Review Article

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Critique on "The Origin of the Postulates in the Bohr Model of the Hydrogen Atom" by Pinke, Osz, Lente, Culminating in a Unification of the Quantum Mechanics of Bohr, Not His Contribution at Copenhagen, With Quantum Gravity, (M-Theory)

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Abstract

Pinke, Osz and Lente speak of 5 or so postulates for the Bohr model. We would argue otherwise. One postulate is the suggestion, what we call the "space-time curvature condition", equal numbers of wavelengths about a Bohr orbit, 2πR = nλ. And if you put de Broglie, p = h/λ, in at this point, you get the Bohr angular momentum condition. But de Broglie came after Bohr! How did Bohr do it? Pinke, Osz and Lente seem to think that Bohr did it by means of the uncertainty principle, but Heisenberg and his HUP was even later on the scene than de Broglie. We oblige, we shall do it that way too. Since we are so very much concerned with the Bohr atomic theory, in this investigation into Quantum Gravity, M-theory, it is necessary to bring the Schrodinger orbit into the analysis, the Schrodinger orbit belongs to an altogether different kind of atom. Electrons in Bohr orbits feel the electromagnetic force. Electrons in Schrodinger orbits do not feel the electromagnetic force, they are photonic, they travel at the speed of light, and they are kept in their orbits by space-time curvature. Finally, we turn the electromagnetic interaction, specifically the $m = m0/\sqrt{(1 - v^2/c^2)}$ relativistic mass, into Quantum Gravity by employing v: c → ∞, an extension of the v: 0 → c analysis of that equation. (c/0 = ∞/c = ∞!) With our investigations into Quantum Gravity, finally to facilitate a graviton getting from one end of an electromagnetic flux tube to the other, we have to point out that classical electromagnetism is erroneous, insisting that the "curling" field lines at the surface of the conductor are entirely azimuthal, that there is no axial component, we instigate Bax, facilitating formation of a helix. There is no chance of measuring this minute Bax, because the speed of light is so enormous compared to the spatial dimension of our terrestrial electromagnetic flux tube, electrical circuit.

Keywords: Space-time curvature, de Broglie, angular momentum, fermionic, photonic, relativistic mass, flux tube, helical, azimuthal, axial, uncertainty principle (HUP).

Introduction

This paper directly follows one which was submitted to HyperScience a couple of weeks ago, (Farmer, 2026), "Another take on the Musakhail-Farmer gravitational aether, the Krueger-Farmer gravitational aether". I am hoping for simultaneous publication of the two papers. What is particularly relevant here, regarding (Farmer, 2026), is our knowledge of M-theory. It was the topic of my MSc dissertation, "Duality and M-theory". M-theory is "eleven dimensional Supergravity". The extra space-time dimension acquired as we go from superstrings, 10 space-time dimensions, to M-theory, 11 space-time dimensions, is contributed by Newton's law of universal gravitation:

$$F = \frac{GMm}{R^2}. \tag{1}$$

Now the "duality" in M-theory is a 5-fold duality, yet reminiscent of a two-fold duality, the electromagnetic duality. For every electron, there is a positron, for every electron pathway, B, there is a positron pathway, E, all that sort of stuff. And we have devised a theory of quantum gravity accounting for this 5-fold duality, with the Higgs boson and the Reverse Higgs boson employing two of those dualities, (Farmer, 2025), p 79. And, as luck would very much have it, in the previous paper, (Farmer, 2026), we employed discussions of the Higgs boson and the Reverse Higgs boson into discussions of the Krueger-Farmer gravitational aether!

Let's start with Bohr's ground-breaking hypothesis for an electron orbiting a nucleus. Because the nucleus is so much heavier than the electron, mP ~ 2000me, we can regard the nucleus as stationary. We assume circular orbits, an electron momentum p = h/λ giving rise to a certain number of wavelengths around the orbit. Bohr said "let there be an integral number of wavelengths around an orbit. Independent of the orbital radius, R".

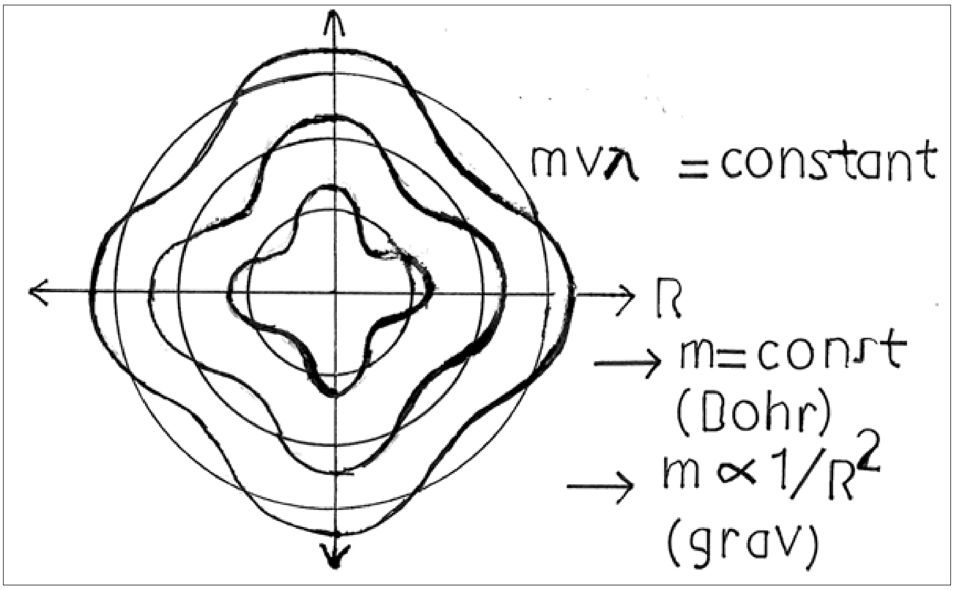

Figure 1: Bohr's hypothesis, number of wavelengths around an orbit is a constant, irrespective of orbit radius. Here we choose n = 4 wavelengths around an orbit

