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Revising Electrodynamics: New Perspectives on Molecular Bonding in Chemistry

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ABSTRACT

This paper proposes a radical reinterpretation of electron dynamics in atoms, arguing for a fundamental revision of both Bohr and Schrödinger atomic models. Introducing the concept of a "Reverse Higgs process," the authors suggest that electrons can lose their rest mass and propagate at the speed of light as massless entities on electromagnetic or so-called "ghost" waves. The work challenges conventional quantum mechanical views of the radial wavefunction ψ(R), proposing instead that ψ(R) represents a constant orbital size rather than a probabilistic distribution. The authors present a geometric reinterpretation of orbital shapes using twisted rope analogies to explain transitions between s-, p-, d-, and f-orbitals, emphasizing that space-time curvature naturally leads to orbital quantization. By distinguishing between ghost waves and true electromagnetic waves, the study further argues that electron trajectories are well-defined rather than probabilistic clouds, effectively reinterpreting quantum entanglement and spin. Ultimately, the paper claims to complete Einstein's theory of special relativity and suggests a unified framework for understanding electron propagation, molecular bonding, and the structure of complex molecules. This new perspective has implications for foundational physics and chemistry, challenging longstanding interpretations and proposing an alternative geometric and dynamic basis for atomic and molecular behavior.

Keywords: Special Relativity, Bohr, Schrodinger, p-orbit, radial wavefunction, space-time curvature.

INTRODUCTION

The chief purpose of this paper will be to arrive at a concise and complete statement about electron dynamics, the matter of how electrons travel, propagate, as alluded to in the abstract above, with in mind a subsequent in-depth study of chemical bonding, i.e. molecular orbitals, whereupon an electron continuously propagates between two atomic orbitals that satisfy $\Delta l = \pm 1$.

And subsequently, we move into a detailed study of aromaticity. What do physicists currently know about the manner in which electrons propagate? Next to nothing. They know that an electron has mass, but do not realize that it can lose that (rest) mass and propagate upon photons at the speed of light. By the Reverse Higgs boson. Which nobody knows about because nobody has analyzed the following equation of Einstein, beyond Einstein himself when he applied Taylor series in the low energy limit.

$$E^2 = (pc)^2 + (m_0c^2)$$

or

$$E^2 = m_0c^2 + \frac{1}{2}\frac{m_0v^2}{\sqrt{1-\frac{v^2}{c^2}}} \quad (1)$$

Well, that is spectacular. Out of that simple E^2 equation, and equation (2) below, you get all that. But that is not the

half of it. Einstein's transformation, equation (1) above, was derived as a Taylor series approximation, in the limit $v \to 0$.What about other than that? In particular, $v \to c$. Einstein didn't do it. In fact, nobody's done it, apart from Dirac it would seem. We analyze this E^2 equation in a completely different manner to that of Dirac, because we are completing special relativity, not building upon it. It is likely the difficulties that Quantum field theorists are having, when they are presented with the completion of special relativity, will be resolved from this process of continuing, where Einstein left off.

LITERATURE REVIEW

In the four listed references, extensive investigations have been carried out in mathematics, physics and chemistry. We have a completion of special relativity, instituting the Reverse Higgs process, whereupon an electron can have its rest mass removed, subsequently it propagates as a photon. We have investigated the Schrodinger and Bohr atoms extensively, even devised a Bohr theory for multiple electron orbits, [1]. Bohr orbits are massive, described by Newtonian mechanics, $v \ll c$, mass = amplitude approximatly is constant. The variation occurs via a wide range of velocity variations. Whereas in the Schrodinger scenario, we have massless propagation, no variation in velocity $v = c$. And λ of de Broglie, $p = h/\lambda$, is the same for both Bohr and Schrodinger, a Bohr atom has exactly the same set of energy transformations as a Schrodinger atom. So, Bohr does the variation via variation in speed $\boldsymbol{v}$, (constant $m = \psi$), and Schrodinger does it by variation in $m = \psi$, (constant $\boldsymbol{v = c}$). Finally note that the Bohr electron is held in its orbit by Newtonian force. But the Schrodinger electron is held in its orbit by space-time curvature, because it is massless, $v = c$, it is a photon! In these references, a lot of work has led to the conclusions put forth in this paper, that Einstein is in fact only half right! Planets, or one might say agglomerations of nuclei are attracted by Newtonian force. Non-nuclear entities, chiefly photons, and also non-nuclear fermions, (massive electron), do not interact with gravitational fields in the Newtonian manner, however. Instead, they pursue the space-time curvature which Einstein worked out so admirably. And Newtonian force is experimentally, although not theoretically indistinguishable from Einsteinian space-time curvature, they both produce the same trajectories. Well almost. It turns out that with the space-time curvature effect on photons, Newton's third law is not obeyed, when a photon bends in a planetary gravitational field, the planet does not experience a reactive force.

METHODOLOGY

This is the revolutionary path we shall take. The Bohr atomic model and the Schrodinger atomic model are at odds with each other. So much so that the modern physicist carries around with him a prescription: Bohr is wrong, it was replaced by Schrodinger when physicists learned more about quantum theory. Bohr's is the old quantum theory. We follow an alternative proposition. What do we make of the discrepancy between Bohr and Schrodinger? In a Bohr atom, electrons are confined to $v < c/10$, meaning the total mass in equation (1) above differs from m_e, the electron rest mass, only in the fourth or fifth significant figure. Bohr orbits are circular, (or elliptical!) And two dimensional. Schrodinger orbits can be circular, like Bohr, but they can also be a figure of eight rotation, into a two-lobed dumbbell, plus various assemblies of this. Schrodinger orbits are three-dimensional. Enough, we say. These alternate descriptions cannot be describing the same phenomenon. There must be two kinds of atoms, a Bohr atom and a Schrodinger atom. And one can be converted to the other, then back again. In a metal lattice, atoms exist in the Bohr atomic form, outside it, in the Schrodinger form. Schrodinger is where all the chemistry takes place, the shape of the p-dumbbell and combinations of it, along with the circular s-orbit, make very intricate structures possible, which would not be possible with circular/spherical Bohr orbits. In particular, with the most complex molecules, that we meet in molecular biology and biochemistry. There are no difficulties in the Bohr lone electron hydrogen atom. Nothing is wrong about it. But the physics of the Schrodinger model has turned out to be wrong. Bohr put $m = m_e$ into his equation, and not:

