What is Ultimately Possible in Physics? Physics! A Hero's Journey with Galileo, Newton, Faraday, Maxwell, Planck, Einstein, Schrodinger, Bohr, and the Greats towards Moving Dimensions Theory. E pur si muove!

by Dr. Elliot McGucken

ABSTRACT:

Over the past few decades prominent physicists have noted that physics has diverged away from its heroic journey defined by boldly describing, fathoming, and characterizing foundational truths of *physical* reality via simple, elegant, logically-consistent postulates and equations humbling themselves before *empirical* reality. Herein the spirit of physics is again exalted by the heroic words of the Greats—by Galileo, Newton, Faraday, Maxwell, Planck, Einstein, Bohr, and Schrodinger—the Founding Fathers upon whose shoulders physics stands. And from that pinnacle, a novel *physical* theory is proposed, complete with a novel *physical* model celebrating a hitherto unsung universal invariant and an equation reflecting the foundational *physical* reality of a fourth dimension expanding relative to the three spatial dimensions at the rate of *c*, or $dx4/dt=ic$, providing both the "elementary foundations" for relativity and QM's "characteristic trait"—entanglement, and its nonlocal, probabilistic nature. From *MDT*'s experimentally-verified equation relativity is derived while time is unfrozen and free will exalted, while a *physical* model accounting for quantum nonlocality is presented. Entropy, Huygens' Principle; the wave/particle, energy/mass, space/time, and *E/B* dualities; and time and all its arrows and asymmetries emerge from a common, foundational *physical* model. *MDT* exalts Einstein's "empirical facts," "naturalness," and "logical simplicity." For the first time in the history of relativity, change is woven into the fabric of space-time, and the timeless, ageless, nonlocal photon of Galileo's/Einstein's "empirical world" is explained via a foundational *physical* model, alongside the fact that *c* is both constant and the maximum velocity in the universe. The *empirical* GPS clocks' time dilation/twins paradox is resolved by proposing a frame of absolute rest—the three spatial dimensions, and a frame of absolute motion—the fourth expanding dimension upon which *ageless* photons of *zero rest mass* surf; which underlie and give rise to Einstein's *Principle of Relativity*.

When the solution is simple, God is answering.[1] –Einstein

If, relative to K, K' is a uniformly moving co-ordinate system devoid of rotation, then natural phenomena run their course with respect to K' according to exactly the same general laws as with respect to K. This statement is called the principle of relativity.[2] –Einstein, 1954

No great discovery was ever made without a bold guess.[3] –Newton

For an idea that does not at first seem insane, there is no hope.[4] - Einstein

If I have seen further than others, it is by standing upon the shoulders of giants.[5] –Newton

In questions of science, the authority of thousands is not worth the humble reasoning of one individual.[6] –Galileo

Books on physics are full of complicated mathematical formulae. But thought and ideas (the fourth dimension is expanding relative to the three spatial dimensions at *c*), not formulae, are the beginning of every physical theory.[7] —Einstein/Infeld, *The Evolution of Physics*

> But before mankind could be ripe for a science which takes in the whole of reality, a second fundamental truth was needed, which only became common property among philosophers with the advent of Kepler and Galileo. Pure logical thinking cannot yield us any knowledge of the empirical world; all knowledge of reality starts from experience and ends in it. Propositions arrived at by purely logical means are completely empty as regards reality. Because Galileo saw this, and particularly because he drummed it into the scientific world, he is the father of modern physics—indeed, of modern science altogether. - Einstein[8], *Ideas and Opinions*

Epur si muove – (And yet it does move.)[9] –Galileo

.. my dear Kepler, what do you think of the foremost philosophers of this University? In spite of my invitations, they have refused … to look at the planets or Moon or my telescope.[10] –Galileo

A new scientific truth does not triumph by convincing its opponents and making them see the light, but because its opponents eventually die, and a new generation grows up with it.[11] -Planck

…my observations have convinced me that some men, reasoning preposterously, first establish some conclusion in their minds which, either because of its being their own or because of their having received it from some person who has their entire confidence, impresses them so deeply that one finds it impossible ever to get it out of their heads. Such arguments in support of their fixed idea ... gain their instant acceptance … whatever is brought forward against it, however ingenious and conclusive, they receive with disdain or with hot rage.... No good can come of dealing with such people . . . their company may be not only unpleasant but dangerous.[12] –Galileo