We call this the "Bohr space-time curvature condition". It says nothing about orbital radius R, it is completely general for R. So, Bohr's condition amounts to:

$$2\pi R = n\lambda, \; n = 1, 2, 3, \ldots . \qquad (2)$$

From there, it is a simple matter to employ the de Broglie relation, $mv\lambda = h$, yielding:

$$mvR = n\hbar. \qquad (3)$$

That is, the angular momentum is quantised. From there, one employs Newtonian mechanics, we have a central potential, $V = (1/4\pi\varepsilon)Q/R$ where Q is the electron/nuclear charge. And you institute the angular momentum quantisation in this classical calculation, and out comes a discrete set of energy levels. For the various "n" we have specific orbital radii, and speed. The most inner orbit is n = 1, as you increase n the orbits get progressively more outward, and the speed decreases. (As opposed to the gravitational situation, where the speed increases with R). It applies only to hydrogen, one electron, and the orbital speeds are maximal at around v = c/10, progressively decreasing as you go outward, such that the electron mass, $m = m_e/\sqrt{(1 - v^2/c^2)}$, only differs, maximally, from me in about the fourth significant figure. Effectively, for Bohr orbits, m = constant, v highly variable. The polar opposite of the Schrodinger orbit, v = c = constant, m = Ψ highly variable. Out of a space-time curvature condition that is completely general for R, we acquire, by classical calculation alone, specific values for R(n), v (n), E(n).

All very good. I was pleased with myself, I understood the Bohr theory. The space-time curvature condition, $2\pi R = n\lambda$, employ de Broglie, you get the angular momentum quantisation, substitute into Newtonian potential calculation. Very good. Only one problem. De Broglie came after Bohr! So this is not the way Bohr did it. Bohr did not employ the de Broglie relation, $p = h/\lambda$, because de Broglie hadn't invented it! That is what a large part of this paper is addressing. When it became abundantly clear to me that de Broglie came along significantly after Bohr, well I wanted to know how Bohr did it without de Broglie. And I was hoping to find out in this paper by Pinke and co. But I didn't! It is still a mystery to me! Anyway, let's proceed.

Methodology and Literature Review

Now, in the abstract, Pinke et al. (2025), we read that the successful Bohr theory was *later justified* by three independent discoveries: the wave-particle duality of de Broglie, the uncertainty principle of Heisenberg and the direct detection of the angular momentum of the photon by Raman and Bhagavantum. Well yes, we can certainly do it no easier than with de Broglie, but Bohr did not have de Broglie. So I was intrigued to find out how Bohr did it. But I am none the wiser, because the authors appear to be presenting a calculation involving an uncertainty principle, the problem being that Heisenberg came even after de Broglie. The de Broglie wavelength is a critical part of the Schrodinger analysis, so Schrodinger certainly could not have come before de Broglie. Still mystified as to how Bohr did it. On the subject of the angular momentum of the photon, well I thought we were talking about the *electron* spin, not the photonic spin. Anyway, if you want to do photons, then, (Farmer, 2026).

Spin (photon) = spin (fermion, e^+/e^-) + spin (ghost) = ± ½ ± ½ = 0, ±1. (4)

We read, Pinke et al. (2025), Introduction, that the Bohr model for the hydrogen atom was first laid out in 1913. "The quantum mechanical model replaced it as the up-to-date theory within the next two decades. Yet the Bohr model – perhaps owing to its simplicity and easily comprehensive mathematical background – is used in chemistry education even in the 21st century".

That's where physicists have gone tragically wrong. Discarding the Bohr theory, in favour of the Schrodinger, when both models predict the hydrogen spectrum just as feasibly. Well, as we mentioned, they are polar opposites, the Bohr atom and the Schrodinger atom. The same spectra, represented by "λ", the wavelength of the radiation, then you employ de Broglie, $mv\lambda = h$. So for Bohr, the variation is of electron speed, the mass $m \sim me$ is very close to a constant, while the speed v is highly variable. Conversely, for Schrodinger, $v = c$ is a constant, and $m = \Psi$ is highly variable. So it is clear that Bohr and Schrodinger are at odds with each other. Therefore physicists dropped Bohr. Bad move! Particularly when you consider this symmetry in the de Broglie variables. Bohr atoms exist inside metal lattices, Schrodinger atoms exist outside metal lattices. Only Schrodinger atoms, with the elegant structure of their orbits, can account for chemical reactions. No chemical reactions go on inside a metal lattice.

So you have Bohr orbits, massive, the orbiting electrons have a rest mass, $v < c$, ($v < c/10$). They orbit on "ghost waves", which do not have a specific mode of oscillation, (e.g. "sinusoidal"). They have only one oscillation, not the dual **E/B** of the electromagnetic wave. They carry one fermion, and no ghost. Conversely, fermions in *Schrodinger* orbits are *photons*. They employ a dual oscillation, **E/B**, and carry a ghost. Of course they travel at the speed of light. They have an energy $E = ½\, m(\text{fermion})c^2 + ½\, m(\text{ghost})c^2 = mc^2$. We accounted for the spin of these photons above.

It is indeed ironic that the chemists favour the Bohr model, because it is more accessible than the Schrodinger model for people with limited mathematics. It is ironic because the only atomic model relevant to chemists is the Schrodinger model. Chemistry occurs outside the metal lattice!

Just a final distinction between Bohr orbits and Schrodinger orbits. Electrons are held in Bohr orbits by Newtonian force. The Bohr analysis, once you have the angular momentum quantisation condition, is all about Newtonian force. What about Schrodinger orbits? Not massive fermions, $v < c$, massless ones, $v = c$. *Photons*! Radiation, confined to the path of the orbital. Well, photons do not feel electromagnetic force, because:

$\mathbf{E} = -\boldsymbol{v} \times \boldsymbol{B}$, (verify that yourself, for dual Maxwellian radiation, where $c = E/B = |\mathbf{E}|/|\mathbf{B}|) \rightarrow \mathbf{F} = q(\mathbf{E} + \mathbf{v} \times \mathbf{B})$ = Lorentz force = 0. (5)

So a photon will not feel "external" electromagnetic forces. Then what keeps it in its orbit? Einsteinian space-time curvature! (Farmer, 2026). Gravitationally, photons, electrons and positrons cannot feel Newtonian force, they can only feel Einsteinian space-time curvature. Between nuclei, we have Newtonian gravitational force. One or the other, *not both* simultaneously, and they are experimentally indistinguishable. Hence Einstein's space-time analysis agrees with the observations of Mercury, but if the Newtonian calculation was done properly, with a delay in action owing to the time for passage of a graviton, it too would agree with observation. And we see this carries over into atomic theory, you have force, (massive fermions, e^+/e^-, $v < c$), and space-time curvature, (massless fermions – photons, e^+/e^-, $v = c$). But we also have "weak-strong gauge bosons", which travel at $v = c$ axially, in the interior, of electromagnetic circuits, flux tubes. These do feel the Newtonian force, not the Einsteinian space-time curvature. Well they move in a straight line, at a constant speed, so could they anyway? But anyhow, they *simultaneously* feel the *aether force*, and the energy dissipation associated with this aether/electromagnetic force is Force x velocity = E.c, where both E and c are axially directed.