$$m = \frac{m_e}{\sqrt{1-\frac{v^2}{c^2}}} \tag{2}$$

But he got away with it! Because the electrons in the Bohr orbits so not travel fast enough that m in equation (2) will differ significantly from me. It turns out Schrodinger made the same mistake, but paid for it dearly. That is because electrons in Schrodinger orbits travel at $v = c$, not $v < c/10$. So, when Schrodinger instigated $m = m_e$ into his equation, he forced his Schrodinger atom into a Bohr atom! Same electronic transitions, same absorption/emission spectra, but the Schrodinger amplitudes, ψ are totally wrong, thanks to this oversight of Schrodinger. Heisenberg sabotaged Schrodinger's lecture, tried to make him understand that the correct approach is to take the energy levels of the Bohr atom and put those into the Schrodinger equation, not to use the Schrodinger equation to replicate something that we already knew through Bohr. And this is essentially the path we have followed in this paper. Essentially, and this may sound harsh but it is true, physicists and chemists have no idea about the radial part of the wavefunction. They cannot calculate its value for any atom, not even hydrogen. They think that is a function of R, $\psi(R)$, when in fact it is nothing more than a value of R. All this, because it has not occurred to them that if you look at the de Broglie expression, $mv\lambda = h$, well v, λ are wave properties, therefore m is a wave property, therefore it equals the amplitude of the wave. Essentially:

$$m = \psi \tag{3}$$

Continuing on from Introduction, above. What else do physicists know? They know an electron exists inside an atom in two, seemingly contradictory states. According to the Bohr description, the electron states are circular orbits, with well-defined radii and electron speed. In the Bohr model, physicists specify a mass of the electron is equal to

me. All good, electron has a rest mass, as it must do for Bohr orbits because $v < c/10$, and saying its mass is equal to its rest mass is the same as saying it has low velocity, i.e. $v < c/10$. Next, we have the Schrodinger atom. No current picture of electron propagation whatsoever. No conjecture as to what its velocity might be. Other than small, because they put $m = m_e$ as they did for Bohr. And because of this, they got the math's wrong and invented an electron cloud and asserted that that was sufficient, and happily forewent any precise description of an electron propagating somewhere and sometime, and propagating on some kind of wave. What then do I know about all this? An electron propagates on a wave. Either an electromagnetic wave, $v = c$, or a ghost wave, $v > c$ (e.g. Bohr), or $v > c$, (graviton). The electromagnetic wave can be stuck to a Schrodinger orbital, and in this case the orbiting electron will obviously be massless, $v = c$, $m_0 = 0$. Or, it can propagate massively, on a ghost wave, (Bohr orbit). And the process of an atomic conversion, Schrodinger atom goes to Bohr atom, this is equivalent to measuring the spin, of the electron component of the Schrodinger orbit, in fact every electron in these Schrodinger orbits, of an atom, and assigning directions, accordingly, in the circular (in fact elliptical) Bohr orbits. Regarding the process of measuring the photon spin, $S = 0, \pm 1$, the spin of the ghost that gets together with this fermion, creating $S = 0, \pm 1$, is discounted, the massive electron flies off to say the right, if $S(e^-) = +½$, and to the left, if $S(e^-) = -½$. That is what this paper is about in its entirety, the manner in which fermions propagate in free space, and in both kinds of atomic orbits, Bohr versus Schrodinger, and the manner in which this manner of electron propagation is all held together.

RESULTS

We begin with the p-orbit, l = 1, but the description extends almost trivially to higher values of angular momentum, l = 2, 3. So you are at the nucleus, you look around the p-orbit at various angles, ϕ. The value of $\psi(\phi)$ is treated as a distance, and you have your fermionic orbit.

Figure 1: We are treating the wavefunction ψ as a distance in space, defining a fermionic orbit.

In the previous HyperScience publication, Quantum Physics Foundations for Understanding Atomic and Molecular Orbitals, [5], we have proposed an explanation, and we'll build on that foundation in this paper. So why is that an electron trajectory? In particular, ψ is synonymous with distance, when ψ is an amplitude! Well, we are talking about Schrodinger orbits, so $v = cte = c$. So, consider de Broglie $mv\lambda = h$ or $mc\lambda = h$. Now we have proposed that the mass, m, is an amplitude, because v is wave speed, λ is wavelength, therefore m is equal amplitude, because what else could it be! Okay? And the amplitude is identically ψ. $m = \psi$. So, $v = c = cte$. Double $m = \psi$ and halve λ. But $\lambda = \lambda_e$, right! We are talking about an electron, propagating on an electromagnetic wave, $\lambda = \lambda_e$. Now we have seen, at great length, that electron wavelengths are measuring rods for space. So, viewing through the electron wavelength, at a quantity of distance behind, and double $m = \psi$, halve λ_e double quantity of space behind electron. Because the measure of space is the electron wavelength, right! [1].

Figure 2: If you halve the electron wavelength, through which you are viewing distance behind, then by comparison to the electron wavelength, the distance behind it is twice as large, by comparison

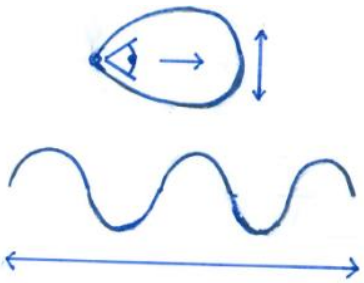

Figure 3: Top view of p-orbit, above, associated space given by the solid double arrow, radial space given by the dashed double arrows. And below, ground level view of associated space

So, we just consider the associated space whereupon we have the desired result, ψ equates to a spatial dimension, on the understanding that if we double it, we simultaneously double radial space, i.e. simultaneous amplification of the two dimensions of space. That accounts for $\phi = 0$, for other angles we analyze it this way.

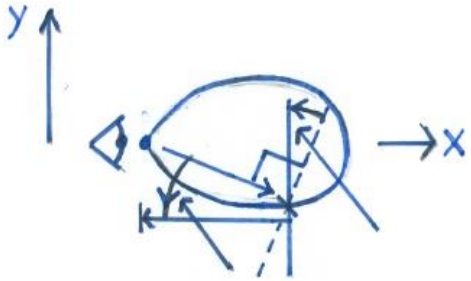

Figure 4: As we move around the orbit, from the central position $\phi = 0$, we are concerned with the indicated angular projection. The eye is looking along the x-axis

So, in Figure 4 we describe the added x-component of the electron p-orbital trajectory. Well, that is precisely

$(d)cos\ \phi$. Both indicated angles are identically ϕ. And if the x-component expands in such a manner, the y-component will expand accordingly. Conclusion: the entire ψ trajectory is in proportion with radial distance, $R \propto \psi$. $\psi(R)$ is just a number that describes how you multiply an atomic orbital of a given shape to upsize it, make it the same thing, only bigger, the dimension of it increases in direct proportion to $\psi(R)$.

