Unification Accomplished:
Einstein's dream realized in the Single Field Theory

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Abstract: Since Einstein died in 1955, very few theoretical scientists have tried to complete his work because the pendulum of history has swung toward favoring field theories based on the quantum for the expected unification of physics. Nearly everyone now believes that the quantum (discrete point) and relativity (continuity) are incompatible and the quantum is more fundamental than relativity and continuity, so those who have sought unification have looked for new and unique quantum approaches to accomplish unification. However, the truth is that the quantum and relativity are not incompatible and the traditional differences between the two–discreteness and continuity, indeterminism and determinism–are just the outward appearances of an even deeper fundamental problem–geometric point and extension–that when solved renders relativity and the quantum completely compatible. This deeper problem is even more significant because Riemann knew of and failed to consider and even purposely ignored the problem of point-elements and based his differential geometry of surfaces on metric-elements alone. Therefore, expanding the Riemannian geometry to include point-elements, which can be interpreted as discrete points for the quantum, forms a fundamental enough foundation for developing a unified field theory.

Keywords: Unification, unified field theory, quantum theory, single field theory, Riemannian geometry, space-time continuum

Introduction: Setting the table

Within a few years after Einstein published his initial paper on the general theory of relativity [01], the mathematicians Hessenberg [02] and Levi-Civita [03], and the physicist Weyl [04] noticed there was a critical shortcoming with the tensor calculus used to express the Riemannian geometry he used. The tensors (tensor calculus) represent the points along the curvature in an *n*-dimensional Riemannian surface, *i.e.*, approaching the tangent points ($\Delta s \rightarrow 0$) along a curved line from either side, but not representing what happens to the curvature 'in' or 'at' the discrete points (where Δs becomes 0) themselves. So, Einstein's gravity theory was not as complete as thought, even though it explained everything known about gravity and even predicted new physics. It was not so much Einstein's physical mistake as it was a mathematical incompleteness in Riemann's geometry that dated back to and had been commented on by Riemann in his original paper on the differential geometry of surfaces [05].

Riemann's geometry only considered extensions in space, what he called metric-elements. He did not address point-elements, *i.e.*, the geometry and/or any physical contributions they might make at the individual points of space themselves, but dismissed them. Yet in the final paragraphs of his paper, Riemann directly and unequivocally stated that the true nature of space could only be found in its smallest measurable parts – quanta. Riemann never meant his geometry to provide the final answer for the nature of space and, by extrapolation, Einstein's space-time continuum. In other words, there is far more to Einstein's fundamental idea of a curved space-time continuum than anyone yet knows or even suspects and the general theory of relativity is essentially incomplete.

These men, later accompanied by Eddington [06], Einstein himself [07], Cartan [08], and others began to develop what has become known as the non- and later pseudo-Riemannian geometries to address the Riemannian shortcoming. These were also described as "tangent geometries" by Pauli [09] because they only referred to the single point in the curved surfaces from which a tangent surface could be drawn. The non-Riemannian geometries were geometries of, or even within, the very points in space, where scientists and mathematicians alike thought that electromagnetic forces originated, so developing the non-Riemannian geometries would hopefully give gravity and electromagnetism an equal geometric basis in the physical world. Doing so left Einstein's new gravity theory intact while providing geometric alternatives in points to account for electromagnetism, but that assumption or conclusion was wrong even though it propelled the search that Einstein and other scientists made for a unified field theory for the next several decades.

Those earlier non-Riemannian and related geometries, by concentrating on points alone, did not address the problem of how discrete points could give rise to continuous extensions over space, creating a basic conceptual flaw in the original Riemannian geometry of surfaces, so how points were mistakenly interpreted and represented through the calculus of tensors was propagated throughout all the attempts to unify general relativity, electromagnetism and the quantum. The difference between point and extension is still so strong in all forms of geometry and the scientific worldview that it also condemns the Standard Model, superstrings, branes, supergravity, quantum loops and quantum gravity in general to the same shortcomings. The new and most advanced quantum theories, in general, have no method of generating or explaining the continuity of space and time that we observe in nature.

So, when the curvature of our three-dimensional surface space was equated to matter/energy stress and thus gravity by Einstein, the problem was not with gravity theory itself. For what it did accomplish, a more accurate modern replacement for Newton's gravity theory, it has been completely successful. General relativity has been verified as accurate by confirming several predictions, the latest being the detection of gravity waves by LIGO. The problem with unification can only be found in the human derived mathematical expression of physical space in which gravity acts by our failure to recognize the point-effect of space as a separate component of the extended (metric) gravity field. Space is a single continuous relative framework for the workings, all of the workings, of our physical world, but it can be interpreted by the human mind and expressed in two different but equivalent ways, as either a three-dimensional collection of extensions or metric elements (relative space) or as a collection of individual (discrete) points (an absolute or absolute-like space), even though modern physics, both the quantum and relativity theories, completely rejects this duality as strictly Newtonian.

Even Newton had seen this difference although he expressed it differently. If how we express space mathematically is the true problem, then this inherent dualism should affect the physics of both electromagnetism and gravity in a similar manner and realizing this, they would appear more symmetrical to each other in their mathematical formulations. In other words, gravity should have two fundamental components instead of one (either Newtonian m**g** or Einsteinian $\mathbf{R}_{ik}$), just as electromagnetism does (Lorentz force of q**E** and m**v** ⊗ **B**). And just as the electric field **E** acts as an extension space like gravity (center to center), a secondary effect of the gravity field should act relative to point space just like magnetism (around the point center) in relation to the electric field. The second fundamental term of gravity yields dark energy and dark matter (collectively called gravnetism), which are mistakenly labeled since they are not separate types of energy and matter, rather than electromagnetism, as concluded by Einstein and past theoretical researchers.