Results

"It may appear somewhat paradoxical that Bohr was awarded the Nobel Prize in Physics essentially in recognition of that atomic model that bears his name, which was in fact entirely based on classical physics with the exception of a few additional postulates. Within two decades, a group of scientists working on this atom model with Bohr's considerable contribution had essentially rendered the original model obsolete by developing the wave-mechanical model of the atom", (Pinke et al., 2025). Enough said! If you still have disrespect for the Bohr model, then I don't think you read above. The Schrodinger atom is *every bit* as *classical as* the Bohr atom. Electrons bound to specific orbits, specific velocities, trajectories, *not* these "electron clouds of probability" the physicists have dreamed up, that is completely wrong. Specific distance of the orbit from the nucleus, for an s-orbit (spherical), or a specific distance of the extremity of a p-orbit from the nucleus. The only difference being photonic versus fermionic propagation, $v = c$ versus $v < c$, and all the other distinctions between the two kinds of orbits, as discussed above. Most particularly, the shapes of the orbits. The Bohr analysis is specifically a circular analysis. But it works. Some physicists have shown the Bohr orbit can be generalised to an elliptical orbit. The suggestion is that you spin the circular orbit about a central axis, you get a spherical Bohr orbit, analogous to the spherical Schrodinger orbit. But because the orbit is spinning, "centrifugal forces" come into operation, stretching the circular orbit into an ellipse. Nothing like the structural elegance of the "figure-of-eight" Schrodinger orbit, which one spins about its central axis to get the familiar 3D "dumbbell" that the chemists are so concerned with. It is this which makes chemistry possible. Chemistry would not be possible if atoms outside the lattice were Bohr atoms.

So consider the Schrodinger atom. An s-orbit, spherical, has angular momentum quantum number $l = 0$. A p-orbit, the 3D "dumbbell" has $l = 1$. The condition for chemical bonding between two orbits, a scenario in which the two orbits "touch", either in one place or two, is "$\Delta l = \Delta 1$", between the two orbits. Most of the chemical knowledge we have is related to s- and p-orbits. For example, take two carbon atoms. One of these will be in the s-state, one of these will promote its electron to the p-state, then all the two atomic orbitals have to do is touch, and you get a *molecular orbital*, which chemists have not so far fathomed is nothing other than two atomic orbitals touching, hence sharing their electrons. That is how easy it is to get a molecular orbital, a molecule, from two atomic orbitals. So, apart from the Noble gases, which have a full shell, atoms will not exist in isolation. There will always be a favourable lower energy state acquired by molecular bonding. For example, you never see oxygen, O, it is always O_2. And you don't have N in the atmosphere either, it is N_2. Etc. So an atom cannot exist in isolation, except for the Noble gases, for which all electrons are paired anyway. For atoms with an odd numbered number of electrons, atoms with an unpaired electron, they cannot exist like that, inevitably they will exist as a molecule where all *electrons are paired*!

What's so great about all electrons being paired in Schrodinger atoms, either in isolated Nobel gas atoms or otherwise? What's great about it is that you take two paired electrons in a Schrodinger orbital, $s = \pm\frac{1}{2}$, then you can reverse the direction of one of them, turning it into a positron. Insodoing preserving electromagnetic current. We might be amenable to this! We are doing away with conservation of electric charge, but the benefit is a conserved current. Conserved currents are very important in Quantum Field Theory. Most particularly, now we see that every electronic photon in a Schrodinger scenario occurs in unison with an oppositely directed positronic photon. Which is, of course, the whole thing about radiation, it has of necessity equal numbers of positronic and electronic photons.

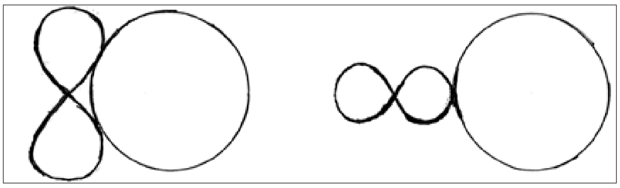

Figure 2: An s-orbit and a p-orbit "touch" to form a molecular orbital. There are two manners in which this can happen,
(i) σ-bonding, single bond [Right] versus
(ii) π-bonding, double bond [Left]

So, the rule in chemistry of getting two atomic orbitals to touch in this manner, forming a *molecular orbital*, whereupon electrons can be exchanged between the two atomic orbitals, is:

$$\Delta l = \pm 1. \quad (6)$$

l is the angular momentum quantum numbers of the atomic orbitals. For example, the spherical orbit in Figure 2 above, the s-orbit, has $l = 0$. The dumbbell shaped orbit, the p-orbit, has $l = 1$. So between the two atomic orbitals, $\Delta l = \pm 1$ is satisfied.

This is the basis of the richness in biochemical diversity in biological systems, the appearance of these double bonds. Proteins in our bodies are made of amino acids, most particularly we have the C=O π-bond in the amino acid, lending itself to all the richness of biochemistry. Let's just discuss the manner in which this π-bond in the amino acid is the key to biological complexity.

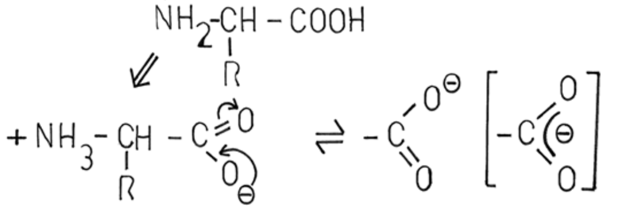

Figure 3: Resonance of the carboxyl group in an amino acid

The reason physicists and chemists have not cottoned onto the simplicity and beauty of the creation of the molecular orbital from atomic orbitals, simply by touching, is because they have gone tragically astray in the basic physics. They will not admit the sensible conclusion, that Schrodinger orbits have exactly defined, confined orbits. There is no "cloud of probability", and there is certainly nothing as unacceptable as the suggestion that atomic electrons have certain existences outside the atom, and all the way to $R = \infty$. Simply not true at all. Once you do away with that false notion, chemistry becomes a breeze!