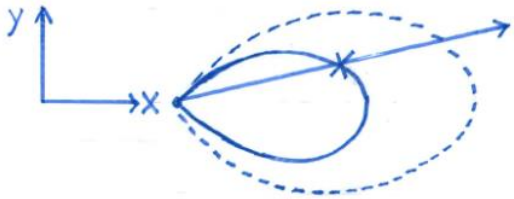

Figure 5: We envisage a p-orbit of dimension = 1, then if you increase R, thereby $\psi(R)$, because $\psi(R)$ is value of R, you increase the dimension of the orbit, in proportion

And reverting momentarily to Cartesian coordinates, if you start with a position on the orbit, then you increase $R \propto \psi(R)$, then simultaneously x, y increase in proportion. So $\psi(R)$ is just a number, which tells us, for a given orbit, quantum number l describes its shape and $\psi(R)$ describes how big it is. For a given orbit, $\psi(R)$ is a constant, whether that orbit is an s-orbit, (constant value of R around entire orbit, circular orbit), or otherwise, (figure-of-eight orbit, etc). Yet modern physicists have an altogether different view of things. These physicists claim that within an individual orbit, $\psi(R)$ is a variable, not a proportionality constant, and that it has the following profile.

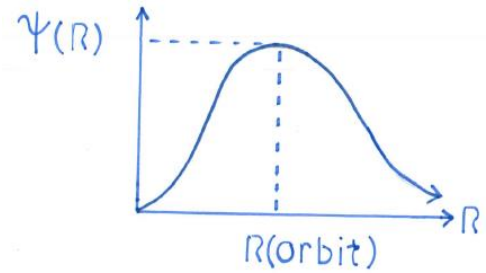

Figure 6: The erroneous behavior attributed by physicists as a description of what is going on inside an individual atomic orbital.

Physicists envisage some sort of probability field, $\psi(R) * \psi(R)$ giving a probability of finding an electron at that location, and the trajectory is not limited to a linear exactly defined path, it's just that there is a certain value of R where $\psi(R)$ is highest. Thus, physicists, (and chemists, the chemists too are not excused from participation here), have got it all wrong. Because they haven't analyzed the Schrodinger equation sufficiently. Culminating in that eye-sore in Figure 6 above. They appear not to conceive that the electron would have some specific trajectory, not simply a probability cloud. And, most particularly, what would be the speed of these electrons? Yet the Bohr atomic model gives exact electron trajectories, and exact speeds. Physicists have disregarded Bohr's atomic model, called it the old quantum theory, that was replaced when physicists understood quantum mechanics better. Physicists are wrong. It doesn't take much nouse to deduce that since there is no description of velocity in the Schrodinger analysis, that velocity is universally $v = c$. And similarly, from my investigations into the quantum harmonic oscillator, in the absence of any knowledge to the contrary, it is not simple harmonic behavior, as in the classical oscillator. The sinusoidal behavior simply does not come up therefore we are obliged to conclude that it does not exist. Because R does not vary over the orbit, it is easiest to first consider s-orbits, $l = 0$, spherical orbits. To begin with, we leave the potential $V(R)$ out of it, but we should just mention that $V(R)$ is a function of R only, there is no $V(\theta, \phi, R)$. This will prove crucial in our investigations. Therefore, we have

$$\psi = \psi_0 exp\ j(kx - \omega t) \tag{4}$$

$$-\frac{\hbar^2}{2\psi}\nabla^2\psi = E\psi \tag{5}$$

By selecting $\psi = \psi_0 e^{j(kx-\omega t)}$ in the equation 5 we have

$$\frac{-\hbar^2}{2\psi_0 e^{j(kx-\omega t)}}(jk)^2\ \psi_0 e^{j(kx-\omega t)} = E\psi_0 e^{j(kx-\omega t)}$$

$$\psi(R_{orbit}) = \frac{\hbar^2 k^2}{2E} \tag{6}$$

Here $k = \frac{2\pi}{\lambda}$, $mv\lambda = h$, $v = c$ and $k = \frac{h}{mc}$ and finally

$$= \left(\frac{4\pi^2}{\frac{h^2}{m^2c^2}}\right) = \frac{4\pi^2 m^2 c^2}{h^2} \tag{7}$$

Here $\psi(R_{orbit}) = \frac{\hbar^2}{2E}\left(\frac{4\pi^2 m^2 c^2}{h^2}\right)$ so that $m = \psi(R_{orbit})$. Indeed, we do not even to bother with any potential proportionality constants.

$$m = \frac{2E}{c^2} \text{ or } E = \frac{1}{2}mc^2 \tag{8}$$

So, we increase energy eigenvalue E, say $n = 1$ and 2, where, n is the principal quantum number. Considering spherical orbit, s-orbit, varying n only varies the size of the orbit. Presumably, if you increase n, (thereby increasing $\psi(R)$ in line with our previous discussions), well, we call this going to higher energy levels. So presumably the energy eigenvalue, E increases. Well, zero potential, V, is defined as infinitely from the nucleus. So going outwards, the energy increases or becomes less negative. Now we shall consider that when a central potential is introduced, $V(R)$, no angular dependence, simultaneously and necessarily the m term in the Schrodinger equation similarly becomes $m(R)$.

$$\left(-\frac{\hbar^2}{2\psi(R)} + V(R)\right)\psi = E\psi \tag{9}$$

So, as you go to these more outer orbits, E increases, therefore $m = \psi(R)$ increases. Then we start with the

atomic situation, $V(R) \neq 0$. Then remove the nucleus, $V(R) \rightarrow 0$. No longer atomic. Noting the manner in which if we remove a Reverse Higgs boson, that is, the electron no longer has an electromagnetic wave packet, $v = c$, to propagate upon, then that electron becomes massive, $m < c$. Now we know that in its massive state, a fermion has no ghost. Ghosts are facilitated when fermions get onto electromagnetic waves, Energy, $E = ½mc^2$(fermion) + $½mc^2$(ghost) = mc^2. When the fermion gets off the electromagnetic wave, becomes massive, it loses its ghost. No ghost: $E = ½mc^2$. Give it a rest mass, m_0. Suppose now $v \rightarrow c$. (Re-introduce Reverse Higgs). $E = \frac{1}{2}c^2\left(\frac{m_0}{0}\right)$, therefore, requiring that $m_0 \rightarrow 0$. That is, we introduce the Reverse Higgs. A massive fermion is converted to a massless one, a Bohr atom is converted to a Schrodinger one. And we re-introduce $V(R) \neq 0$. m0 has to vanish, otherwise in the massive phase, $E = (½m_e\,c^2)/0 = \infty$, (massive phase).

