Derivation of the Schwarzchild Solution from a Scalar Model of Spherical Quantum Waves

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It is shown that if space is modeled as an elastic medium that propagates spherical, scalar quantum-waves, then the ratio of the square of the wave velocity to c^2 reveals the same results as the familiar time dilation formula that is produced from the Schwarzchild G_{44} component. The Schwarzchild radius derived from the scalar-wave model is shown to be equal to the radius of the universe, implying that there are no gravitational singularities present within the radius of the Universe.

1. Introduction

Einstein's highly coupled, non-linear field equations were based on the postulate that mass warps surrounding space. The solution to these equations for a spherically symmetric, non-rotating mass was found by Schwarzchild in 1916 and the G_{44} component describes the Schwarzchild radius and time dilation effect of the mass [1]. This result has lead to the conclusion that a mass occupying a radius less than the Schwarzchild radius must be a black hole which consumes matter and from which light cannot escape gravitationally. It will be show that the time-dilation formula from G_{44} can be reproduced with simple potential-energy equations that describe the speed at which spherical quantum waves propagate in an elastic space fabric. The resulting singularity from this scalar model shows that the radius of the singularity is the radius of the universe, a natural consequence of escape velocity as modeled by Newtonian gravitation. The time-dilation formulas that result from this Newtonian model duplicate the G_{44} solution without the complexity of a singularity and it's associated problems.

2 The Spherical Wave Model

Albert Einstein first developed the concept that mass warps surrounding space. The same concept in reverse is part of the elastic space model proposed, where the compression length of space determines the rest energy of a particle. The characteristic-compression length, r, of the space fabric will be shown to be related to the rest energy of the particle through this elastic space model, where particles are in reality the interference of two wave centers of spherical standing waves due to the compression of the space fabric. This compression is part of a standing wave structure where a spherical wave coming into the particle center combines with spherical wave outgoing from the wave center to form the two solutions of a spherical wave function that we measure as a particle at the wave center [2,3].

This wave function is not to be confused with the Schrödinger wave equation, which requires the use of Planck's constant, h, in Schrödinger's equation. The discrete nature of matter can be described with standing matter waves that have integer wave numbers and can be described completely with Newtonian physics which is more fundamental as a unit of discreteness than is Planck's constant in Schrödinger's equation.

Also, Schrödinger's wave equation is believed to propagate at instantaneous speed, although this has not been proven experimentally. It has been shown that Schrödinger's wave function travels faster than c, and faster than our current technology is capable of measuring, but not necessarily instantaneously. The spherical wave equation proposed by Wolff [2] has the features of transferring information faster than the speed of light when a shear force exists in the fabric, however standing spherical waves which create particle wave-centers always travel at the speed of light in this model as will be shown. In this sense, Wolff's spherical wave function meets the experimental requirements of a wave function that describes quantum entanglement and information transfer that is faster than c but which has a more physically-intuitive basis than the probability-density function associated with Schrödinger's equation.

Schrödinger himself disagreed with the probabilistic interpretation of his equation and instead stated the following: "Let me say at the outset, that in this discourse, I am opposing not a few special statements of quantum mechanics held today (1950's), I am opposing as it were the whole of it, I am opposing its basic views that have been shaped 25 years ago, when Max Born put forward his probability interpretation, which was accepted by almost everybody" [6]. Schrödinger also stated that "What we observe as material bodies and forces are nothing but shapes and variations in the structure of space. Particles are just schaumkommen (appearances)." [7]

The probability-density function of Schrödinger's equation, which predicts the location of particles in space, can also be interpreted as the location in space of wave peaks of a standing wave, which must have an integer number of full wavelengths within the given length of the standing wave motion. The larger the integer number is, the greater probability of a particle in any given region of space is. From this interpretation, the prediction of wave-centers of a particle becomes deterministic instead of probabilistic, based on the analysis of a fixed standing wave. Thus, the experimental predictions of Schrödinger's wave equation may be shown to be equivalent to a deterministic, standing matter wave equation as shown originally by interpretation of the Bohr radius in the Hydrogen atom as an integer number of matter wavelengths.