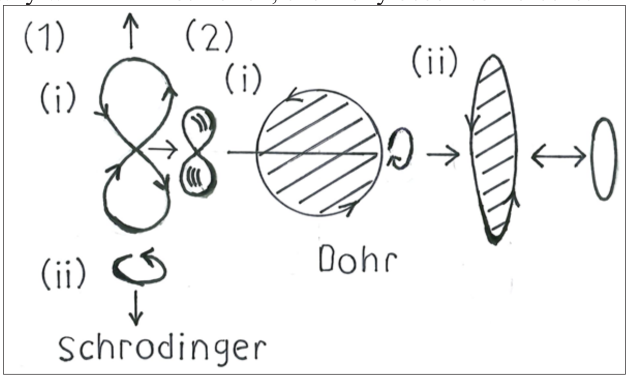

Figure 4: Getting 3D orbits from planar orbits by rotation.
(1) The figure-of-eight Schrodinger orbit, rotated to give an angular momentum, l, versus
(2) the Bohr orbit, angular momentum defined *first*, then do the rotation

Okay, so what about the central classical problem that an orbiting electron is accelerating, therefore it should radiate and lose energy? Perhaps, for some reason related to the fact that the electron is confined in an orbit, it simultaneously absorbs all the radiation it emits. That is one possibility. Or perhaps the electron "saves up" all the radiation it should have emitted, as an "IOU", ΔE, at a later time, Δt, according to the uncertainty principle, $\Delta E \Delta t \sim \hbar/2$. We hypothesise that this will coincide with the weak decay of its associated proton in the nucleus, $p^+ \rightarrow n + e^+$.

Pinke, Osz and Lente appear to have adopted the standing wave hypothesis, for Bohr orbits. We know the wavelength λ and the speed v in the Bohr orbit. But a lot of physicists say it is *two* waves, of that wavelength and speed, moving in opposition, that's how you get a standing wave. However we have only one electron, not two. There is no corresponding standing wave hypothesis for Schrodinger orbits. We reject the standing wave hypothesis. Since the Schrodinger model comes to assistance here in matters of the Bohr orbit, let's have a brief discourse of where we are at this point in time, with regard to angular momentum in Bohr and Schrodinger orbits.

We have already suggested that Bohr orbits might be elliptical rather than circular, owing to a rotation about an axis of symmetry across the circular Bohr orbit. Elliptical Bohr orbits are catered for theoretically. So let's just discuss this angular momentum that we are introducing by choosing to rotate a circular Bohr orbit. Let us see if we can make some sense out of a multitude of matters concerning angular momentum in Bohr and Schrodinger orbits.

Pinke, Osz and Lente: "Taking the Bohr model literally, the hydrogen atom should not be pictured as a sphere, but as a very thin disc. The motion of the electron always remains in the plane defined by the velocity vector of the electron and the position vector drawn from the nucleus to the electron. In multi-electron atoms, one may imagine different electrons orbiting the nucleus in different planes, resulting in an overall spherical distribution, but for the hydrogen atom containing a single electron, for which the Bohr model was remarkably successful, there is no escaping its inherently planar structure within the framework of classical physics", (Pinke et al., 2025).

So let's start with the Bohr atom. You have this circular orbit, it's not spherical. But you can *make it spherical*, or 3-dimensional at any rate, by rotating about a central axis. If the introduction of an elliptical path owing to this "centrifuge" operation is included, you get not a sphere but what we might call an "elliptoid". It's easier just to think of it as a sphere, analogous to the s- Schrodinger orbit, (angular momentum quantum number l = 0). So we start with this circular Bohr orbit. The angular momentum is purely a description of this circular motion, or elliptical if we want to be strictly correct. Then we rotate about the axis of symmetry, the centrifuge operation, introducing an altogether different angular momentum about that central rotation axis, the centrifuge axis. At this point, assume this additional angular momentum doesn't have any physical significance, we are not investigating what its magnitude might be, we are just in the business of trying to get 3D Bohr orbits by analogy with the 3D Schrodinger orbits.

Consider Figure 4 above, (2) (i) → (ii). Start with a circular orbit, angular momentum all defined, then provide an additional rotation axis, the Bohr orbit becomes 3D and an elliptoid 3D shape. This is the manner in which atoms exist inside metal lattices.

So what about Schrodinger atoms? They have an altogether different hierarchy for angular momentum than do Bohr atoms. As the angular momentum quantum number l increases from zero to one to two to three, you get an increasing complexity of geometric shapes, but we can reduce this all down to the spherical s-orbit, l = 0, and the "dumbbell shaped" p-orbit, l = 1. Beyond l = 1, it is just increasing numbers of p- dumbbells in various orientations. So it all boils down to the spherical s-orbit, which is trivial and we'll not bother with it here, and the p-orbit, the dumbbell.

Now there appears to be no connection between the shapes of these Schrodinger orbits, and their angular momentum quantum numbers. What, for example, is the significance of the fact that zero AM is spherical, AM = 1 is the dumbbell? There is no connection between the physics and the geometry. Because physicists have not worked this out! How do you get a dumbbell shape? You start with a planar orbit, a "figure-of-eight" pathway. Then, just s we did for the Bohr orbit, we choose an additional rotation axis, and get a 3-D shape out of it. You start with the figure-of-eight planar orbit, you rotate, you get the dumbbell. The critical point I want to make here is that it is in this new rotation system, this secondary rotation, this "centrifuge operation", by analogy with the Bohr orbit, that the quantum mechanical orbital angular momentum l, ml, is introduced, in Schrodinger orbits.

So, start with a planar "figure-of-eight" orbit, rotate about the z-axis, you get you 3D p-orbit "dumbbell". This is where the whole thing gets very interesting. That AM we are concerned with, for Schrodinger orbits, l, ml, is not related to that figure-of-eight shape at all. Of course as you trace the planar pathway, it has a certain AM, albeit a varying one. But what about at the "cross-over point", the origin, "R = 0" in l = mvR = mcR? It appears to vanish. Whatever way you look at it, it does not appear that the QM AM is a description of this planar pathway, in the manner that it is for the planar pathway of the Bohr orbit. No indeed. In the Schrodinger scenario, the QM AM is a description of what is happening about this rotation axis, not a description of what is happening in the figure-of-eight trajectory in the plane. We appear not to be concerned with the AM in the figure-of-eight plane. It is variable, it vanishes, and so does its significance, it is not described by the QM AM quantum numbers.