$$\frac{\hbar^2 k^2}{2\psi_0 e^{j(kx-\omega t)}} + \frac{\kappa}{R} = E$$

E comes from the Bohr orbit, giving us our eigenvalue in the Schrodinger analysis.

$$\psi = \left(\frac{1}{2}\right)\left[\frac{\left(\frac{h^2}{4\pi^2}\right)\left(\frac{4\pi^2 m^2 c^2}{h^2}\right)}{\left(E-\frac{\kappa}{R}\right)}\right] \quad (10)$$

$$m = \psi(R) = (E - \tfrac{\kappa}{R})\left(\tfrac{2}{c^2}\right) \quad (11)$$

So, what about R for a p-orbit, d-orbit, f-orbit? In this case, over the trajectory, R is variable. What could a constant R be? Clearly there is no alternative but for this to be the end of the lobe, the point where the figure-of-eight orbit touches the axis of symmetry, (the axis of rotation), and as above: Noting that for different κ, we have different atomic number of the atom in question. In fact, $\kappa \propto N$. So, we remove the potential $V = \kappa/R \rightarrow 0$, whereupon E = ½mc2. But $V = 0$ is at $R = \infty$! So, we go up to higher orbits, for a given atom, just movements of its valence electron: Increasing E is proportional with decreasing $V = -(\kappa/R) \rightarrow 0$ and then $E \rightarrow ½mc^2$. This is unghastly. You only have $E = mc^2$ if you have a ghost, to accompany that fermion. In contrast, R → 0. $E \rightarrow mc^2$, (small orbit). $|E| = |\kappa|/|R|$. Ghost held with maximum tightness. So, for R very small, (say $n = 1$ orbit), Schrodinger or Bohr orbit, then $|E|$ is very large, that is, E very negative. So: an electron in a higher orbit, the more so, the more unghastly, (n ↑, say), cannot emit a Reverse Higgs boson, cannot gain a rest mass, increasingly for ↑ R, becomes more and more unghostly. If it wants to gain a rest mass / eject a ghost, this is increasingly difficult for ↑R, and to do it you will find a greater tendency to do it if you take the electron down towards lower orbits, e.g.: n: 4 → 1. Because then it is more ghostly, in a better position to eject that ghost, gain a mass, leave its atom. So, the $\psi(R)$ amplitude, enforced by $\psi = m = m_e$, facilitates a Bohr orbit, gives the following spectrum.

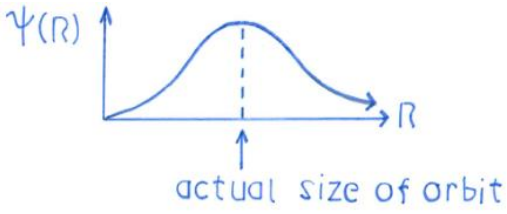

Figure 7: The $\psi(R)$ versus R spectrum you see is what physicists anticipate for an individual electron orbit.

In point of fact, they (the physicists) are wrong, the electron orbits exclusively at R defined by the peak of that spectrum, where $d\psi(R)/dR = 0$. There is no electron cloud, no probability of finding an orbital electron at orbits other than one specific value of R. The actual size of the orbit is indicated in Figure 7. Recall we are only, to begin with, in consideration of Schrodinger s-orbits, circular, the entirety of the orbit occurs at a fixed position, R. We'll extend to other orbits, p-, d-, f-orbits, later, using the same principle, but note that if we are in consideration of circular orbits, we are dealing with Bohr and Schrodinger simultaneously. So let's just consider Bohr, momentarily. Because it's Bohr, massive electrons, $v < c$, no ghost. So we make an analysis of ghostly behavior.

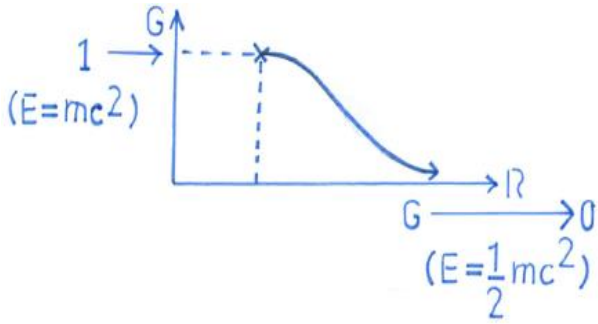

Figure 8: Ghostliness is defined as $G = 1$, $(E = mc^2)$, versus $G = 0$, $(E = ½mc^2)$, such that G follows the Bohr-Schrodinger $\psi(R)$ spectrum, specifically, ψ(Schrodinger → Bohr)

We enforce $m \sim m_e$ = constant, and in between $R = R_{orbit}$ and $E = \infty$, G is described by the erroneous $\psi(R)$ dependency on R in Figure 7. We shall see in what manner Figure 7 is erroneous, and in what manner this can be rectified.

We enforce $m = m_e$, then we enforce a Bohr orbit, from a Schrodinger orbit, at this point we are only considering circular Schrodinger orbits, and we can switch between Schrodinger and Bohr at our leisure. Schrodinger (ghostly, massless) → Bohr (unghostly, massive). And we see, in Figure 8, that as you increase R , ↑ R, ghostliness is converted to unghostliness.

There is a reduced tendency, reduced favourability, of the process Schrodinger → Bohr. The Schrodinger process is favoured by maximal ghostliess.

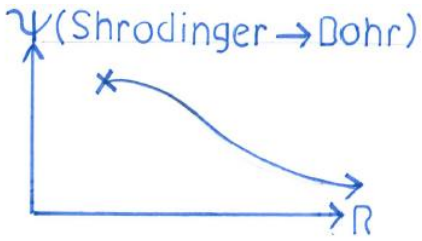

Figure 9: The erroneous $\psi(R)$ spectrum that has kept physicists in confusion becomes a spectrum of favorability for the process Schrodinger → Bohr, described by a wave function, ψ(Schrodinger →Bohr)

Now let's consider non-circular Schrodinger orbits. We only have to consider the p-orbit, higher angular momentum orbits are just various arrangements of the $l = 1$, figure-of-eight p-orbit. So $\psi(\theta, \phi)$ gives the orbit shape, then the size of the orbit is given by R_{orbit}, for a circular orbit, or by the R at the extremity of the p-orbit.