The form of the basic spherical wave equation of amplitude Φ for waves moving at speed c is:

$$\nabla^2\Phi - \frac{1}{c^2}\partial^2\Phi / \partial t^2 = 0 \quad (1)$$

The two amplitude solutions of the wave equation are as follows:

$$\Phi^{IN} = \frac{1}{r}A_0 e^{(i\omega t\ +\ ikr)} \quad , \quad \Phi^{OUT} = \frac{1}{r}A_0 e^{(i\omega t\ -\ ikr)} \quad (2,3)$$

The combination of (2) and (3) as follows creates the electron wave-center and removes the problem of infinite amplitude at $r = 0$:

$$\Phi^{IN} - \Phi^{OUT} = \frac{1}{r}A_{in}e^{(i\omega_i t\ +\ ik_i r)} - \frac{1}{r}A_{out}e^{(i\omega_o t\ -\ ik_o r)} \quad (4)$$

Where ω_i and ω_o are the in-going and outgoing mass-frequencies of the electron, which are the same if there is no relative motion and k_i and k_o are their associated wave numbers. Upon inspection it is seen that (4) will produce a finite amplitude at $r = 0$, as can be seen by taking the limit as r approaches 0. This eliminates the need for renormalization of the function that is found in dealing with the electron radius and the renormalization procedures of QFT.

As the solutions (2) and (3) are scalar equations that are independent of θ and ϕ and are only dependent upon the spherical coordinate r, we may simplify the equations for the compression force produced by both incoming and outgoing waves as follows:

$$\| \partial\Phi^2 / \partial r \| = F \approx kr \quad (5)$$

where F is the force of compression given by the partial derivative of the potential with respect to r, r is the distance over which the space fabric is compressed, and k is the elastic constant of space. By integrating the force law of (5) from a chosen reference $r = 0$ to any arbitrary point r in the space fabric, and setting the result equal to the rest-energy of a particle we obtain:

$$mc^2 = \tfrac{1}{2}kr^2 \quad (6)$$

where m is the mass of the particle and k is the elasticity constant of space. From this relation we can derive k from known quantities as follows. If $m =$ the mass of the Universe, 1.44 x 10^{53} Kg, and for $r =$ radius of the Universe, 1.9 x 10^{26} meters we obtain:

$$k = 7.18\times10^{17}\ \text{Newtons/meter} \quad (7)$$

For $m =$ mass of pi-meson$_{(+)}$, 139.6 MeV and $r =$ range of strong nuclear force which is the maximum known nuclear radius (7.88×10^{-15} meters), we obtain $k = 7.18\times10^{17}$ Newton/meter which is the same as (7). If $m =$ mass of electron, 9.11×10^{-31} Kg and $r =$ classical electron radius of 2.82×10^{-15} meters, then $k = 2.0\times10^{16}$ Newton/meters which is a factor of about 10 from (7). Also, for $r =$ the Planck length, $k = 7.18\times10^{17}$ Newton/meter, we find that $m = 10^{-68}$ Kg, an estimate of the photon mass as first proposed by J.P. Vigier [4]. For the case of $r = 10^{-18}$ meters, which is the approximate weak nuclear force range and using k from (7), we find $m =$ 2.2 eV/c^2 which is a predicted mass for the electron-neutrino. In addition, the search for a neutral particle of 33.9 MeV in 1995 to explain the unexpected time discrepancies in pion decay [8] reveals that the compression length for the 33.9 MeV mass is 3.94× 10^{-15} meters as determined from (6). This is exactly one half of the compression length of the pi-meson$_{(+)}$, which as described above is also the maximum nuclear radius (7.88 femtometers) determined from (6). It is anticipated that more neutral particles will be found at compression lengths of (7.88 fm)/ n, where n is an integer, consistent with standing wave theory.

Thus, it is shown from (6) and (7) that the key force ranges for gravitational, strong, weak and electromagnetic forces yield a rest-mass of a particle that has been hypothesized or is measured in mass as the particle associated with transmitting the corresponding force. The nature of a field is therefore proposed to be the interaction of wave centers, a theory which may be tested for the electric field by measuring the resulting interference of gamma rays which have the same Compton wavelength as an electron (512 KeV such as those produced by Na-22), that are obliquely crossing the path of a high-intensity electric field [9]. For transient and short-lived particles that are not stable and do not govern one of the four forces, we can show that a scalar but dynamic force equation of the form $mr'' + br' + kr = 0$ accurately predicts a transient change in mass (r'' is the second time-derivative of the compression length, similar to r in (6)), m / b is the lifetime of the particle, $\sqrt{k / m}$ is the oscillation frequency of the mass, and k is the same elasticity constant from (7).

For the J/Psi meson, a vector meson which has a transient mass m of 3097 MeV and a known mean lifetime of $m / b = 7.2\times10^{-21}$ seconds, we find that the decay constant $b = 0.76\times10^{-6}$. For the Upsilon meson, another vector meson which has the same principal decay mechanism as the J/Psi meson above (both mesons have a similar quark makeup and are also their own anti-particles), the measured mean lifetime is $m / b = 1.3\times10^{-20}$ seconds and the transient mass m is 9460 MeV, which has a decay constant $b = 1.29\times10^{-6}$, less than a factor of one-half when compared with the decay constant of the J/Psi meson. The decay constant b is similar to a frictional constant that could theoretically be derived from the dynamics of the wave interaction during the decay of transient particles.