Conversely, in the Bohr scenario, the AM we are concerned with is in the planar circular orbit, not the AM introduced by the rotation about the axis of symmetry. The introduced AM for the Bohr orbit, and the AM dependence for the planar figure-of-eight Schrodinger orbit, we are not concerned with here, they do have some physical relevance, and we have acquired, elsewhere, a certain symmetric connection between these two "redundant angular momenta". All very good, in the Bohr orbit one is concerned with the AM *before* the rotation, in the Schrodinger orbit one is concerned with the introduced AM *after* the rotation. But talking about a 3D elliptoid is analogous to talking about a planar circular path, with the provision that elliptical orbits are *also* catered for in the Bohr analysis. Not by Bohr himself, but by subsequent physicists. Fundamentally, Bohr and Schrodinger orbits are symmetrically analogous to one another by manner of which they become three dimensional entities. And symmetrically opposed.

Now what about multiple electron Bohr orbits? Pinke, Osz and Lente propose that they are all (planar) circular orbits, but at random orientations, with an overall spherical constituency. That is not correct at all. You start with the planar orbit, various electrons orbiting in this plane, a 2D trajectory. You then do the rotation, the centrifuge operation, all the circular orbits go around together with one another. The whole plane rotates in unison. But some electrons will be travelling clockwise and some anti-clockwise in this plane. How is that? Well, we are concerned with the Schrodinger → Bohr atomic transformation. At the instant the transition is triggered, Schrodinger electrons in various orbits will have various spins, s = ±½. But Schrodinger electrons are photons. So they have spin 0, ±1, if you count the ghost. But in a Schrodinger → Bohr transition, you do not count the spin of the ghost. Because the Bohr electron doesn't have a ghost. So the Bohr electron is not concerned with the ghost it left behind. So, say, we'll have spin (Schrodinger) = +½ (at instant of transition) → clockwise Bohr orbit, and spin (Schrodinger) = -½ → anti-clockwise Bohr orbit.

Now let's talk about Schrodinger orbits. With Bohr, we are looking for a manner in which to get standing waves as suggested strongly by Pinke, Osz and Lente, and have ultimately decided against it. The corollary to this is that in chemistry, i.e. in Schrodinger orbits, outside the metal lattice, *electrons always come in pairs*. Why? Only the Noble gases can exist in monatomic form, and they have all their electrons paired. Because no other elements can exist in isolation, as a single atom, then their valence electrons exist as pairs in *molecular orbitals*, albeit if it were possible for them to exist as one atom, they would have one chance in two of a valence electron, that is, electron in an unfilled shell, being isolated and not in a pair. So that's the wonderful thing about QM and chemistry, electrons never exist in isolation, they always exist *in pairs*. What is the physical significance of this, as opposed to the chemical significance?

In Quantum Field Theory, there is a very important concept of "conserved Noether currents". We know that in nature, in chemistry, *all electrons are paired*. So the picture we have of it, all Schrodinger orbits, atomic or molecular, (atomic is what's going on *inside* the valence shell, molecular is what is going on in the valence shell), contain two electrons. They are allowed to occupy the same atomic or molecular orbital because although each electron of the pair has identical quantum numbers, n, l, ml, they differ in having opposite signs of spin, $s = \pm ½$. Would these two electrons, opposite spin, be travelling in the same direction? Or in opposite directions? Well if it was opposite directions, that would constitute zero electric-magnetic current. We do not accept this. We insist there has to be an electromagnetic current in an atomic or molecular orbital. So the two electrons travel in the same direction, with opposite spins.

Now supposing we were willing to accept non-conservation of electric charge, yet while preserving electromagnetic current. Turn one of the electrons around, and change its identity, let it be a positron, moving in the opposite direction. Still opposite spins, $s = \pm ½$, still the same electromagnetic current.

$e^- \rightarrow$
} Preserved "Noether current" of Quantum Field Theory.
$e^- \rightarrow$

$e^- \rightarrow$
} Same electromagnetic current, still spin $s = \pm ½$.
$\leftarrow e^+$

So, as luck would have it, electrons are always paired in chemistry and quantum mechanics because they aren't in fact electron pairs at all, they are fermionic partners, electron and positron, propagated oppositely and thus preserving electromagnetic current, while doing away with conservation of electric charge. And of course the whole thing about Schrodinger orbits is that they are photonic, $v = c$, fermions propagating upon electromagnetic waves, dual oscillation **E**/**B**, the wave carries a ghost. Because of this, it has zero Lorentz force, $\mathbf{E} = -\mathbf{v} \times \mathbf{B}$, so it does not feel the electromagnetic force. So how does it stay in its orbit? Space-time curvature of photons! As opposed to Bohr, that is not photonic, those Bohr electrons are feeling the electromagnetic force.

When it comes down to it, all fermions come in pairs in "natural processes", e^+/e^-. Radiation, equal numbers of electronic and positronic photons. Same direction. Electricity, equal numbers of e^+/e^- helically propagated photons at the surface of a conductor, oppositely directed, and equal numbers of axially propagated e^+/e^- in the interior, in the form of *weak-strong gauge bosons*, oppositely directed. To see how the WS GB corresponds to the GBs of the other fundamental forces and their unifications, one is referred to a table of "Ghost #" for these GBs, (Farmer, 2026).

And of course in the Schrodinger orbitals. Not in Bohr orbits. Electrons are not paired, nor are they photons, they are massive, $v < c$, (in fact $v < c/10$), they do not come with ghosts, whereas the WSGB, massless, $v = c$, although it doesn't have a *dual oscillation* like the other "natural" processes, it nevertheless has a "potential ghost", which is why it is classified as a "natural process". What about the Bohr orbit makes it "unnatural"? Profound answer. The Bohr wave is a *ghost wave*. Analogously to the fermionic ghost. It is "as if" we had a fermion, propagating upon an electromagnetic wave. But $v < c$. It is not an electromagnetic wave, it has no particular association with the Maxwellian wave:

$$\psi = \psi_0 \times \exp j\,(kx - \omega t),\ v = c = \frac{1}{\sqrt{\mu\varepsilon}} \tag{7}$$