The Dark History of Physics

The only other person who seems to have noted this discrepancy expressed his concern in a simple equation based on a comparison to electromagnetism's Lorentz force. In 1893 Oliver Heaviside [10] expressed this extension/point duality for gravity by the equation

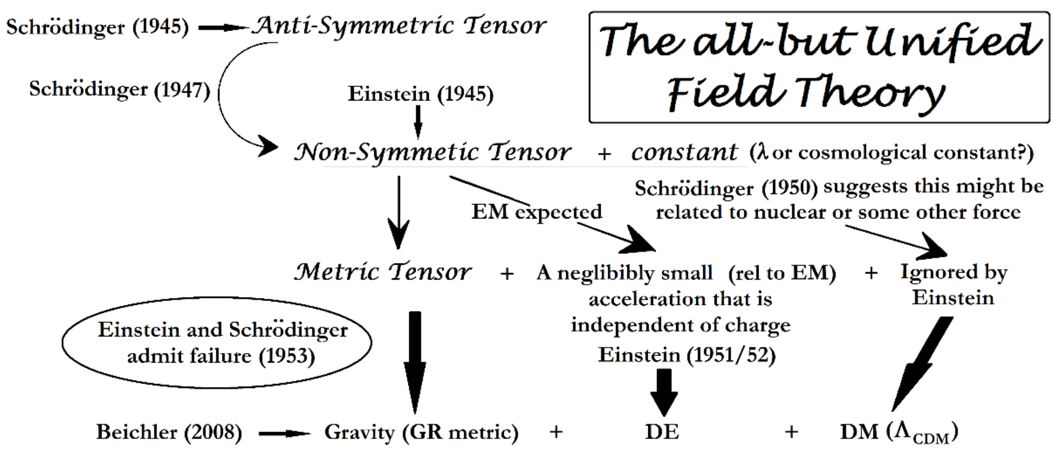
$$\boldsymbol{F} = \mathrm{m}\boldsymbol{g} + \mathrm{m}\boldsymbol{v} \otimes \boldsymbol{S},$$

a formula that was specifically made to look like the Lorentz force equation. He then correctly explained the vector ***S*** as a true Machian centrifugal force, an expression of the attraction of the rest of the matter in the universe for an object orbiting a local central dominant gravitating body or changing position relative to the center of gravity along a tangent line, relative locally to the center of motion and non-locally to the rest of the material universe.

The fact that his paper and formula went almost completely ignored by physicists and scientists for generations only demonstrates how little has been known about both Riemannian geometry and the true nature of space, but as everything is with nature if you ignore nature she will come back to haunt you. We can see now that Heaviside's equation does approximately describe what is now called Dark Matter and Dark Energy as a secondary (non-local) gravitational effect according to classical physics rather than a modern quantum effect due to hypothetical and completely unverified and possibly undetectable Dark Matter particles. Modern torsion field theorists do heed Heaviside's formula and/or the later Einstein-Cartan anti-symmetric theory, but they have yet to correctly interpret its connections to dark matter and dark energy and justify it use as representing a point-element geometry within the Riemannian framework.

The belief that Newton and Einstein's gravity theories, based solely on extension and thus relative space, has been so strong that no other person has seen or mentioned that the simultaneous point-geometric nature of space also needed to be considered for a complete description of gravitational effects. If this attitude were not so strongly imbued in the past and present scientific worldviews, Einstein and Schrödinger could have predicted the existence of what we now call Dark Energy and Dark Matter nearly seven decades ago.

After working on the five-dimensional theory with Bergmann and Bargmann [11], Einstein returned to his 1925 efforts [12] based on a non-symmetric model in 1945 [13]. He continued supporting this model until his death in 1955. Schrödinger was instead interested in the earlier ideas of Eddington concerning the affine connection and parallel transport which had been used in the Einstein-Cartan anti-symmetric model of 1929 [14], so he adopted the anti-symmetric approach in 1944 [15]. In 1947 [16] and again in his 1951 book *Space-Time Structure* [17], Schrödinger demonstrated how and acknowledged that his anti-symmetric tensor could be mathematically reduced to an equivalent form that combined the metric and non-symmetric tensors with a constant λ. He even suggested that the constant could be Einstein's old cosmological constant or perhaps it represented the nuclear force or a new gravitational effect [18], but Einstein rejected the notion completely since he was happy with and only thought he needed the metric and non-symmetric tensors to unify gravity and electromagnetism.



If Einstein, Schrödinger and their colleagues had not been so intent on relating the non-symmetric tensor to EM and thus unify GR and EM, they could have predicted DM and DE as secondary gravitational effects five decades before they were first observed

After 1951 Einstein made calculations on the effect of his non-symmetric field on a charged particle [19], but the acceleration values he found were negligibly small, independent of the charge on the particle and even whether it was charged or not, so Einstein was finally forced to concede that the non-symmetric model did not yield electromagnetism from the combined field equations.

Yet if he had just read the clues correctly, he would have seen that he and Schrödinger had predicted a completely new secondary point effect of the gravitational field that we would today equate with Dark Matter in the form of Λ_{CDM} and Dark Energy in the form of a negligibly small accelerating force around all material particles and bodies. He and others were so convinced that the non-symmetric and other methods to describe geometry in or about the points of space would only yield electromagnetic effects and nothing else within a unified field, that he missed his chance to create new physics. Einstein was thus forced to give up his dream of a unified field theory and spent his remaining years editing and republishing his book the *Meaning of Relativity* [20], leaving the fate of his unified field theory in the hands of future scientists who had no real interest in it.

Einstein and Schrödinger had very nearly finished the first step in unification–completing general relativity–in the early 1950s, but they were so intent on interpreting the anti-symmetric and non-symmetric tensors as ultimately electromagnetic in nature, they failed on all accounts. Yet they were not alone in this oversight and misinterpretation of the point-effect on gravity. All the scientists searching for a more generalized mathematics and a unified field theory made this same mistake except for Kaluza [21] who extended Einstein's four-dimensional space-time by embedding it within a higher-dimensional space in 1921 as Riemann had originally suggested. Kaluza is the only scientist to have ever successfully, although some say artificially, generated Maxwell's equations from a unified Einstein field. But he only extended individual points into the higher embedding space, which was only enough to regenerate the electromagnetic equations and no more so his theory was woefully incomplete. However, like all of the others, Kaluza considered his five-dimensional extension of general relativity as infinitesimal extensions in the fourth direction of space from the discrete points in three-dimensional space without explaining how the originating points could remain discrete and still be continuous with other such points to form the continuity of curvature of the three-dimensional surface of our common space.

