event horizon is very dynamic and coupled to the rest of the universe in ways seldom considered.

Figure 2 below shows a cross-section of the Kerr-Schild black hole with inner and outer event horizons; the vertical line in the center of the diagram is the ring singularity viewed edge-on. Photons impinging on the horizon generate *"wormholes"* or an *"axial singularity"* at the poles.

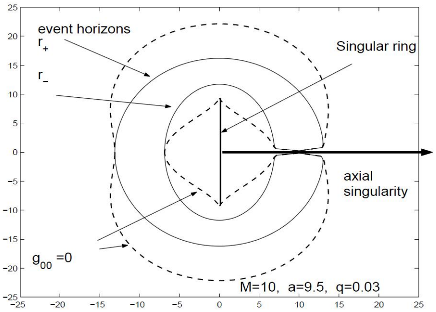

Figure 2. Holes in the horizon of a rotating black hole formed by a singular beam directed along the axis of symmetry(after Burinskii[33]).

Note that the beam at the pole corresponds to ubiquitous axial jets, for example, those observed at the poles of black holes with accretion discs. Also note that a second jet can form at the opposite pole due to Coreolis effects which would correspond to the double-torus geometry of the Haramein-Rauscher solution.[43]

Figure 3 below shows the event horizon of a black hole can be pierced by photons. Each piercing results in a wormhole or line singularity that is *"semi-infinite"* in extent.

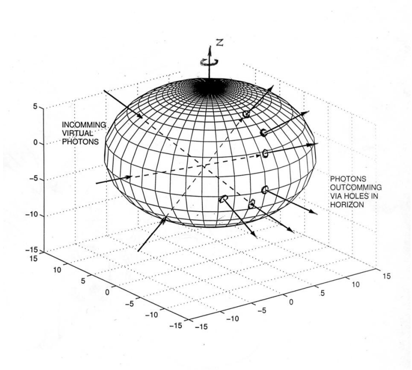

Figure 3. Excitation of a black hole by the zero-point field of virtual photons forms a set of micro-holes at its horizon (after Burinskii[33]).

Generally, it is thought that black holes have little interaction with the external universe and are characterized by only spin, mass and charge. This lack of characteristics is described by saying that *"black holes have no hair."* From Burinskii's descriptions, however, it follows that black holes are intimately coupled to the external universe through many micro-wormholes, as in our model. This may resolve the *"information paradox"* because the wormholes are classical or semi-classical channels or *"wave guides"* that allow for exchange of mass and energy and offer a mechanism by which black holes can have *"hair."* Burinskii also states: *"The known two-sheetedness of the Kerr metric, a long time mystery, turns out to be matched perfectly with the holographic structure of space-time. The resulting classical geometry produced by fluctuating twistor-beams may be considered as a fine-grained structure which takes an intermediate position between the classical and quantum gravity."*[32]

Through the multiple holographic micro-wormhole channels, black holes become open systems. In the terms of Ilya Prigogine, such highly dynamic systems are *"dissipative structures, far from equilibrium"* which can have increasing, stable or decreasing entropy, depending on conditions.[44,45] Therefore, the entropy of a black hole becomes a function of the balance of flows both inward and outward. Through being coupled to the energy of the vacuum fluctuations, black holes may even create negentropy, which opens the possibility of continuous creation of order through the polarization of the vacuum.

5.4 Stable Orbits for Binary Black Holes

Dr. Janna Levin Professor of Physics and Astronomy at Barnard College of Columbia University considers the energy levels for binary orbiting black holes. She compares these orbits to the ones of atoms, where the smaller black hole represents a kind of macroscopic *"electron"* and therefore the massive one corresponds to a Schwarzschild proton. She states: *"A spinning black hole with a much smaller black hole companion forms a fundamental gravitational system, like a colossal classical* *analog to an atom… The black hole atom is not just a theoretical construct, but corresponds to extant astrophysical systems detectable by future gravitational wave observatories.”* [46]

She extends this correspondence to the classification of periodic orbits which are considered as energy levels in a macroscopic system analogous to the energy levels of electron orbitals. *"Bare black holes are as perfect as fundamental particles. As Chandrasekhar said, ‘The black holes of nature are the most perfect macroscopic objects there are in the universe.’ A black hole with a given mass and spin is indistinguishable from every other black hole with the same mass and spin. Likewise, a supermassive black hole with a much smaller black hole companion forms a kind of macroscopic, classical atom, reminiscent of the hydrogen atom. In analogy with atomic physics, the orbits around a given black hole can be completely described by a periodic table… – a table of periodic orbits ordered in ascending energy from the stable circular orbits (the ground-like state) up to the last bound orbits (the energy of ionization). Further, the energy levels of the periodic orbits around a black hole are, formally speaking, discrete.”*

Astrophysical evidence is therefore, starting to emerge that shows an analog from cosmological black holes to atomic and subatomic dynamics. This as well gives supporting evidence that a black hole atomic structure can be constructed and will have stability and orbital behavior that may produce the periodic table of elements.

5.5 Do We Live in a Black Hole?

Dr. V. I. Dokuchaev of the Institute for Nuclear Research of the Russian Academy of Sciences shows that there can be stable periodic orbits even inside of black holes which are located between the Chauchy horizon and the outer event horizon of a Kerr-Newman black hole. He suggests that even advanced civilizations may exist in the interior of super-massive black holes.[47]

Dr. Nikodem Poplawski professor of physics at Indiana University considers what happens when a massive particle falls into an Einstein-Rosen bridge or “*wormhole*”. His results suggest: “*… that observed astrophysical black holes may be Einstein-Rosen bridges, each with a new universe inside that formed simultaneously with the black hole. Accordingly, our own Universe may be the interior of a black hole existing inside another universe.”* [48] These conclusions are congruent with our result, as shown in section 2 in which the cosmological constant can be extrapolated from a Schwarzschild proton inflated to the universal size with consideration of the internal vacuum fluctuations.

6. CONCLUSION

Here we have demonstrated a clear geometric and holographic relationship between the micro-structures of the proton and the macro-structure of the universe. These relationships cannot be deemed coincidental considering the accuracy of the predictions of both the Schwarzschild condition and the measured mass of the proton. Furthermore, the values extrapolated for the cosmological constant, the size of the universe and the number of particles in it, all fall well within widely accepted standard values. Therefore, these results stand firmly between relativistic physics and quantum theory as they generate the Schwarzschild condition and the standard mass of the proton from geometric considerations that relate the Planck units and the Planck density to cosmological structures, hence generating a framework for scale unification.

In work in progress we continue to explore these relationships in terms of harmonic oscillatory modes of the wormhole string structures and their network arrangements. These considerations involve gyroscopic and Coreolis resonance mode mapping determined by vacuum fluctuation dynamics near and at horizons. Thereafter, further considerations will be explored relating to the entropy and electromagnetic components of such systems.

ACKNOWLEDGEMENTS

The author would like to acknowledge Dr. Michael T. Hyson for his valuable assistance and research support in the completion of this paper and Dr. Elizabeth A. Rauscher for her valuable advice and her foresight, trailblazing research and courage.

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