Millions saw the apple fall, but Newton was the one who asked why.[13] –Baruch

What is Possible in Physics? Physics! Moving Dimensions Theory

We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.[14] –Newton

Everything should be made as simple as possible, but not simpler.[15] –Einstein

A physical theory can be satisfactory only if its structures are composed of elementary foundations. The theory of relativity is ultimately as little satisfactory as, for example, classical thermodynamics was before Boltzmann had interpreted the entropy as probability.[16] –Einstein

When two systems, of which we know the states by their respective representatives, enter into temporary physical interaction due to known forces between them, and when after a time of mutual influence the systems separate again, then they can no longer be described in the same way as before, viz. by endowing each of them with a representative of its own. I would not call that one but rather the characteristic trait of quantum mechanics, the one that enforces its entire departure from classical lines of thought. By the interaction the two representatives [the quantum states] have become entangled.[17] -Schrodinger

MDT provides both the "*elementary foundations*" of relativity that Einstein yet sought, and the foundational *physical* reality underlying and causing quantum nonlocality and entanglement, which Schrodinger labeled the "*characteristic trait"* of QM. Einstein's *Principle of Relativity*, as well as his two postulates, derive from MDT's simple *physical* model (Fig. 1) and single postulate which is more concise and has the added benefits of providing for free will, liberating us from the block universe, weaving change into the fundamental fabric of space-time for the first time in the history of relativity, and providing an elementary, foundational *physical* model for time and all its arrows and asymmetries, entropy, and QM's nonlocality and entanglement, as well as reality's probabilistic nature. The fourth dimension is inherently nonlocal via its invariant expansion, which is the *source* of nonlocality as well as relativity. All of this is more fully developed in Dr. E's 2008 paper on *MDT* which examines Einstein's *1912 Manuscript on Relativity*[18] and derives relativity from *MDT*'s *dx4/dt=ic*: *Time as an Emergent Phenomenom*: *fqxi.org/community/forum/topic/238*.

Simple, logical proofs of *MDT*:

MDT PROOF#1: Relativity tells us that a timeless, ageless photon remains in one place in the fourth dimension. Quantum mechanics tells us that a photon propagates as a spherically-

symmetric expanding wavefront at the velocity of c. Ergo, the fourth dimension must be expanding relative to the three spatial dimensions at the rate of c, in a spherically-symmetric manner. The expansion of the fourth dimension is the source of nonlocality, entanglement, time and all its arrows and asymmetries, *c*, relativity, entropy, free will, and all motion, change, and measurement, for no measurement can be made without change. For the first time in the history of relativity, change has been wedded to the fundamental fabric of spacetime in MDT.

MDT PROOF#2: Einstein (*1912 Man. on Rel.)* and Minkowski wrote *x4=ict*. Ergo *dx4/dt=ic*.

MDT PROOF#3: The only way to stay stationary in the three spatial dimensions is to move at c through the fourth dimension. The only way to stay stationary in the fourth dimension is to move at c through the three spatial dimensions. Ergo the fourth dimension is moving at c relative to the three spatial dimensions.

MDT twitter proof (limited to 140 characters): SR: photon is stationary in 4th dimension. QM: photon is probability wave expanding @ *c*. Ergo: 4th dimension expands @ *c* & MDT: *dx4/dt=ic* –from http://twitter.com/45surf

> A people that were to honor falsehood, defamation, fraud, and murder would be unable, indeed, to subsist for very long.[19] –Einstein

MDT Sides With the Simplicity of the Heroic Greats in Word, Equation, and Deed

MDT presents a new universal invariant reflecting a foundational physical reality of a fourth expanding dimension—an elementary law from which Einstein's *Principle of Relativity* can be built by pure deduction. Begin with a universe with four dimensions *x1, x2, x3, x4* where the fourth dimension is expanding relative to the three spatial dimensions at the rate of *c*, *dx4/dt=ic*, and all of relativity is shown to naturally emerge in Dr. E's above paper, as does quantum mechanics' nonlocality and entanglement, wave-particle duality, space-time duality, mass-energy duality, entropy, and time and all its arrows and asymmetries.