So, when Einstein and Bergmann took Kaluza's theory a bit further in 1938, they did not fare much better because they also failed to develop a complete model of the higher embedding dimension which yielded its physical properties. Yet from this point and onward, all that was necessary to unify all of physics was merely noting that discrete points in the quantum absolute space are equivalent to 0-D point Voids with 'twist' [22] in the Riemannian relative space-time continuum. Doing so would allow the expansion of Riemannian geometry to include point-elements that could be identified with the quantum in three-dimensional space, define the characteristics of the higher-dimensional embedding space (manifold) by demonstrating the continuity of discrete points, which Kaluza had also neglected, and develop a successful unified theory.

What is the reality of the Quantum?

In the meantime, quantum theory advanced at a rapid pace in a completely different direction, further isolating itself from the very concept of simple relativity, let alone the more complex relativity concepts of Galileo and Newton and theories of Einstein, while Einstein and a few others sought unified field theories out of which the quantum of measurement would somehow magically appear. In I927 Bohr and Heisenberg introduced quantum mechanics based on the uncertainty principles at the Solvay conference. It was meant to be a non-geometrical point theory, yet it still seemed to be searching for or even necessitates using an artificial or pseudo-geometry in the form of the so-called quantum field, although no one normally thinks of it in this way.

This search has resulted in the standard particle model of the quantum which is now the major paradigm in physics, but it also led to a philosophical conundrum that no one has yet been able to solve. General relativity and the quantum theory are the two greatest and most accurate theories ever devised, but for all practical purposes they are thought to be mutually and completely incompatible.

Philosophical thought on the problem has resulted in two major paradoxes which only seem to be unsolvable: the discrete versus continuity debate and the debate pitting determinism against indeterminism. Yet both debates are no more than endless, useless and meaningless philosophical banter that has little or nothing to do with real physical science. In truth, relativity and the quantum are completely compatible through the geometric connection afforded by the higher embedding dimension.
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The discrete versus continuity debate results from a misstatement or misrepresentation of the point-/extension geometrical problem, but the concept of the dualistic nature of physical space (point quantum versus metric curvature) resolves that problem. So, the determinism versus indeterminism debate is no more than much ado about nothing since neither viewpoint completely represents physical reality, just human vanity regarding physical reality. This means that the quantum and relativity are not incompatible as has long been thought, but are in fact totally compatible once the philosophical problems that have long biased debates on the subject are dismissed as physically irrelevant. Once the Einstein unified field theory has been completed by combining the anti- or non-symmetric approach of Schrödinger and Einstein (to account for dark matter and dark energy) with the higher embedding dimension approach of Kaluza (to account for a unified model of electromagnetism and general relativity), the accepted dualism of space, point versus extension, leads to a full unification of quantum and relativity in the form of quantized space-time curvature, which is accomplished by utilizing Klein's implied suggestion [23] that quantizing the embedding fifth spatial dimension quantizes four-dimensional space-time.

Many of the problems of modern quantum theory are mathematical rather than physical because the mathematics used in many cases has been rigorized to the extent that it has not only been stripped of all reference, but stripped of any possible reference to physical reality and thus been purified according to a completely mental standard with no regard to physical reality. In doing so, the practice of rigorization has introduced discrepancies and differences between pure mathematics and physics which sometimes lead physics astray in its quest to accurately describe nature through a series of ever increasingly correct theories. This practice was also part of the problem with original development and interpretation of the non-Euclidean geometries as a whole and Riemannian geometry in particular as well as the tensor calculus developed to express them all. Such mistaken beliefs have only served to impress the fallibility of the human mind onto nature, even at the expense of the infallibility of nature.

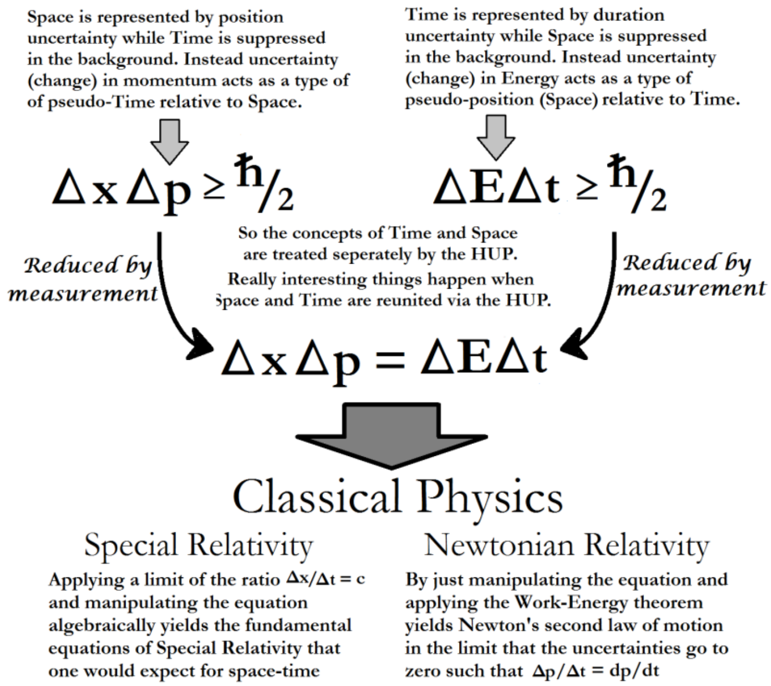
The differences between mathematics and physics have recently gained added importance in modern physics where quantum theory is leaning more heavily on pure mathematics to guide it, while at the same time beginning to run into problems because physical reality does not necessarily follow predictions generated by rigorized mathematical systems. In fact, quantum theory in the form of the Heisenberg uncertainty principle and quantum mechanics drives a stake directly through the very heart of nature and the fundamental nature of the concept of 'change', so basic to physics, by artificially dividing the natural connection between space and time upon which our physical reality and universe have evolved.