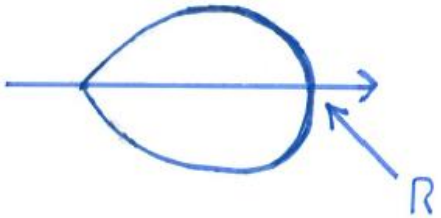

Figure 10: The shape of the p-orbit is described by $\psi(\theta, \phi)$, while its size is described by $\psi(R)$, which is in proportion to the value of R at the extremity of the orbit, and $\psi(R) \propto$ this R

We are in consideration of the extension from circular Schrodinger orbit, s-orbit, to figure-of-eight Schrodinger orbit, p-orbit. They are equivalent in the Schrodinger analysis, insofar as you just take the shape of the orbit, $\psi(\theta, \phi)$, then multiply by $R \propto \psi(R)$, to get the size of it. Then R in Figure 10 above might actually be R of the equivalent circle, i.e. a smaller value of R, but still in proportion. See below. But why does the equivalent circle to the p-orbit have a smaller value of R, smaller value of the extremity of the orbit? This question is tied up ultimately with the fundamental physical reason why an atom undergoes a transition from a circular orbit to a figure-of-eight. Quantum mechanics arises out of a circular piece of rope!

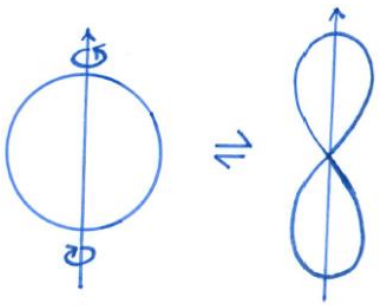

Figure 11: Take a circular piece of rope, (s-orbit). Place a couple of people outside the rope. Each twists the rope, oppositely to one another, in the manner illustrated, and the result is the figure-of-eight p-orbit.

Or, to generalize, you can put four people around the circular orbit, each twisting oppositely to one another, then you get a d-orbit, four lobes, two p-orbits orthogonal to one another. Etc, for f-orbits, again, more people

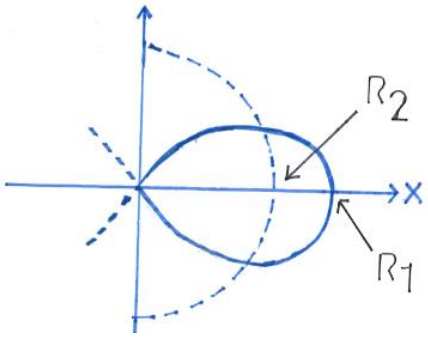

Figure 12: The piece of rope is the same length for the s-orbit and the p-orbit that eventuates out of it, by twisting, as described above, such that the extent of the orbit, in the x-direction, is greater for the p-orbit than the s-orbit, $R_1 > R_2$.

Obviously, the size of the two orbits, the two different orbital shapes, is in proportion. The size of the p-orbit is in proportion to that $\psi(R) \propto R$, at the extremity of the p-orbit, which is also in proportion to the circumference of that circular piece of rope that was twisted into the p-orbit. Recall that we are in consideration of the wavefunction, ψ(Schrodinger → Bohr). Circular orbits describe Bohr simultaneous with Schrodinger. So, in figure 12 above: $R: R_1 \rightarrow R_2$. Perhaps, then: $\psi(\theta, \phi) \rightarrow$ some function, $f(R_1, R_2)$, for the process Schrodinger → Bohr, whereupon we are now in more general consideration of figure-of-eight orbits, p-orbits, such that $\psi(\theta, \phi) \rightarrow$ constant. That is, for a circular orbit, there is no variation of ψ over the orbit, it no longer depends on θ, ϕ. We propose that $\psi(\theta, \phi)$ needs to be normalized as it becomes a constant, p-orbit, (figure-of-eight) → s-orbit, (spherical), by multiplying by R_1/R_2 or R_2/R_1. Consider just the axis of symmetry, the x-axis in Figure 12 above. So, whether p-orbit or s-orbit: $\psi \propto R$. So, for p-orbit → s-orbit, Schrodinger → Bohr, we find $\psi(\theta, \phi)$[constant] is reduced. That is, multiply by R_2/R_1, and we have R_2/R_1 a universal constant, for a p-orbit, and a different universal constant for a d-orbit, and again a different universal constant for an f-orbit.

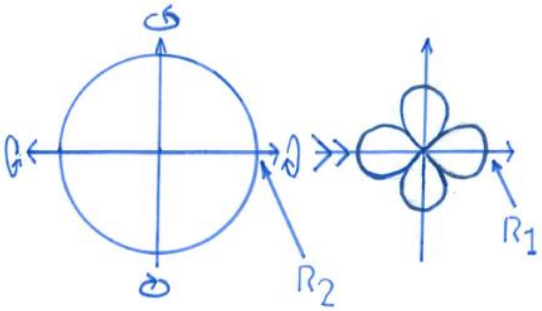

Figure 13: If you get four people twisting a circular orbit/rope, in the manner described, you get an orbit with four lobes, a d-orbit

So, for l: $1\,(p-) \rightarrow 2\,(d-) \rightarrow 3\,(f-)$, we find R_1/R_2 increasingly small, and we go into a Bohr orbit, normalize, multiply by R_2/R_1. That is, the more confined the orbit, restricted to smaller R: increase $\psi(\theta,\phi)$, increase l, angular momentum quantum number. This makes sense, if we have an electron orbit closer to the nucleus, then we increase $\psi(\theta,\phi)$. So, for the same size p-, d-, f-orbits, then the higher energy orbit, $(p-\rightarrow f-)$, the larger sphere, (Bohr state), then the higher energy the Bohr orbit too. What this is telling us is what happens to the various angular momenta as we go from a Schrodinger into a Bohr orbit? Certain of the Bohr orbits are reversed for certain of the various AM. So, for a given $\psi(R)$, we are concerned with those increasingly large Bohr spherical orbits, $p- \rightarrow d- \rightarrow f-$. Note that $m(R) = \psi(R)$ is a radial function. Not $m(\theta,\phi) = \psi(\theta,\phi)$. That is, the only way to increase m(R) is to decrease R. So, for $\uparrow l \rightarrow R_1/R_{21}$ increasingly small, R_2/R_1 increasingly large, and we normalize: $\psi \rightarrow \psi\,(R_2/R_1)$. The orbit is constricted within a smaller radius R, (larger ψ). Note that the orbit is the same length, both orbits constituted out of that specific piece of rope. And larger $\psi(R)$. See Figure 12 above. As you go down in R, (higher l), $\psi(R)$ increases. As per the current state of quantum mechanical deduction, the proposition that m =constant = m_e. The latter statement is only correct if you want to talk about Bohr atoms, for which $m = m_e\,/\sqrt{(1 - v^2/c^2)} \sim me$. So, we revise Figure 9, by manner of interpretation, what lies on the coordinate axes, which was itself a revision of various ideas in quantum mechanics which we seek to revise extensively.