> Behind it all is surely an idea so simple, so beautiful, that when we grasp it - in a decade, a century, or a millennium—we will all say to each other, how could it have been otherwise? How could we have been so stupid?[20] –Wheeler

> Three Rules of Work: Out of clutter find simplicity; From discord find harmony; In the middle of difficulty lies opportunity.[21] –Einstein

MDT presents a physical principle more fundamental than Einstein's *Principle of Relativity*, as all of relativity naturally emerges from *MDT*'s postulate, along with time and all its arrows. And too, *MDT*, via the natural smearing of locality into nonlocality heralded via the expansion of the fourth dimension, provides a *physical* model for quantum entanglement—that which Schrodinger stated was the "characteristic trait" of quantum mechanics. So it is that *MDT* provides a common, foundational *physical* model for quantum mechanics and relativity, thusly unifying them on a *physical* level. *MDT* rides with the simplicity of the heroic Greats in word, equation, and deed:

> Any intelligent fool can make things bigger, more complex, and more violent. It takes a touch of genius—and a lot of courage—to move in the opposite direction.[22] –Einstein

> Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the

> process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds.[23] –Maxwell

> I don't believe in mathematics.[24] –Einstein

> Do not worry about your difficulties in mathematics, I assure you that mine are greater.[25] –Einstein

> Geometry is not true, it is advantageous.[26] –Poincare

In *Einstein's Mistakes*, Ohanian reports on how physics advances via the emphasis not on math, but on *physical* reality.[27] *MDT* exalts nature and the physical reality of a timeless, ageless photon, providing a simple, unifying *physical* model for entropy, statistical mechanics, relativity, and quantum mechanics.

> A good decision is based on knowledge and not on numbers.[28] –Plato

> Not everything that counts can be counted, and not everything that can be counted counts.[29] –Einstein

> Mathematics are well and good but nature keeps dragging us around by the nose.[30] –Einstein

In *Disturbing the Universe*, Freeman Dyson writes, "The great discoveries of Einstein's earlier years were all based on direct *physical* intuition. Einstein's later unified theories failed because they were only sets of equations without *physical* meaning. Dick's sum-over-histories theory was in the spirit of the young Einstein, not of the old Einstein. It was solidly rooted in physical reality."[31] In *The Trouble With Physics*, Lee Smolin writes that Bohr was not a Feynman "shut up and calculate" physicist, and from the above Dyson quote, it appears that Feynman wasn't either. Lee writes, "Mara Beller, a historian who has studied his [Bohr's] work in detail, points out that there was not a single calculation in his research notebooks, which were all verbal arguments and pictures."[32]

In his office Einstein had framed copies of portraits of , *Faraday, and Maxwell*. In *Einstein*, Hoffman exalts *physical reality* over mere math:

> Meanwhile, however, the English experimenter Michael Farady was making outstanding experimental discoveries in electricity and magnetism. ... lacking mathematical facility, he could not interpret his results in the manner of Ampere. And this was fortunate, since it led to a revolution in science. . . most physicists adept at mathematics thought his concepts mathematically naïve.[33]

MDT Asks: Why Relativity, Entanglement, Entropy, Nonlocality, and Time?

> The important thing is not to stop questioning.[34] –Einstein

It is interesting that Einstein introduced relativity as a principle—as a primary law not deduced from anything else. Millions have seen Einstein's relativity born out via experiment, but it was I who asked, "*why* relativity?" And I found the answer in a more fundamental invariance—the fourth dimension is expanding relative to the three spatial dimensions, or $dx4/dt = ic$. Change is fundamentally embedded in space-time. And not only can all of relativity be derived from this, but suddenly we have a *physical* model for entropy, time and its arrows and asymmetries in all realms, free will, and quantum nonlocality

and entanglement. MDT accounts for the constant speed of light *c*—both its independence of the source and its independence of the velocity of the observer, while establishing it as the fastest, slowest, and *only* velocity for all entities and objects moving through space-time, as well as the maximum velocity that anything is measured to move. And suddenly we see a *physical* basis for $E=mc^2$. Energy and mass are the same thing—it's just that energy is mass caught upon the fourth expanding dimension, and thus it surfs along at *c*.