It may be logical and even advantageous to find how space and time act independently in nature, but it may not always be prudent to do so. Scientists must realize that the experimental results from this mental and unnatural split of space from time do not always represent the true reality of nature, but only a special limiting case within our overall physical reality. Mathematical rigorization and the subsequent rigorization attempts in quantum physics automatically consider space and time as 'just' property-less variables and thus gives them some type of esoteric but unnatural equivalence, but doing so is not always and for all purposes such a good idea that has invaded and inhibited the advance of physics through unification for far too long.

The split of space (Δx) and time (Δt) is 'justified' in the quantum mechanical worldview as the pawn and plaything of momentum (Δp) and energy (ΔE), which are considered fundamental quantities in their own rights at the same or even a more fundamental level than space and time. They thus render a type of pseudo-space (ΔE) or pseudo-time (Δp), whichever the case might be, rather than applying to a space and time or space-time framework for reference, which would seem more natural. In this sense, the Heisenberg uncertainty principle is based solely on mathematical rigorization and not on true experiences and observations of nature and thus the Heisenberg uncertainty principle, without physical justification, overly and restricts physics and nature in an unnatural way. So, although there are flaws in relativity theory, under these conditions quantum theory has been the real 'fly in the ointment' as far as unification is concerned, while accepting this new philosophical change regarding the quantum and quantum mechanics allows unification to go forward.

Compatibility

Given the two fundamental formulations of the Heisenberg uncertainty principle, which basically define the modern quantum theory, there are several ways to proceed that allow other physical models of reality to be included or unified with the quantum. By setting these two equations equal, we get classical physics again. [24] For example, when the condition that the ratio of the uncertainty in position to time is less than or equal to the speed of light ($\Delta x/\Delta t \leq c$), Einstein's equations for special relativity can be easily (algebraically) derived. On the other hand, when that condition is relaxed and the Work-energy theorem applied, Newton's second law of motion ($F = dp/dt$) can also be derived. These derivations should demonstrate that quantum mechanics and classical physics are completely compatible as well as indicate the direction to take for their unification.



So, it would seem from Heisenberg uncertainty principle's expression of uncertainty that bringing space and time back together (from their unnatural mathematical separation) suppresses the quantum effect as exemplified by the disappearance of Planck's constant, rendering the event physically real for consideration by classical physics. In other words, suppressing Plank's constant by combining the different quantum expressions for space and time results in a reality described by Newtonian physics and general relativity. This implies that Planck's constant is at least proportional to a binding constant for space and time at individual quantum points.

A quantum point is discrete (physically disconnected) in ordinary three-dimensional space, but it is simultaneously a member of an infinite number of points that constitute an extension in three-dimensional space that passes through it. This presents a paradox: how can a quantum point be both discrete and continuous at the same time, especially in the case of quantum theory? However, the three-dimensional discrete quantum is still simultaneously connected to (entangled with) all such points in three-dimensional space via its fourth-dimension extension. In this respect, the three-dimensional quantum point is mathematically equivalent to a zero-dimensional (0-D) geometrical point or 0-D Riemannian point-element. In the physical case, the discrete quantum point becomes the 0-D point/twist Void of single field theory which represents the 'gravnetic' vector potential (expressing dark energy in empty space between particles and points of mass inertia inside particles). It is the gravitational equivalent to the magnetic vector potential in electromagnetic theory. When expressed as such, photons and all point particles in the Standard Model of the quantum can be interpreted as either point-centers of mass curvature or point-centers of energy stress (single field resonance density patterns) in the single field model, which conceptually reinforces the unification process.

The mental split of space from time creates the uncertainty (which does not exist in nature), but only within the discrete points of space and not the relative extensions (metrics) of space which remain deterministic, by invoking the Planck constant, thus demonstrating that ħ is nothing more than the point-by-point or point-binding constant of time to space. The point-based quantum space (corresponding to Riemannian point-elements in real relative space) that is generated by the collection of all possible simultaneous quantum events in the universe represents a background absolute space of possibilities (which is flat and three-dimensional by default, if not by reality) in comparison to Einstein and Newton's relative space, which also explains why the two have not yet been unified. So, the common interpretation of the Heisenberg uncertainty principle as a

$$\Delta x \Delta p \geq \hbar/2 \quad \underline{\textit{OR}} \quad \Delta E \Delta t \geq \hbar/2$$

situation is not correct, at least not as correct as a

$$\Delta x \Delta p \geq \hbar/2 \quad \underline{\textit{AND}}/\underline{\textit{OR}} \quad \Delta E \Delta t \geq \hbar/2$$

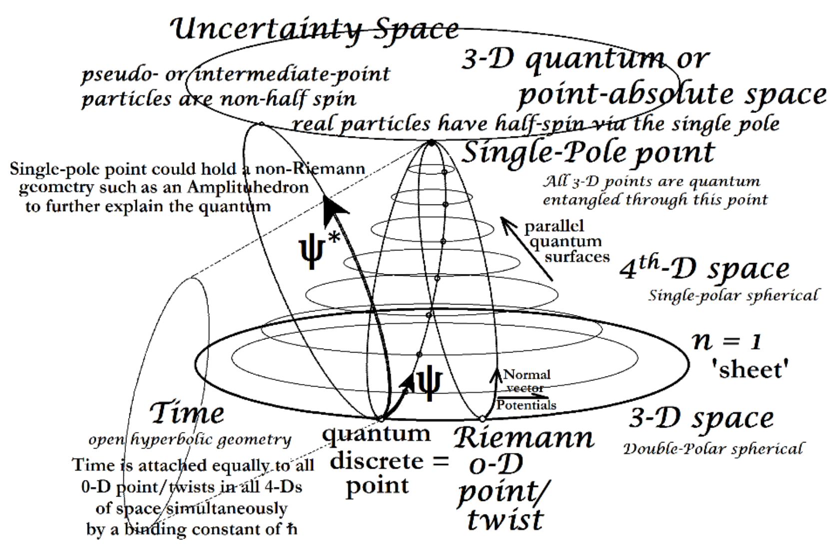
situation. Choosing ***OR*** yields quantum mechanics, but choosing ***AND*** yields classical physics.