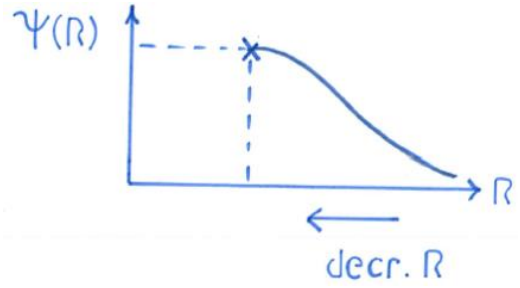

Figure 14: We continue to ponder on the erroneous $\psi(R)$ interpretation of QM. $\psi(R)$ is not a variable, a function of R, within a given orbit

For an individual orbit, $\psi(R)$ is a constant, and between various orbits, that occur at various values of R, we retrieve the familiar curve. Recall: $V = \kappa/R$, $\kappa \propto N$ = atomic number, identically the charge of the nucleus:

$$V = \left(\frac{1}{4\pi\epsilon}\right)\left(\frac{Nq_e^2}{R}\right) \tag{12}$$

That is the potential that should operate in the Schrodinger analysis, the Schrodinger atom, because that is the only force that the electrons feel. They do not feel each other, none of the electrons are aware of any of the others. There is no electron-electron repulsion in $V(R)$.

Other than the fact that two electrons cannot simultaneously occupy the quantum state, n, l, ml, s. This very different to the Bohr atom, where electrons do feel the Coulomb repulsion of electrons inside that orbit. This is in the multiple electron Bohr analysis, [2] pp 419-439. The non-interaction between Schrodinger orbital electrons is expressed in the orthogonality condition. For any two electrons in orbit around a specific atom, with wavefunctions ψ_1, ψ_2, the non-interaction or orthogonality condition is:

$$\int \psi_1{}^* \psi_2 d\tau = 0 \tag{13}$$

where the integral, dτ, is over all space. One might say the net overlap between the two electrons, wavefunctions ψ1, ψ2 is zero. That is, the net effect is that they do not feel each other, at all, beyond the fact that two of them cannot simultaneously occupy a given quantum state. But we are not varying N, in Figure 14 above, we are just varying l. And if you are considering the angular momentum quantum number, l, nevertheless, we expect that the z-component of the angular momentum, ml will in some way be relevant, and as you increase N, you increase the allowable l, then you increase the total number of quantum states available: $m_l = -l, -l+1. -l+2, \ldots, 0, 1, 2, \ldots l$, giving a good variation of states, variable $\psi(R)$, across this distribution, Figure 14. So, this is why when we learned the Schrodinger equation, in third year physics, we learned it as $(\nabla^2 + V)\psi = E\psi$, and not $\left(-\frac{\hbar^2}{2m}\nabla^2 + V\right)\psi = E\psi$. Because that factor, $-\hbar^2/2m$, is immaterial in finding $\psi(\theta,\phi)$. Physicists cannot find $\psi(R)$ anyway, and it must have occurred to them by now that they are barking up the wrong tree. So, let's not bother about it! Okay? Do not worry about that factor, because it does not appear in the $\psi(\theta,\phi)$ analysis, which in particular is to-date the greatest success of the quantum theory, accounting for the structure of the periodic table, the orderly designation of quantum numbers and a very restricted orbital shape, to the periodic table in its entirety. We might say, the fundamental physics we sought was in the shape of the molecular orbital, enormously simplified to four possibilities, s-, p-, d-, f-, over the entirety of atomic variation, by the following separability of:

$$m = \psi(R,\theta,\phi) = \psi(R)\,\psi(\theta,\phi) \tag{14}$$

$$m = m(R) = \psi(R) \tag{15}$$

Because $V = V(R)$, and $V \neq V(\theta,\phi)$, it is a function of R, $V(R)$, only. Now consider the behavior of the system as the radial distance R decreases while the wavefunction ψ increases.

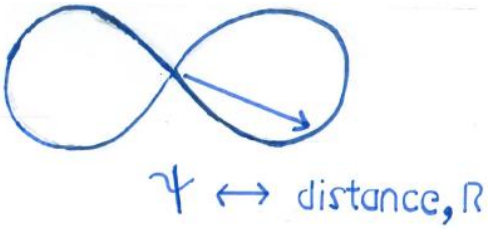

Figure 15: In the Schrodinger wave mechanics analysis, the wave amplitude, ψ, is in proportion to the distance from the source, the nucleus.

In analogy with string theory, imagine starting with a circular s-orbital and twisting it in various ways—similar to how string configurations are deformed. This idea applies to other orbitals as well, consistent with our earlier discussions. Fundamentally, this reflects the Schrödinger relation $\psi \propto R$, highlighting their equivalence. We discussed this in the previous paper, but provided no hypothesis as to how such an $\psi \propto R$ equivalence could come about. We do so now. Recall that the electron wavelength is a measuring rod for space, whether that electron is massive, $v < c$, or massless, $v = c$, propagating on an electromagnetic wave. So, we imagine looking through an electron wave, at a non-fermionic electromagnetic wave behind it. Only the wavelength of the electron is a measuring rod for space, the electromagnetic wave behind it carries no fermion, therefore it has no measuring rod of space status. We are in consideration of the wavelength of this ghostly electromagnetic wave, λ, as viewed through the fermion, λ_e. Then double λ_e halve the λ of the bare electromagnetic wave behind the electron measuring rod. We do not observe a simultaneous contraction of the velocity of that ghostly electromagnetic wave, because the electron is in some manner also a measuring apparatus of time, such that $v(em) = \Delta x/\Delta t = cte = c$. [1][2][3]. Mass behaves in this fashion too, because space, time, mass all obey a Lorentz factor, $\sqrt{1 - v^2/c^2}$. Hence, we have a unification between our two discussions:

(1) Explanation of why the electron's orbit corresponds to the wavefunction solution ψ, highlighting the relationship $\psi \longleftrightarrow R$.

(2) Investigation into the nature of $\psi(R)$, given that $\psi(\theta, \phi)$ has already been fully accounted for. The focus now shifts exclusively to $\psi(R)$.

Above, we analyzed the Schrodinger equation by taking:

$$\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} \rightarrow \frac{\partial^2}{\partial x^2}.$$

But when you go to spherical coordinates, two things happen:

a) $V(x, y, z) \rightarrow V(R)$

b) $m = \psi(x, y, z) \rightarrow \psi(R)$

Resulting in $\left(-(\hbar^2/2\psi(R))\nabla^2 + V(R)\right)\psi(\mathrm{R}) = \mathrm{E}\psi(\mathrm{R})$.