In *Einstein's Mistakes,* Ohanian writes, "Einstein's own formulation of the Principle of Relativity three hundred years later imitated Galileo's in treating this principle as a law of nature and not as a mathematical deduction from anything else." [35]

Einstein's Principle of Relativity Derived from MDT: MDT's Diverse Successes

Well, MDT provides a more fundamental law with an equation: $dx4/dt = ic$, from which relativity is derived in Dr. E's above paper. An added benefit are all the other entities $dx4/dt=ic$ accounts for with a *physical* model, ranging from entropy, to QM's entanglement and nonlocality, to time and all its arrows. MDT accomplishes a diverse array of *physical* feats:

- ∗provides the "elementary foundations" for Einstein's relativity and Schrodinger's "characteristic trait" of QM—entanglement.
- ∗unfreezes time & liberates us from the block universe, allowing for and exalting free will
- ∗weaves change into the fundamental fabric of space-time for the first time in the history of relativity
- ∗derives relativity from a more fundamental universal invariant: $dx4/dt=ic$
- ∗provides a physical model for entropy
- ∗provides a physical model for quantum entanglement (QM's characteristic trait)
- ∗provides a physical mechanism for nonlocality—the fourth expanding dimension distributes locality
- ∗provides a physical model unifying the dualities—space/time, energy/mass, wave/particle, E/B
- ∗provides a physical model for the invariance of c—both its independence of the source and its independence of the observer
- ∗provides a physical model for the spherically-symmetric expanding wave-front of probability that defines a photon's path
- ∗offers a resolution for both the EPR Paradox and Godel's problems with the block universe relativity implied
- ∗offers a physical model for why nothing can move faster than c.
- ∗offers an intuitive model for the length-contraction can accompanies all motion
- ∗accounts for both the agelessness (from relativity—nonlocality in time) and the nonlocality (from QM) of the photon
- ∗accounts for the gravitational slowing of time and light, as well as the gravitational redshift
- ∗provides a unique physical model underlying wide-ranging phenomena in quantum mechanics, relativity, and statistical mechanics.
- *provides a physical model for time and all its arrows and asymmetries

MDT & Nobel Laureate Physicists vs. String Theory/LQG

MDT was inspired in part by Einstein's words pertaining to the higher purpose of physical theories:

> Before I enter upon a critique of mechanics as a foundation of physics, something of a broadly general nature will first have to be said concerning the points of view according to which it is possible to criticize physical theories at all. The first point of view is obvious: The theory must not contradict empirical facts. . . The second point of view is not concerned with the relation to the

> material of observation but with the premises of the theory itself, with what may briefly but vaguely be characterized as the "naturalness" or "logical simplicity" of the premises (of the basic concepts and of the relations between these which are taken as a basis). This point of view, an exact formulation of which meets with great difficulties, has played an important role in the selection and evaluation of theories since time immemorial.[36] –Einstein

Contrast MDT's elegant, unifying successes with String Theory's "not even wrongishness." The first page of *String Theory in a Nutshell* states in a footnoted sentence:

> String Theory … gained popularity because it provides a theory that is UV finite.(1) . . . The footnote (1) reads: "Although there is no rigorous proof to all orders that the theory is UV finite..."[37]

So you see, string theory is not a finite theory, but this is generally kept to the footnotes, when mentioned at all. Many Nobel Laureate physicists harbor reservations regarding strings:

> We don't know what we are talking about[38]. --David Gross

> It is anomalous to replace the four-dimensional continuum by a five-dimensional one and then subsequently to tie up artificially one of those five dimensions in order to account for the fact that it does not manifest itself. -Einstein to Ehrenfest (Imagine doing this for 10-30+ dimensions!)

> String theorists don't make predictions, they make excuses[39]. – Feynman

> String theory is like a 50 year old woman wearing too much lipstick.[40] - Laughlin, Nobel Laureate

> Actually, I would not even be prepared to call string theory a "theory" rather a "model" or not even that: just a hunch.[41] –'t Hooft

> It is tragic, but now, we have the string theorists, thousands of them, that also dream of explaining all the features of nature. . .when one person spends 30 years, it's a waste, but when thousands waste 20 years in modern day, they celebrate with champagne.[42] -Glashow

> I don't like that they're not calculating anything. I don't like that they don't check their ideas. I don't like that for anything that disagrees with an experiment, they cook up an explanation-a fix… It doesn't look right.[43] -Feynman

> superstring physicists … cannot demonstrate that the standard theory is a logical outcome of string theory. …they have not yet made even one teeny-tiny experimental prediction. ..superstring theory does not follow as a logical consequence of some appealing set of hypotheses about nature.[44] — Glashow

> The great irony of string theory, however, is that the theory itself is not unified.… !![45] *Introduction to Superstrings & M-Theory* –Kaku