As shown from the examples in (5) and (6), we can use a scalar formula for the speed of the spherical, standing waves in a fabric of elasticity k:

$$\text{speed} = \sqrt{kr / \sigma} \quad (8)$$

Where $k = 7.18\times10^{17}$ Newton/meter as previously determined from (7), r is the displacement or amplitude of the wave in the space fabric, and σ is the mass-per-unit length of the space-fabric.

For a wave that has a displacement equal to the radius of the universe, the numerator under the radical in (8) becomes:

$$F = k(10^{26}\text{meters}) = 7.18 \times 10^{43}\text{Newton} \quad (9)$$

Now we examine σ, or the linear mass-per-unit length of the space fabric. If we take the average mass of the Universe found from critical and average density determinations as 1.44×10^{53} Kg, and the distance that the force in (9) acts over as the radius of the Universe $= 1.9 \times 10^{26}$ meters, we find σ as:

$$\sigma = \frac{1.44 \times 10^{53}\ \text{Kg}}{1.1 \times 10^{26}\text{meters}} = 1.3 \times 10^{27}\,\text{Kg/meter} \quad (10)$$

Substituting the value for σ from (10) and the value of kR_u from (9), we find the speed of the spherical standing waves from (9) to be:

$$\text{speed} = \sqrt{\frac{kR_u}{M_u / R_u}} = \sqrt{\frac{k}{M_u}}R_u = 2.46 \times 10^8\,\text{m/s} \quad (11)$$

which is seen to be very nearly c. Also note that the radical in (11), $\sqrt{k / M_u} = 2.28 \times 10^{-18}$ seconds^{-1}, which is Hubble's constant, H_o. Then the familiar Hubble relation, $\text{speed} = Hr$ is revealed from (11). The speed in (11) is that of the spherical waves either going into or coming out of the center coordinates of a particle, as the solution to the spherical wave equation yields a positive and negative solution.

3. Time Dilation Effects

From (8) and (9) we know that the upper limit for v is c and this corresponds to a tensile force equivalent to the mass of the universe and hence the speed of the incoming waves to each particle in the universe. Therefore, particles with masses smaller than M_u will exhibit a force that is less than (9) with correspondingly lower speeds for the particle's outgoing wave. If we take a given example mass of 10^6 Kg and calculate from (6) what the displacement r is (knowing k from above) we find $r = 500.6$ meters. This is the compression length in the space fabric that corresponds to this mass and because the force is less than in (9), we expect the speed of the scalar quantum waves to be less than c, which will amount to time-dilation effects at distance r from the particle of this mass.

When we substitute $r = 500.6$ meters into (8) we find $v =$ 0.526 mm/sec, which is the speed of the out-going quantum wave solution from the mass at 500.6 meters from the center of the mass. There is also the pull on the example mass (10^6 Kg) from the remaining mass in the Universe (kR_u) which is similar to Mach's principle [5], and results in a velocity c of the in-going quantum waves at the particle, based on the two solutions of the wave equation.

The time dilation effects result from the ratio of the speed of outgoing to incoming quantum waves at the particle center. When we take the ratio of the 'out-wave' speed to the 'in-wave 'speed of c we find $v / c = 1.753 \times 10^{-12}$ and

$$v^2 / c^2 = 3.07 \times 10^{-24} \quad (12)$$

From the Schwarzchild solution, the time dilation at a distance r from the center of the gravitational source M is

$$T = T_0 \Big/ \sqrt{1 - 2GM / rc^2} \quad (13)$$

For the example of the mass of 10^6 Kg and $r = 500.6$ meters, it is found that the denominator of (13) is approximately the same as (12):

$$v^2/c^2 \approx 2.96 \times 10^{-24} = 2GM / rc^2 \quad (14)$$

where v^2 / c^2 is substituted from (12) and is based on cosmological parameters (M_U, R_U) of the Universe which are known to have an uncertainty that suggests (14) could be a fundamentally correct relationship. If we apply the Lorentz transformation to (12) and the results of (14) we arrive at the formula:

$$T = T_0 \Big/ \sqrt{1 - v^2 / c^2} \quad (15)$$

From (12) and (14), the time dilation formula of (15) is derived that is numerically equivalent to the Schwarzchild solution of (13), regardless of the mass that is chosen for the example. This is derived from the simple scalar equations of (6) and (8). There is a difference when solving for the singularity in (15). By setting the denominator of (15) equal to 0 and substituting (8) for v we find the relation:

$$kr / \sigma c^2 = 1 \quad (16)$$

where σ is found from (10). Then r is found from (16) to be

$$r = R_u = 1 \times 10^{26}\ \text{meters} \quad (17)$$

indicating that the only black hole that exists is the Universe itself.