Therefore, the angular solution $\psi(\theta, \phi)$ is a completely separate identity, insofar as it has nothing to do with that factor, $-\hbar^2/2\psi(R)$. When we write $\psi(R)$, it just means that we are in consideration of the size of the orbit, that is, concerned with its radial dimension, it is not some specific R we are talking about, either for circular orbits, (s-orbit), or figure-of-eight orbit, (p-orbit), except insofar as: $\psi(R) \propto R$, and certainly not, for an individual orbit, anything like the profiles we have discussed above, ref figures 14, 9, 8, 7, 6, above.

Now $\psi \propto$ distance in orbit from the origin, distance from the nucleus. [Electron wave-space model, electron wavelength is a measuring rod for space]. So, consider the variable, R. We define it as the place where the s-orbit or p-orbit touches the x-axis.

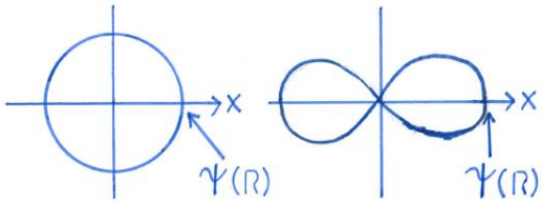

Figure 16: The value of $\psi(R)$ is in proportion to the size of the circular or figure-of-eight orbit, defined as the point where the orbit crosses the x-axis, the x-axis being axis of symmetry, for the p-orbit, the rotation axis, whereupon the figure-of-eight turns into a 3-dimensional dumbbell

It is that rotation and its subsequent angular momentum, rather than the angular momentum associated with the planar figure-of-eight trajectory, that we are talking about, in Schrodinger analysis. It is the AM we are referring to with l = 0, 1, 2, 3. s-orbit, p-orbit, d-orbit, f-orbit. In summary, $\psi(R)$ is not a function of R, it is a value of R. That is, it is the value of the radius of an s-orbit, or the spatial extent, along the x-axis, of the p-orbit. We are confident the p-orbit can be described like this, by analogy with the s-orbit, because of the discussion above, in which we pointed out that the p-orbit can be acquired simply by a dual twist of a circular s-orbit, in an anti-symmetrical fashion. So, the whole thing comes down $\psi = k \times$ distance (R variable).

Now in our electron wavelength as a measuring rod for space analysis, we proposed viewing a naked electromagnetic wave, i.e. one not carrying a fermion, its wavelength λ is not a measuring rod for space. And we are viewing through an electron wave, whether that wave is a massive electron, bare electron, $v < c$, or a massless electron, i.e. the electron itself propagating on an electromagnetic wave. Because the whole issue is the electron wavelength as a measuring rod for space, then conversely the distance $\propto \psi$ we are talking about is the electromagnetic wavelength of that naked wave behind the electron, that electromagnetic wave that is not carrying a fermion. So, the de Broglie expression becomes $\psi c\lambda = h$. So, you double λe $\longleftrightarrow$ halve distance. Well clearly, ψ $\propto$ distance. That is, qualitatively. But what about quantitatively? What is that proportionality constant? $\lambda_{em} = \kappa/\lambda_e$ and then $\lambda_e = \kappa/\lambda_{em}$. The naked Revere Higgs process, removal of rest mass of a stationary electron, meaning, $E = m_0c^2 + ½\,[\mathrm{m_0v^2/(1 - v^2/c^2)^{1/2}}] = m_ec^2$, (it being the case that $v = 0$). Here we propose, for the naked Reverse Higgs process, that $\lambda_e = \lambda_{em}$. That is, the electron has the same wavelength when it is stationary as that electron when it has had its rest mass removed, is now propagated on the electromagnetic wave, velocity v: $0 \rightarrow c$. Therefore $m_0 = m_e$ and $mc\lambda = h$ and finally we have

$$\psi = \left(\frac{h}{c}\right)\left(\frac{m_e^2 c^2}{h^2}\right)\lambda_{em} = \left(\frac{m_e^2 c}{h}\right)\lambda_{em} \qquad (16)$$

At this point, it appears that c/h serves as a useful factor. Just verifying: $mv\lambda = h$ and $c/h = 1/\mathrm{m}\lambda$. $\psi \longleftrightarrow e^2(1/\mathrm{m}\lambda)\ \lambda_{em}$. Consider a portion of the Schrodinger trajectory, a massless electron propagating on an electromagnetic wave, and it has wavelength λ_{em}.

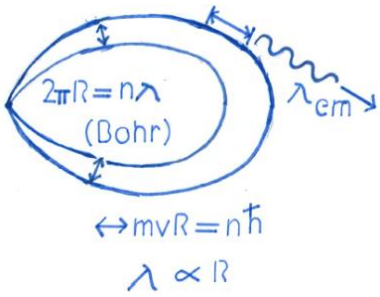

Figure 17: You have the shape of the p-orbit, definition of size gets hazy

For the Bohr orbit, we propose what is in other works, [4] as a space-time curvature condition that: $2\pi R = n\lambda$ and $mvR = n\hbar$, the quantisation of angular momentum, after applying the de Broglie wavelength, $p = h/\lambda$, to the space-time curvature condition. $\lambda \propto R$, which is simply a re-statement of the space-time curvature condition, which is presented in Figure 18 below, for $n = 4$. So, if you know what λ_{em} is in the orbit, you know $\psi(R)$. And the extent of the orbit, $\psi(R)$, is in proportion to λ_{em} and $R = \frac{n\lambda_{em}}{2\pi}$.

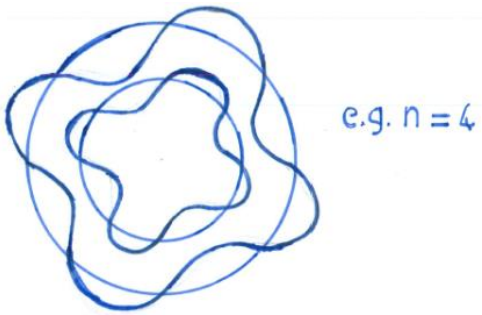

Figure 18: Space-time curvature condition of Bohr. He proposes a whole number of wavelengths about one orbit, $n = 4$ in this instance, and $\lambda \propto R$, as above.