The ***OR*** case also leads to the creation of a background three-dimensional absolute point-space as a collection of the ‘discreteness’ of all points that make up the universe as a whole. The ***AND*** choice is expressed by the simple relativity of extensions and the collective continuity of all physically real points in relative three-dimensional space which are all connected through the four-dimensional embedding space. The ***AND/OR*** option, and only the ***AND/OR*** option, thus gives a complete rendering of physical reality for the purposes of mathematical modeling in theoretical physics. From these new interpretations of the Heisenberg uncertainty principle, new conclusions can be reached that change the quantum paradigm and allow unification with relativity once the point/extension problem with Riemannian geometry has been fixed [25].

A false belief that relativity and quantum theories are completely and will always be mutually incompatible (when they are only mutually incompatible regarding three-dimensional space) and cannot be unified as equally fundamental aspects of nature, while retaining the major characteristics and concepts of each theory, has dominated physics and science since 1927. It is true that quantum indeterminism has no place in a continuous world since it is limited to the unconnected discrete point, just as a discrete point cannot exist along a continuous line (it would form a discontinuity) or surface, yet an infinite number of discrete physical 0-D point/twist Voids make up a continuous space-time manifold which is not necessarily indeterministic. This fact also suggests that these two physics paradigms can be unified quite easily and seamlessly by applying a modified Riemannian geometry that includes point-elements that represent discrete quantum points.

The continuous world of relativity can remain deterministic (in its extension) within its domain of application, while the quantum world of the discrete point remains indeterministic (at least inside discrete points and only inside discrete points) in quantum absolute space, even after unification because one does not geometrically preclude the other. Classical Riemannian geometry is about extensions growing infinitesimally smaller and smaller as zero is approached ($\Delta S \rightarrow 0$) without ever reaching zero, whereas the quantum uncertainty uses a similar concept of extension going to zero but in this case zero is reached. Under these circumstances, it is safe to conclude that the Heisenberg uncertainty principle is merely a physical limiting condition, not unlike the purely mathematical rigorous definition of an instantaneous velocity which only reaches the zero point (ΔS) conceptually since the time quantity (Δt) can never go to zero, which would create an unwanted infinity. The Heisenberg uncertainty principle applies when circumstances (specific physical conditions) are experimentally established to unnaturally and thus artificially separate changes in time from three-dimensional space, or vice versa, at discrete points in space, which restricts the uncertainty principle's range of use to the infinitesimally small quantum world and renders it all but useless in the common everyday world of our experiences.

The difficulty in understanding how a point can be discrete (disconnected and indeterministic) quantum upon reduction while it is just another point in a continuous line (0-D point-element), space or manifold, is the real problem for physics and unification. As suggested above, the solution to this problem lies in the fact that the collection of all discrete quantum points that are possible does not represent the relative space of extension, but rather a point-absolute or quantum absolute space of possibilities that reduces to the Riemannian extension or metric-space of relativity when the collapse of the wave function produces a relative reality.



So, technically the uncertainty is in the discrete point itself and thus a defining characteristic of the point-absolute space and not relative to the physically manifested space of reality other than through collapse of the wave function. On the other hand, the Schrödinger wave function is an expression of the quantum in real four-dimensional space-time or three-dimensional space, but it represents what is expected (a statistical expectation) to happen and not the true uncertainty.

The relationship between them is, using the Dirac bracket notation,

$$\Psi(x) = \langle \psi |\ f(x)\ | \psi^* \rangle$$

$$\Psi(x) = \psi^2 f(x).$$

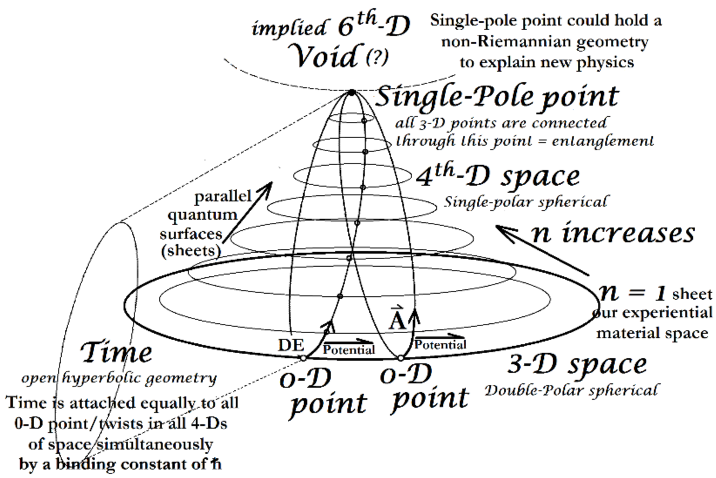
The real uncertainty, ψ, is in the discrete point relative to three-dimensional space, but the imaginary uncertainty, ψ*, is the probable extension of reality into the quantum absolute space through the higher-dimensional embedding space. The split between them is merely the degree and/or a function of how seriously space and time are disregarded relative to each other in the Heisenberg uncertainty principle by experimentalists and interpreters of reality who try to mentally define reality in an unnatural manner in terms of the Heisenberg uncertainty principle.