4. Conclusions

The Schwarzchild solution for time dilation is duplicated in the proposed model of spherical matter waves. Starting from a model of a spherical wave equation, the scalar formulas for force and speed are used to describe the nature of spherical waves in space, showing the speed of the waves to be c and this in turn defines the rest energy of the particle produced at the wave center of the spherical waves as mc^2. It is shown that the particles associated with transmitting the four forces of nature can be described by an equivalence between the energy of compression in the space fabric and the rest-energy of the particle.

It is also shown that the Lorentz transformation of the outgoing spherical quantum wave to the in-going spherical quantum wave produces the same time-dilation effects as the Schwarzchild G_{44} solution from an arbitrary mass M. The similarity to a Schwarzchild radius that results from the spherical wave model is a radius that is equal to the radius of the universe, implying there are no gravitational singularities present in the Universe.

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Analysis of the de Broglie Phase Wave (cont. from p. 53)

• Quantum numbers relate to the fact that relative distances are multiples of wavelengths or of groups of wavelengths. We see that interacting vibratory systems arrange themselves mutually as determined by the phase wave. Thus their wave centers (particles) are separated by whole multiples of wavelength (where these numbers are no longer mysterious - they are deduced rather than postulated).

Physics, being founded on observation of Nature, should accept these discoveries, even if they are contrary to current particle beliefs.

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The Wave Structure of Electron Spin

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The origin of the mysterious quantum spin of the electron and other charged 'particles' is shown to be a result of the Wave Structure of Matter (WSM). Spin is a *spherical rotation* in quantum space of the inward quantum waves of an electron at the electron wave-center to become the outward waves. Spherical rotation, a unique property of 3D space, can be described using SU(2) group theory algebra. The WSM spin agrees completely with the theoretical spin derived by Dirac (1929), and shows the physical origin of his Dirac Equation.

1. History of the Wave Structure of Matter and Spin

The Wave Structure of Matter (WSM) is relatively unknown to modern scientists who incorrectly propose that basic matter is composed of discrete '*particles*' with discrete quantities of mass, charge, and spin. However the basis for WSM was proposed a century ago, in the works of William Clifford at Cambridge U, and Nobelist Irwin Schrödinger.

William Kingdon Clifford was a mathematician and astronomer nearly a half-century before Einstein's General Relativity Theory (GRT) or Quantum Mechanics (QM). In 1876 Clifford discussed the geometry of space at astronomical distances and in atom-sized space, stating: *I hold:*

1) *That small portions of space are in fact analogous to little hills on a surface which is on the average flat, namely that the ordinary laws of geometry are not valid in them.*

2) *That this property of being curved or distorted is continually being passed on from one portion of space to another after the manner of a wave.*

3) *That this variation of the curvature of space is what really happens in that phenomenon which we call the motion of matter, whether ponderable or ethereal.*

4) *That in this physical world nothing else takes place but this variation subiect to the law of continuitv.*

Einstein's GRT is regarded as the first successful non-Euclidean space, but in truth it is pre-dated by Clifford's. Clifford's geometry represented matter by space curvature. But unfortunately, Clifford's ideas were too difficult to grasp for a community just beginning to cope with non-Euclidean geometries in the 1870's. Einstein's curved space was not as radical in 1915 as Clifford's was in 1870. So it triumphed.

Clifford's space model is the description of matter in motion he published in his magnum opus, the **Elements of Dynamics**, in 1878. The book described an elastic medium interpreted as the whole of curved space. Thus if the expansion and the spin are known at every point, the whole motion can be determined. He related gravitation to a strain in space. The space of Clifford was a four-dimensional elliptic space. The constant of curvature was too small for detection through astronomical observations, but that fact did not negate the possibility that space could be other than Euclidean.

Clifford's 'scale of Nature' (future quantum theory) described connections of contiguous points of space using curvature in the fourth dimension. The three-dimensional analogue of this curvature was an elastic medium in which *twists* (future spin) were the fundamental element. The *twists*, in turn, composed *vortices* and *squirts* that supplied strains in the elastic medium which gave rise to electromagnetic and gravitational forces.