And that space-time curvature gives us the quantization of angular momentum, the Bohr analysis, a very different AM to that of the Schrodinger orbit, but it is facilitated very simply through application of the de Broglie wavelength, (as is the Schrodinger analysis). The fact that, evidently, de Broglie published his work many years after the Bohr atomic theory emerged completely mystifies me. Anyway, how do we get λ_{em}? As $\psi = \psi_0\ exp\ j(kx - \omega t)$ and then

$$\frac{\partial\psi}{\partial t} = \frac{E\psi}{\mathrm{j}\hbar} \qquad (17)$$

and

$$E\psi = j\hbar\left(\frac{\partial\psi}{\partial t}\right) \qquad (18)$$

Since $E = \hbar\omega = \hbar(2\pi f)$ and from here we have

$$\lambda_{em} = \frac{2\pi\hbar c}{E} \qquad (19)$$

So, in summary, we start with zero AM, $l = 0$, s-orbit. Then we twist into a p-orbit, as in Figure 11 above, to give angular momentum quantum number $l = 1$ then $m_l = -1, 0, +1$. And similarly for d-, f-orbits, increase the twisting complexity, gives different angular momentum quantum numbers, $l = 2, 3$ respectively and $m_l = -2, -1, 0, 1, 2$, and $m_l = -3, -2, -1, 0, 1, 2, 3$, respectively. The success of the analysis of the $\psi(\theta, \phi)$ part of the wavefunction, $\psi(\theta, \phi, R)$ is breathtaking, it accounts for the periodic table in its entirety.

DISCUSSION

When transitioning from the Bohr model to the Schrödinger framework, we effectively accelerate orbital electrons to the speed of light, thereby eliminating their rest mass. This process represents a missing element in special relativity, which we refer to as the Reverse Higgs process. In this context, the Reverse Higgs boson is envisioned as a ghost-like wave traveling at the speed of light ($v = cv$), onto which the fermion is accelerated. Initially, we consider two ghost waves-one corresponding to each oscillation of the electromagnetic field, E and B. When a fermion is placed onto this structure, the resulting wave carries both a real fermion and a fermion ghost. A profound implication of this model is that the wave itself can be a ghost. A fermion ghost shares all the fundamental properties of a real fermion-such as radius, position, mass, speed, spin, and phase-except for electric charge. Similarly, this wave ghost can support a Bohr-like fermion, analogous to the way a real electromagnetic wave supports photon propagation. However, in the Bohr model, the associated speed is much lower, typically $v < c/10 \sim m_e$, while Schrödinger waves ψ can possess a wide range of magnitudes and velocities. We therefore propose the following classification:

Ghost waves: Any wave that supports a fermion or fermion ghost with mass and travels at $v < c$.

Electromagnetic waves: Any wave propagating strictly at $v = c$, as described by both Maxwellian electrodynamics and Schrödinger wave mechanics.

One of the most intriguing conclusions of this investigation is the realization that ghost waves are not constrained to any specific waveform, such as sinusoidal patterns. The only requirement is that they obey the de Broglie relation, $p = h/\lambda$, which determines the wave's length, speed, and amplitude, where mass is interpreted as the amplitude $m = \psi$. The precise waveform-whether sinusoidal or otherwise is irrelevant. The only fundamentally sinusoidal wave in electromagnetic and quantum theory is the solution to

Maxwell's wave equation, propagating specifically at $v = c$, expressed as $\psi = \psi_0 exp\, j(kx - \omega t)\,, v = c = 1/\sqrt{\mu\varepsilon}$. This form applies equally well to Maxwell's equations and to the Schrödinger equation, because Schrödinger's model describes photons propagating along electromagnetic waves confined to the surfaces of atomic orbitals. Alternatively, this phenomenon can be interpreted as photons moving along the surfaces of atomic or molecular orbitals due to space-time curvature. For reference:

Newton describes gravitational forces between atomic nuclei.

Einstein describes space-time curvature, particularly in relation to photon motion.

In conclusion, just as a fermion ghost can be understood as an electron propagating on a wave, it possesses all the electron's characteristics-except electric charge.

CONCLUSION

Consequently, a ghost can overlap with a fermion unlike two fermions, which cannot overlap due to the Pauli exclusion principle (Fermi–Dirac statistics). Extending this idea to the ghost wave, we find that it possesses all the usual characteristics of a wave amplitude, wavelength, and speed. However, it remains only a ghost or phantom the wave is not physically present. Therefore, it is impossible to determine its precise nature whether it would be sinusoidal or otherwise if it were to exist as a real wave. It exists only in the form of a ghost. What kind of knowledge does this represent? It is the kind of insight in which the quantum harmonic oscillator mirrors the classical simple harmonic oscillator in every respect except for the sinusoidal relationships between acceleration, velocity, and position. In the classical case, we observe that a sinusoidal acceleration leads to a sinusoidal velocity, which in turn results in a sinusoidal position. In contrast, within the internal aether-like oscillatory processes inside fermions and in their propagation along electromagnetic waves this behavior transforms. It extends to aromatic processes (where $n > 0$), leading to a form of motion where acceleration is constant in magnitude but switches sign (± constant) as the fermion passes through an antinode. This implies that the oscillation is not sinusoidal, but rather a toggling between two constant states a binary oscillation of internal dynamics around the edge of the fermion, as it rides the electromagnetic wave.

ACKNOWLEDGEMENTS

First, I would like to thank my initial MSc supervisor, Dr. Ray Rivers at Imperial College, who once agreed with me perhaps playfully that $0 \times \infty = c$, although he did qualify it by saying, "Yes, but it also equals one," which is completely understandable. It was around that time that I began developing the early foundations of this theory the Reverse Higgs bosonic process which would eventually evolve into what I consider a completion of Einstein's special relativity. So yes, thank you, Ray. That moment of agreement was a genuine encouragement, and it helped. Next, I would like to acknowledge my other MSc supervisor, Professor Kelly Stelle. I cannot thank him for agreeing with or encouraging me in regard to my theory what would later become my model for Quantum Entanglement Spin, which, from my perspective, signals the end of quantum entanglement as it is traditionally understood. While it is conceivable that some useful physics might still emerge from entanglement-related frameworks, I do not believe that includes concepts like the multiverse or Schrödinger's cat. Kelly did not seem to understand the theory I presented to him, and I chose not to press the matter. In some ways, I'm grateful for this not because he misunderstood, but because I was spared the disheartening possibility of someone fully understanding the theory yet remaining unimpressed by it.
That said, I do sincerely thank Kelly for his pivotal role in organizing the six-month conference on Supergravity, Superstrings, and M-Theory at the Institute Henri Poincaré, in Paris (Luxembourg area), which began in late 2000. That conference provided the structure and momentum I needed to complete my MSc dissertation, Duality and M-Theory. It was also during this period while sitting alone in the library one lunchtime that I had my first moment of inspiration: the idea of an electron riding on a photon, with its spin oscillating first in one direction and then the other. This concept would eventually evolve into what I later termed Spin SSS (Quantum Entanglement). At that time, I had already developed a fairly advanced understanding of the Reverse Higgs boson concept and was contemplating the dynamics of a fermion propagating along an electromagnetic wave. However, I had not yet incorporated Einstein's original expression seen at the left of equation (1) above into my work. That step came later, and with it, I believe I was finally able to complete the framework of special relativity.

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