Unnaturally splitting real space and real time from one another in the Heisenberg uncertainty principle invokes the application of Planck's constant in the scientific interpretation of the experimental results and observations, which means that it makes the most sense for the Planck constant to once again be interpreted as the binding constant for space and time that yields space-time [26]. The quantum theory and relativity theory have now been unified, or at least the fundamental logical basis for their ultimate unification has been laid and this has only been made possible by noting the physical discrepancies that rigorized mathematics and pure mathematical thought has introduced into physics. However, the philosophical re-interpretation of the Heisenberg uncertainty principle does not quantize the continuum, which is necessary for a completely unification of quantum and relativity. That unification must be sought elsewhere.

Quantizing curvature

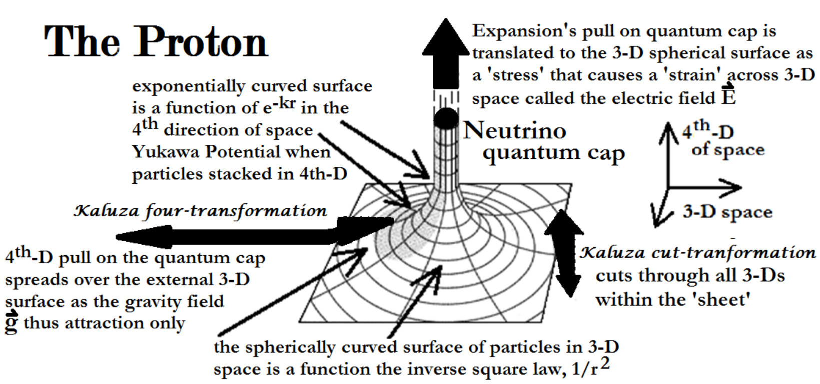
In their 1938 study, Einstein and Bergmann proved that physical laws are the same within all infinitesimally thin parallel three-dimensional surfaces which are stacked like pages in a book in the fourth direction of the five-dimensional space-time continuum. No matter what the four-dimensional distance 'd' between two separate three-dimensional surfaces an infinite number of like surfaces would separate them, yet they would still be governed by the same laws of physics. So, applying Klein's implied suggestion that quantizing the fourth dimension of space would quantize the three-dimensional curved (extrinsic) surface or space means that we merely need to quantize the distance 'd' in the fourth direction of space to quantize the three-dimensional curvature of our commonly perceived four-dimensional space-time world and universe. Given these geometric restrictions and conditions, the Schrödinger wave equation and similar specialized wave equations, such as the Dirac equation, could be interpreted as three-dimensional mathematical expressions that reflect the density and density variations in the four-dimensional single field.

A hypothetical quantum of an infinite number of parallel infinitesimally thin three-dimensional surfaces world form a 'sheaf' or 'sheet' with an 'effective width' equal to 'd' in the direction of the higher embedding dimension and define our quantized world. This quantized 'sheet' would effectively quantize the curvature of the continuum and thus everything within the three-dimensional surfaces that constitute the 'sheet'. Subsequent such 'sheets', stacked one on the other like pages in a book, would represent different quantum energy states within the continuity of the overall four-dimensional unified field. Our own three-dimensional 'sheet' would correspond to the n=1 lowest stable, but extrinsically curved 'sheet' in which we experience our three-dimensional material reality.



All the quantum theory, including the standard model of particles can now be merged with the five-dimensionally extended unified field theory and the n=1 'sheet' can be used to represent the results of, or inwardly contain, the superstrings, branes, quantum loops, supergravity and quantum gravity themselves. This 'quantized curvature' would also define the real material particles, all of which have half-spin due to the 'twist' to the fourth dimension at the single pole: Protons represent the maximum amount of quantized curvature at locations where quantum fluctuations in the rapidly expanding surface blew out to end cosmic inflation, at least until the blowout locations (new protons) were capped by neutrinos; An electron would be the maximum amount of quantized curvature that could occur before blowout where the surface tension of the 'sheet' stopped the blowout, giving the electron an opposite electric charge; And free neutrinos which represent the minimum amount of measurable quantized curvature in the 'sheet'.

Each subsequent three-dimensional surface in the fourth direction of space would have a density half that of the previous surface, so the same would be true for the 'sheets' such that the single field density would go to zero at the single-pole in the fourth dimension of space.



This would guarantee the exponential shape of real extended elementary particles in the fourth direction of space as well as the spherical shape of fundamental particles and nuclei inside the three-dimensional 'sheet.' This shape also allows the stacking of protons and neutrons in the fourth direction of space which corresponds to the shell model of the nucleus while the surface areas of contact between the four-dimensional components (the four-dimensional area of the contact surfaces) would constitute the Yukawa potential. The outward three-dimensional appearance of the four-dimensional stacked protons and neutrons in a nucleus would be perfectly spherical with an even, and even fluidic, mixing of the constituent nucleons. All nucleons would be represented (have an equal presence) equally in the spherical surface of the three-dimensional nucleus, so there would be no need for quantum tunneling to explain various nuclear phenomena.

While the cone shaped metric surface accounts for the Yukawa potential and thus the strong nuclear force, which is just the area of the metric surface of contact between individual nucleons within the nucleus, the individual points in that metric surface form point-to-point contacts of the same stress lines that cause the electric field **E**, which is spatial strain outside of the three-dimensional spherical particle or nucleus. This point-to-point contact along particles surfaces within the nucleus constitutes the electroweak or weak nuclear force inside the nucleus. Therefore, the strong and weak nuclear forces are no more than specialized internal forms of the normally external gravito-gravnetic and electromagnetic fields. This model of the nucleus completely quantizes the curvature of the four-dimensional space-time continuum and a new model of the whole atom, based on the quantized curvature of space-time, can be easily developed [26]. Beyond this, all that is needed is a mathematical accounting for the unification of gravity and electromagnetism, as already suggested, to finish the new unified field theory.

Adapting electromagnetism

To accomplish this is quite simple. Since a discrete geometrical point is equal to a Riemannian 0-D point/twist Void, then Einstein and Bergmann's interpretation of Kaluza's successful five-dimensional unification with electromagnetism can be extended to include a real macroscopically extended five-dimensional space-time whereby our four-dimensional double-polar spherical space-time continuum is embedded in a physically real five-dimensional single-polar spherical Riemannian manifold. So, all that is needed is to reconsider the validity of Kaluza's 1921 theory which was the only unification attempt that successfully combined general relativity and electromagnetism, although with overly restricted geometrical limitations.