> If Einstein were alive today, he would be horrified at this state of affairs... The unsubstantiated belief of our day is relativity itself. It would be perfectly in character for him … conclude that his beloved principle of relativity was not fundamental at all but emergent (emergent from MDT!) [46] - *A Different Universe*, Laughlin

MDT and Socrates' & Feynman's Honorable Pursuit of Truth

MDT delivers an ultimate theory underlying Huygens' Principle which Feynman's many-paths formulation of QM also exalts, whereas Loop Quantum Gravity and String Theory only sustain a myth of an ultimate theory. Feynman echoes the words of the heroic Achilles (whom Socrates referenced in the *Apology*[47]) in defining science as an *honest, honorable* pursuit: "As I detest the doorways of death, so too do I detest that man who speaks forth one thing while hiding in his heart another."[48]

> The first principle is that you must not fool yourself—and you are the easiest person to fool. … You just have to be honest. . . you should explain to the layman what you're doing—and if they don't want to support you under those circumstances, then that's their decision. [49] –Feynman, *Cargo Cult Science*

> To me there has never been a higher source of earthly *honor* or distinction than that connected with advances in science.[50] –Newton

> Errors are not in the art but in the artificers.[51] –Newton

MDT and the GPS Clocks/Twins Paradox

> My solution was really for the very concept of time, that is, that time is not absolutely defined but there is an inseparable connection between time and the signal [light] velocity.[52] –Einstein

Anyone who uses or benefits from GPS readily admits the glaring asymmetry in the twins paradox, and thus that there must be a frame of absolute rest and a frame of absolute motion. Now Einstein's *Principle of Relativity* is also absolutely true, as due to MDT's *dx4/dt=ic*'s inextricable linking of light, time, change, and dimension in all acts of measurements, it is impossible to conduct experiments allowing one to fathom relative motion in the confines of an inertial frame. But the empirical fact that the GPS clocks on the orbiting satellites must be adjusted for relativistic time dilation, testify to the fact that their frame of reference is fundamentally different from the earthbound clocks'. MDT accounts for this asymmetry in the twin paradox/GPS, while also fully supporting the mathematics of Einstein's relativity and *Principle of Relativity*, which is derived from *dx4/dt=ic* in Dr. E's *Time as an Emergent Phenomena*. MDT proposes a frame of absolute motion—the fourth expanding dimension which photons surf, supported by the *empirical* facts that 1) a photon is in a state of absolute motion, having no rest mass; and 2) a timeless, ageless, nonlocal photon remains in one place in the fourth dimension, whose expansion is the source of nonlocality.

Experimental Proofs of MDT

In addition to the GPS asymmetry which proves MDT, let us study the fourth dimension via experiment in earthbound labs. A photon, which is known to stay stationary in the fourth dimension, provides the ideal *physical* entity and tool to probe and characterize the fourth dimension on a physical level, so let us study a photon as it is emitted from a source. Via numerous experiments ranging from double-slit interference experiments to those demonstrating nonlocal entanglement, the photon, in its simplest, most natural form, exists as a nonlocal, spherically-symmetric, probabilistic wave-front expanding at *c*. As relativity tells us that the timeless, ageless, nonlocal photon remains in one place in the fourth dimension, we can deduce that the fourth dimension must be a spherically-symmetric expanding wavefront of locality, supported directly by experimental evidence and observation, thusly proving MDT's postulate of a fourth expanding dimension and equation *dx4/dt=ic*.

I think that in the discussion of natural problems we ought to begin not with the Scriptures, but with experiments, and demonstrations[53]. –Galileo

By denying scientific principles, one may maintain any paradox[54]. –Galileo

A man may imagine things that are false, but he can only understand things that are true, for if the things be false, the apprehension of them is not understanding[55]. –Isaac Newton

Conclusion

What is ultimately possible in physics? Physics! MDT & $dx4/dt=ic$!