That is it, the wave is not specified, it could be sinusoidal, as per our Maxwellian wave solution, or it could be something else. The reason for this is the requirement that in quantum mechanics, the harmonic oscillator is a very different thing than the classical simple harmonic oscillator, its mode of oscillation is *not specified*, and the reason this has happened *in nature* is because we are going to require an aether oscillation inside a fermion, e^+/e^-, that is *not* oscillating in a simple harmonic manner, it is not $a = -kx/m$, it is $a = \pm$constant, as the aether oscillates from one side of the fermion to the other, acceleration reverses abruptly at the "anti-node", and the *reason* we require this oscillation profile, non-simple harmonic oscillation profile, is that in the Reverse Higgs process, whereby an electron or positron is accelerated from $v = 0$ to $v = c$ onto an electromagnetic wave, "Reverse Higgs boson", the acceleration is *a constant*. Why? Well the accelerating force is obviously going to be a constant, so if the mass $m = m_0/\sqrt{(1 - v^2/c^2)}$ is a constant as m0 is removed and velocity is increased to c, throughout the acceleration, then we have, finally, *constant acceleration*, and that is obviously what we need to acquire $E = mc^2$ from Galileo's all important equation of constant acceleration:

$$vt^2 = v0^2 + 2ad \tag{8}$$

Now, regarding the Reverse Higgs process, by manner of which a stationary electron or positron is accelerated onto the electromagnetic wavepacket, the Reverse Higgs boson, $h\nu = h\nu_e = m_e c^2$, well the fermion starts with $m = m_0 = m_e$. As it is accelerated, it progressively loses its rest mass. By the time it reaches $v = c$, $m_0 = 0$. So the relativistic mass:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \rightarrow \frac{0}{0} = m_{e,} \tag{9}$$

we propose. Now we can see clearly how the Lorentz factor behaves as $v \to c$. To find out exactly what "0/0" is here, to confirm that it is m_e, as we proposed to begin with, you need to know exactly how m_0 varies with v. Whoever would have thought it? This dependency can be salvaged by what we call the central equation of special relativity, *the equation of the rotating vector,* (Farmer, n.d.).

$$E^2 = (m_e c^2)^2 = (mvc)^2 + (m_0 c^2)^2, \qquad (10)$$

and m as above, so it's just constants, and v, and m0, so make m0 the subject and substitute in the mass equation, the Lorentz factor equation, equation (9) above, to confirm that as $v \to c$, $m \to 0/0 = m_e$, (Farmer, n.d.). Exercise for the reader: Do the calculation yourself or track it down in my Amazon publications, (Farmer, 2025), (Farmer, 2021), (Farmer, 2022). So for the Reverse Higgs process, the initial mass m = m0 = me, v = 0, and the final mass, $m = m_e$, ($m_0 \to 0$, $v \to c$). Therefore it would seem a good conjecture that since the fermion starts with that mass me, and finishes with that mass me, it then has a constant mass m = me for the entire acceleration process. This can be verified with a simple calculation, cannot find it but it is in fact considerably simpler than the $v \to c$, $m \to 0/0 = m_e$ calculation. Interestingly, in this Reverse Higgs process, we are restoring Newtonian mechanics, constant mass $m = m_e \to a = F/m$ constant, to an Einsteinian special relativistic description that appeared to do away with this beautiful simplicity, by manner of which an acceleration couldn't be considered a constant, for a constant force, because $m = m_0/\sqrt{(1 - v^2/c^2)}$ depends on v, to however small an extent. But as $v \to c$, this dependency on v becomes unfathomably large.

We have worked out some wonderful things about Bohr and Schrodinger orbits, but we are still no closer to finding out how Bohr got $mvR = n\hbar$ from $2\pi R = n\pi$, without de Broglie, $p = h/\lambda$. Then it turns out that Pinke, Osz and Lente have put it all down to the uncertainty principle. But that is Heisenberg's, the HUP! He came along late in proceedings, after de Broglie and a long time after Bohr. So that is not the answer to our query. Anyhow, at this stage, the most prudent thing is to examine their HUP analysis and see what we can make of it.

"It must be pointed out that the Heisenberg uncertainty relation also requires that the electron-proton distance is not well defined as in classical mechanics but smeared out, which means the radius of the Bohr atom is an average rather than a set value", (Pinke et al., 2025).

We utterly dismiss this proposition. There is nothing physically wrong with the classical Bohr model, it is a perfect description of nature, and there is certainly no need to introduce concepts from the Schrodinger analysis that are totally erroneous, to the Bohr model and stuff that model up too. Schrodinger electrons orbit in precisely defined figure-of-eight trajectories, as we have discussed at length. The dimension of that p-orbit is precisely defined, the lobe of the p-orbit occurs at a definite distance R from the nucleus, in the case of an s-orbit, l = 0, its radius is exactly defined, not "smeared out" in any manner, the quantum mechanical people have got this completely wrong. The HUP does not apply to individual fermions. It applies to fermions and ghosts, one of each, trapped inside an electromagnetic wavepacket. They have definite positions inside that wavepacket, but you cannot locate those positions without destroying the wavepacket. This is what happens when you measure the spin of a photon, the measurement destroys the photon, but in the process you do get to determine the instantaneous spins of the fermion and the ghost.

So Heisenberg gives us the wavepacket, associated with the Uncertainty Principle. QTE (Farmer), (Farmer, 2021), (Farmer, 2022), (Farmer, 1993), acquires this wavepacket with respect only to electromagnetic considerations, to satisfy Planck's law, $E = h\nu$. And a fermion, and the ghost antifermionic to that fermion, trapped inside. The position and momentum of the fermion and the ghost are perfectly well defined, just the position is unavailable to us, that knowledge.

Okay, so let's try to get the Bohr angular momentum quantisation condition, $mvR = n\hbar$, without invoking the de Broglie wavelength. Bohr did it in some manner which I am yet to ascertain. Pinke, Osz and Lente did it in some manner which I am not going to bother with. So, finally, I will do it with the uncertainty principle too, and I will do it my way.

Strictly speaking, we have the quantum gravity theory strictly for $v \to \infty$. Strictly speaking, any sort of terrestrial or celestial gravity will satisfy $v \to \infty$ to such an extent that we certainly have the following result:

$$\begin{aligned} m(\text{graviton}) &= \frac{m_c}{\sqrt{1-\frac{v^2}{c^2}}} \\ &\sim \frac{c-\text{mass}}{\sqrt{-\frac{v^2}{c^2}}} \\ &= \frac{-jc \times c-\text{mass}}{v}. \end{aligned} \qquad (11)$$

Discussion

Lagrangian (Musakhail) versus Hamiltonian (Bohr, Schrodinger)

Lagrangians are concerned with force. Specifically, here, gravitational force (Newton) and the aether force of Musakhail, (Musakhail & Farmer, 2026). And Hamiltonians are concerned with energy. Specifically the energy of the Bohr orbit, and the energy of the Schrodinger orbit. Note the crucial fact that the *Bohr atom and the Schrodinger atom have the same energy eigenvalues*, they have the same radiation spectra, λ. So for the de Broglie expression, $mv\lambda = h$, λ the same for Bohr and Schrodinger, the Bohr atom has v variable, $m = m_e/\sqrt{(1 - v^2/c^2)} \sim m_e$ = constant, to say four significant figures. And you have Schrodinger, here, conversely, speed is a constant v = c, and mass $m = \Psi$ is variable. So let's investigate the symmetry of the Lagrangian-Hamiltonian pairing. Regarding the Hamiltonian, both the Bohr and the Schrodinger analysis employ an Hamiltonian.