Kaluza used the four-transformation and the cut-transformation to derive the gravity and electromagnetic fields, respectively, which gave the correct equations for each. That part of his mathematical model was successful. Kaluza's five-dimensional model was severely criticized because he synthetically, unnaturally and artificially introduced the Faraday tensor for electromagnetism into the five-dimensional model without justifying its use. So, if a justification can be made for introducing the Faraday tensor equation, which is only rank-two, and an explanation of how the cut- and four-transformations work within the context of the single field model (already done above) can be found, then the single field theory will be complete. Under these circumstances, single field theory is mathematically straight forward.

Since the electromagnetic portion, $\mathbf{F}_{5\text{-}D}$, of the single field tensor, $\mathbf{S}_{5\text{-}D}$, in the fourth dimension of space is extensive and represented by the magnetic potential vector, as compared to the gravito-gravnetic portion, $\mathbf{G}_{5\text{-}D}$, which is a point and represented non-extended discrete points in the fourth direction of space, electromagnetism can be represented by a rank-two tensor in three-dimensional space, while gravito-gravnetism must be represented by a rank-three tensor (as it normally is) in three-dimensional space. This is the same as saying that magnetic field **B** is extensive over only the two dimensions 2 and 3 out of 4 while the magnetic vector potential **A** is extensive in dimension 4, with the first dimension of three-dimensional space being a separate vector value **v** or the speed of a charged particle moving through a magnetic field in three-dimensional space. This configuration for the four-dimensional tensor **F** is especially convenient because Maxwell originally represented his electromagnetic theory by quaternions which are four-dimensional vectors (four components) with the first value being a constant scalar and the next three values representing the other three dimensions of space (2, 3 and 4).

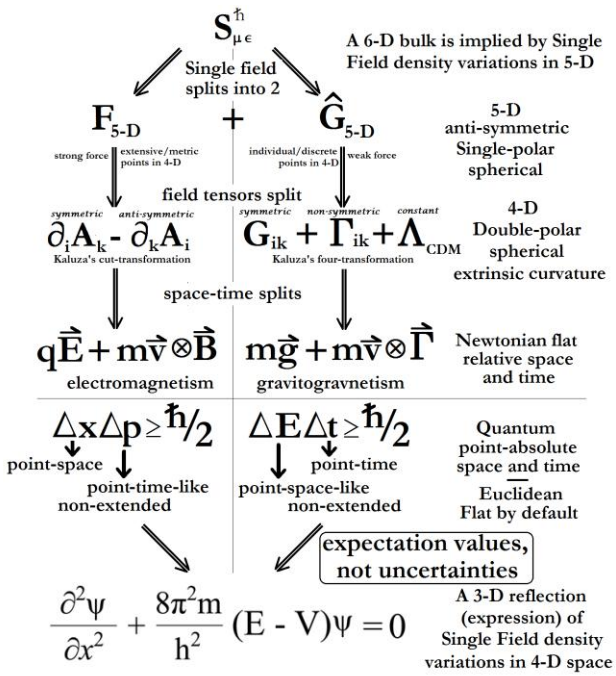
Therefore, only a rank-two tensor such as the Faraday tensor is needed to represent electromagnetism in three-dimensional space and that is just what the single field theory states since the non-symmetric four-dimensional tensor splits into symmetric and anti-symmetric portions when applied to three-dimensional space. The anti-symmetric portion of the electromagnetic tensor in three-dimensional space then breaks down further to give the two-dimensional circular magnetic field **B** around charged objects moving in a third direction and the magnetic vector potential **A** extending into the fourth direction of five-dimensional space-time from discrete geometrical points in the varying magnetic field **B**.

Single Field Theory

Under these physical conditions and restrictions, describing the single field theory is mathematically straight forward. The resulting single field density tensor **S** along the fourth dimension of space manifests in two different ways in five-dimensional space-time by splitting into two parts, representing extension and point, respectively, along the fourth direction of space.

$$\mathbf{S}^{\hbar}{}_{\mu\epsilon} = \mathbf{F}_{5\text{-}D} + \mathbf{G}_{5\text{-}D}$$

The point manifestation is far weaker and becomes the gravito-gravnetic tensor **G** while four-dimensional extension manifests as the much stronger electromagnetic tensor **F**. Each of these splits again into two parts, point and extension, each to be physically interpreted, when reduced to our commonly experienced four-dimensional space-time.



For electromagnetism, the anti-symmetric Faraday tensor emerges, and for gravity the anti-symmetric Schrödinger-Einstein-Cartan tensor emerges, completely describing these two manifestations of the single field as extrinsically curved space-time within a 'sheet' within the context of classical theories that are already well known, tested and adequately expressed in normal physics.

When space and time are split apart to yield classical physics, these emerge as the Lorentz force for electromagnetic and Heaviside force for gravity. The Faraday tensor that currently represents electromagnetism is a primitive rank-two tensor, while the Schrödinger-Einstein anti-symmetric tensor $\mathbf{G}_{5\text{-}D}$ splits into the Einstein non-symmetric tensor (normal metric + dark energy) and a constant equal to $\mathbf{\Lambda}_{CDM}$. Splitting space from time yields Newtonian classical physics in relative extensive space, but also yields the Heisenberg uncertainty principle, if only in the realm of absolute point-space of real discrete quantum points, representing a purely mathematical (and thus an unnatural mental/philosophical rather than true physical) interpretation of physical events at the quantum scale of reality. In other words, measurable extension yields to immeasurable points at the smallest level of reality invoking the possibility of considering immeasurably small variations independent of one another which manifests their (space-time) binding constant ħ into observable and measurable quantities.