Hamiltonian (Bohr)

Energy of Bohr, Schrodinger. But Schrodinger electrons, which are really photons, are held in their orbits by Einsteinian space-time curvature, not Newtonian force. Conversely, Bohr electrons are held in their orbits by Newtonian force,

not Einsteinian space-time curvature. Photons do not feel the electromagnetic force. So, for the Hamiltonian:
Bohr orbit (Newtonian force) → Schrodinger orbit (Einsteinian space-time curvature).

Lagrangian (Musakhail)

Aether force (Musakhail) → space-time curvature condition, (see Figure 1). (de Broglie)
Now, we investigate the uncertainty principle. It is our desire that in doing so, the de Broglie relation $p = h/\lambda$ will appear in proceedings. First note, (Farmer, 2026), that all gravitational interactions in the universe occur in a time frame Δt = constant, whether the interaction is between the earth and the sun or between two stars on opposite sides of the universe. This means that the speed of the graviton is in proportion to distance, R, of the gravitational interaction. v α R, giving us:

$$m \propto \frac{1}{R}, \ v \propto R. \tag{12}$$

So p = mv = momentum does not vary with interaction distance, R. And we know that neither does Δt. But energy E = KE = mv^2 α R. So consider the two standard forms of the Heisenberg Uncertainty Principle:

$$\Delta x \times \Delta p > \sim \frac{\hbar}{2} \qquad \Delta E \times \Delta t > \sim \frac{\hbar}{2} \tag{13}$$

↑ ← Both invariant → ↑

↑ ← Both α R → ↑

By manner of this symmetry, we have confirmed Quantum Gravity, (M-theory), (Farmer, 2026). Now we are talking about the momentum p of a graviton, not the *change in* momentum, Δp, aren't we? Well, we do it all with respect to a frame that goes all the way from vgrav through v = c, m = c-mass/m_e, and finally back to v = 0, m = m_0 = m_e, momentum p = mv = 0 and kinetic energy KE = (½)mv^2 = 0. So Δp is just the difference between "ground zero", v = 0, p = 0 and the graviton momentum. And ΔE is just the difference between ground zero, v = 0, KE = 0, and the graviton energy, (Farmer, 2026).

So consider the Lagrangian part of the symmetry. The HUP symmetry demands v → ∞, effectively. Well that's what the Bohr space-time curvature condition is all about, v → ∞, as R → ∞, see Figure 1.

So, for the Lagrangian analysis, to get from aether force (Musakhail) to space-time curvature condition, v → ∞, you have to transform through the Bohr orbit, by analogy with the Hamiltonian analysis, where you start with the Bohr Hamiltonian and proceed through the Schrodinger Hamiltonian, the space-time curvature orbits. So, the de Broglie expression, $p = h/\lambda$, comes out of the v → ∞, Force → space-time curvature analysis, (Lagrangian versus Hamiltonian) above, working backwards from the HUP result above. v → ∞, HUP of QM unified with gravity. To get the HUP result, v → ∞, we employed the de Broglie expression, $p = h/\lambda$. So now, with our Lagrangian/Hamiltonian symmetry analysis, we start with the space-time curvature condition, v → ∞, it is necessary for the de Broglie relation to be restored from space-time curvature in order to work backwards and be restored to force, aether force, Newtonian force of Bohr orbits. So, by use of the HUP, linking quantum phenomena to gravitational phenomena, we have established the de Broglie relation, $p = h/\lambda$, which we can now employ in the Bohr analysis. Obviously not the way Bohr did it. Obviously not the way Pinke, Osz and Lente did it. But it's the way I did it, and I'm happy with it.

To complete the analysis, we need to make the Bohr space-time curvature condition amenable to gravity. So Figure 1 becomes a description of a graviton rather than an electron. So we rotate the whole thing together, all the wavelengths, the little ones through to the big ones, rotate together. Then v α R → ∞, as required, for the graviton, see discussions above. So v α λ α R. And for gravity, there is no electromagnetic force, V = 0, (gauge boson only carries ghosts), so the total energy E = KE + V = KE = constant, and so:

$$mv^2 = \text{constant} \rightarrow \Psi = m \propto \frac{1}{R^2}. \tag{13}$$

So in the Bohr analysis, we have the space-time curvature condition, and m ~ me → v α $1/\lambda$ α 1/R. The whole thing does not rotate in unison. But when we take this space-time curvature condition and convert from Bohr to gravity, you get an altogether different manner of the space-time curvature condition, and it is entirely constant with our theory of quantum gravity, whereupon the time for graviton exchange Δt is a constant over the entire universe, it takes the same time for the sun and the earth to exchange a graviton as it takes for two stars on opposite sides of the universe to exchange a graviton, with the result that the speed of a graviton is in proportion to the interaction distance, R. Why mv^2 = constant? Well if the whole thing rotates in unison, then v α λ and so de Broglie, $mv\lambda$ = constant α mv^2 = KE.

Another manner, Farmer (2021), p 30, is to consider an electron in an orbit, total energy a constant E = KE + PE. That's the way it works for Bohr atomic orbitals. But for gravity, it's quite different. Focus on Figure 1, the two possibilities mentioned, (1) Bohr atomic versus (2) Gravitational. Now a graviton does not have an electric charge. So the electric potential V = 0. Reducing the energy equation to E = KE = constant. So, a gravitating pair of nuclei is analogous to a Bohr orbit, in terms of energy constancies.

So, we have emergence of the Heisenberg Uncertainty Principle, HUP, from considerations of the Bohr space-time curvature condition, Figure 1, (2) the gravitational condition, m α$1/R^2$, v α λ α R. Unifying the Bohr Quantum Mechanical theory with Quantum Gravity.