In general, a tensor that completely represents surface curvature is placed at a tangent point on a real extrinsically curved three-dimensional surface would have to specify three different quantities associated with the curvature in the surface: (1) The metric change in curvature as the continuous surface draws closer to the point ($\Delta s \rightarrow 0$) and within an infinitesimal distance from the point without actually becoming the point. Einstein's application of the original Riemannian geometry does exactly this, but only this; Otherwise, Riemannian geometry has been (2) expanded to include point-elements. This expansion demonstrates that all points in the three-dimensional surface are connected to each other through the single-pole of a four-dimensional Riemannian spherical manifold (space) in which our three-dimensional double-polar Riemannian surface is embedded. The geometrical characteristics of the surface must be derived at or within the point and that is exactly what the extended Riemannian geometry that includes point-elements accomplishes [26]; And finally, (3) any twist or spin that uses the point as a center of rotation must also be considered. This type of motion relative to individual points in space are exactly what Cartan's anti-symmetric tensor accounts for. In the case of gravity theory, it yields an additive constant for another body in a central gravitational field whose value depends on distance from the central gravitating body.

The gravito-gravnetic field portion of the single field in four-dimensional space is point bound and thus anti-symmetric. Since this tensor is point-scalar in the fourth direction of space, as represented by the gravnetic vector potential (dark matter) points in the three-dimensional metric curved space-time continuum, the configuration of the gravito-gravnetic field is extended in all three-dimensions of three-dimensional space and represented by a symmetric (Einstein's metric gravity field) tensor, non-symmetric tensor (dark energy) and a constant (Λ_{CDM}). So, normal gravity is metric in the normal three dimensions of space and point-scalar in the fourth direction of embedding space, unlike electromagnetism. This means that every particle and object of normal matter is surrounded in all three dimensions of normal space, *i.e.*, spherically, by the Λ_{CDM} component, such as the Dark Matter halos surrounding galaxies. This results in specific predictions concerning dark matter and dark Energy that will allow this model to be tested. The unique three-dimensional characteristics of both electromagnetism and gravito-gravnetism are derived from this split between the fourth and three-dimensional space even though they both emerge from the same single field.

Conclusion

Just as the single field model accounts for the quantum and relativity simultaneously as products of the physical nature of space-time, the Standard Model of particles is completely adapted into the single field model with only a change in the definition of particles. Real material particle must and can only have half-spin to conform to the geometrical requirements of the five-dimensional space-time continuum, while other Standard Model particles (non-half-spin) are either intermediate (between their quantum event creation and decay into real particles) when and if their existence can be verified by experiment, explained by some other means within the context of the single field theory or are just non-existent artifacts of the rigorized mathematics used for calculations in the Standard Model (gravitons, super-symmetric particles) if they cannot be experimentally verified.

Einstein's equivalence principle can now be rewritten in terms of a quantum-ready geometrical point/extension duality: The congregate or collective sum of three-dimensional discrete point extensions (points of inertial mass) in the fourth dimension of space between the overall positive spatial curvature and a particle's extrinsic and thus extensive curvature (gravitational mass) equals the gravitational mass. This means that the mass of anti-particles (the anti-proton) will always be ever so slightly less than the mass of their particle counterparts (the proton) since anti-particles are curved downward on the underside of the positively curved 'sheet'. Moreover, the matter-energy conservation principle would mean that the four-dimensional volume of a particle or material body would remain constant no matter what its rate of relative speed in three-dimensional space or four-dimensional space-time. Therefore, as a particle moves in three dimensions it is Lorentz-Fitzgerald contracted in the direction of motion, but its four-dimensional volume remains constant as its curvature becomes taller and steeper in the fourth direction to compensate for the contraction in normal space.

The pseudo- or intermediate-point particles, with other than half-spins, that are correctly predicted by the Standard Model do not meet the geometric criteria of half-spin in the Riemannian embedding space. They are therefore not real particles except perhaps relative to the quantum point-absolute space of uncertainty because they are unable to form or create metric curvature within the three-dimensional 'sheet' even though they have point-mass inertia which, taken alone, only gives them their non-half spin. They would correspond to single field energy resonance patterns which would be forced to decay to produce half-spin particles with metric curvature or rather real extended particles, with or without kinetic energy, and/or photons.

Photons are always virtual except when being absorbed or emitted by real extended particles or material bodies. They represent the four-dimensional extensions of three-dimensional discrete points that lie along classical Maxwellian electromagnetic wave fronts, *i.e.*, the quantum equivalents of wave-front points in Huygens Principle. Photons have no-spin rather than zero-spin, which is a big technical difference. Since the complete magnetic field is only extensive in three dimensions, 2, 3, and 4, with the magnetic field **B** two-dimensionally extended in normal three-dimensional space and the vector potential **A** extended in the fourth direction of space, spin for the photon and thus the wave-front manifests as wave polarity in three-dimensional space. So, photons do have spin (polarity) in a very special sense, which means they conform to Riemannian geometric criteria for reality, if only virtual, since they cannot form metric curvature and are thus massless but carry energy as real mass-like inertial points.

A single complete model of the atom, consisting of both the nucleus and outer electronic shells, also emerges from the single field theory based solely on the quantized curvature of a space-time 'sheet' of infinitesimally thin parallel three-dimensional surfaces stacked in the fourth direction of space [27]. From this theoretical basis, a complete and comprehensive model of our universe emerges, which even includes physical models of life (the biofield), mind and consciousness [28] as well as a new theoretical model describing the physical evolution of material systems (based on thermodynamical principles) in which biological evolution is just a special case of extremely intricate material complexities [29]. And finally, single field theory renders a complete new model of the 'Big Bang', cosmic inflation and the event ending cosmic inflation (the Big Blowout) that agrees completely with astronomical observations, *i.e.*, it accounts for the missing (never created) anti-particles [30]. In fact, this theory is highly falsifiable in both its various parts as well as a whole, especially with regard to its hyperspatial interpretation and model of Dark Matter and Dark Energy [31].

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