Conclusion

We unify Quantum Mechanics and General Relativity, (Farmer, 2021) p 91. We achieved that unification firstly. Now General Relativity is *electro-grav* unification. There is only one speed that is common to gravitation and the electromagnetic interaction, and that is the speed of light, v = c. Hence, Einstein's gravitational waves, v = c. So since quantum gravity belongs to GR, in this manner, we would therefore expect it to be possible to unify quantum mechanics and quantum gravity, and that is precisely what we have done in this paper, hence the title.

Well, one problem remains, and we have the solution. Why is m α $1/R^2$, for the gravitational Bohr space-time curvature, Figure 1, but for the graviton it is m α 1/R? Firstly note that m = Ψ is an amplitude. It could be, for example, |**E**| or |**B**|. Well the Bohr space-time condition is a rotation about a "nucleus", a spherical symmetry, so we have an inverse square dependency, a Coulomb law, |**E**| α $1/R^2$. Conversely, for the graviton, well the graviton propagates in an helical path at the boundary of an *electromagnetic flux tube*. Just as in the terrestrial electromagnetic situation, where you have a flux tube carrying fermions propagating on magnetic fields lines **B** in helical paths at the surface of the tube. So it's an helical path right! (Physicists assume the surface field lines are entirely azimuthal, however they are wrong, there is a small axial component that is too small for us to discern). So, for the gravitons travelling in helical field lines **B** at the surface of an electromagnetic flux tube connecting the two gravitationally interacting nuclei, we are now of course not concerned with a |**E**|, now we are concerned with a |B|, and we shall conclude there given that classical electromagnetic theory can assuredly give us the required dependency, (in terms of classical electromagnetic "conventionality"):

$$\nabla \times \mathbf{B} = \mu\mathbf{J} \rightarrow |\mathbf{B}| \propto \frac{1}{R}. \qquad (14)$$

So let's be a little geometric about the matter we have raised, the helical field B at the surface of an electromagnetic flux tube, for example a current carrier in a terrestrial electromagnetic circuit, or alternatively an electromagnetic flux tube linking two nuclei in a gravitational interaction.

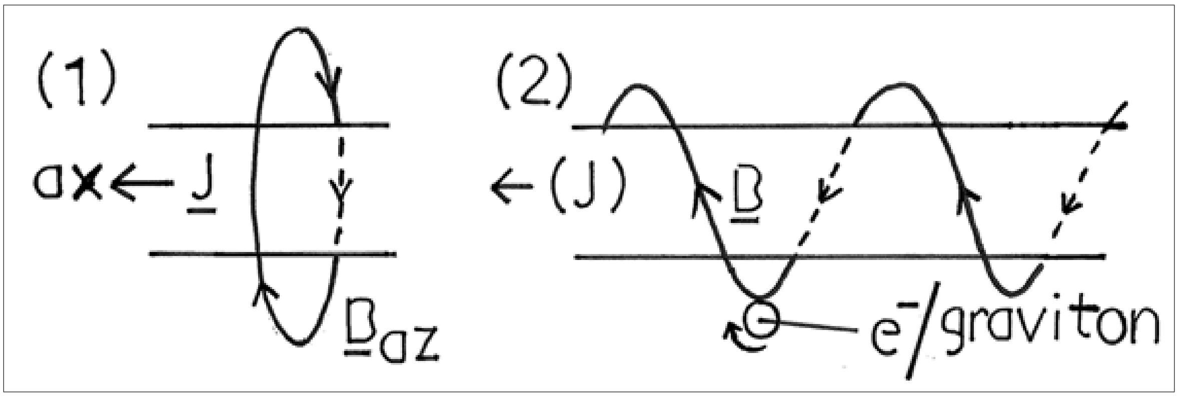

Figure 5: (1) The classical picture, field lines close in upon themselves, no axial component, versus (2) The quantum reality, the field lines B have a minute axial component

This axial component is far too small for us to measure, but it is there, such that the field lines form an helix, which can transport photonic fermions from one end of the conductor to the other. (The flux of fermions centrally, axially, through the interior of the flux tube, is instituted not by photons, still fermions of course, but in the form of *weak-strong gauge bosons*, v = c still, but only a singular oscillation, no ghost, no $E = mc^2$). The helical pathway of photons at the surface is analogous to the photonic pathways in Schrodinger orbits, the curved pathway is facilitated not by Newtonian force, but by Einsteinian space-time curvature. $E = mc^2$ applies exclusively to *photons*, (Einstein: "When a body radiates, the radiation takes away a mass, $m = E/c^2$").

So, in the terrestrial electromagnetic situation, too, not just say in Solar flare observations, where the helicity, the axial component, of **B** is visible on the huge scale that is a Solar flare, the apparently entirely *azimuthal* field lines **B** at the surface of the conductor do *not* close in upon themselves in the manner students and masters of classical electromagnetism have imagined until now. When you think about it, field lines closing in upon themselves in this manner is an unphysical assumption. In a terrestrial circuit, the axial component B_{ax} of **B** is so incredibly tiny, we have no hope of observing it, because the speed of light c is so very great by comparison with the dimension of our EM circuit. For a Solar flare, the dimensions involved are very much larger, hence we can observe the helicity, (Farmer, (n.d.).

This probably accounts for the mess physicists have been in for decades in their Solar flare investigations over a concept of "magnetic reconnection". Presumably by magnetic connection, they are talking about field lines closing in upon themselves in this manner, not with "loose ends". They have been trying to find consistency with this classical fallacy in the scientific theory of the Solar flare they have been trying to develop. Our argument is that magnetic field lines (or electric field lines, for that matter), do not "connect" in this manner, they never close in upon themselves, ever! We have got some useful physics out of their magnetic reconnection discussions, but not associated with such a "magnetic reconnection" which the physicists propose, (Farmer, n.d.).

Finally, the reader is referred to a discussion of the nature of the Higgs boson and magnetic reconnection, (Farmer, 2022) p 104, whereupon the Uncertainty Principle is combined with the extremization of the (**E**/c, **p**) 4-vector. So, in the final analysis, we bring together the Higgs boson whereupon it played a crucial role as one of five M-theory dualities, and the Uncertainty Principle, which was so vital in the final gravitational analysis, (Farmer, 2026), and finally the (|**E**|/*c*, p) 4-vector, which appears particularly relevant, given that the graviton energy E = |**E**| = KE and its momentum p = |**p**| are such a critical component of our gravitational uncertainty analysis.

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