Gradually the conviction gained recognition that all knowledge about things is exclusively a working-over of the raw material furnished by the senses. ... Galileo and Hume first upheld this principle with full clarity and decisiveness[56]. -Einstein

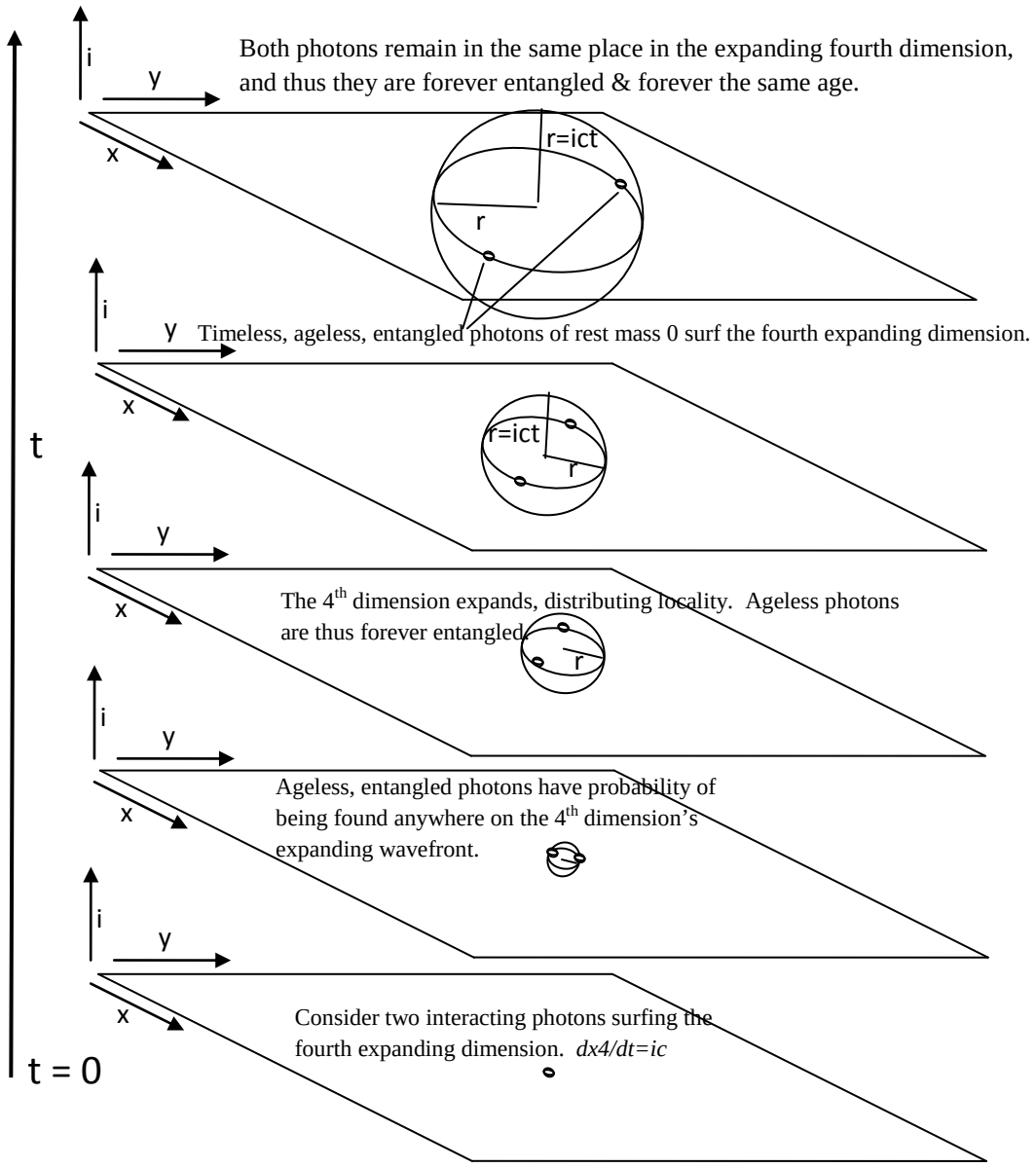

Fig. 1: MDT'S concrete *physical* mechanism for Einstein's *Principle of Relativity*, nonlocality, entanglement, QM's probabilistic, nonlocal character, time's radiative arrow and asymmetry, *Huygens' Principle*, pilot waves, entropy, the constancy of *c*, the independence of *c* from the source, and the timeless, ageless photon: *dx4/dt=ic*. As photons remain in the same place (agelessness/entanglement) in the fourth dimension which expands in a spherically symmetric manner, radiation appears as expanding (never shrinking) probabilistic spherically-symmetric wavefronts (time's radiative arrow). Entangled photons have a higher chance of being found further apart over time (entropy).

Many more MDT figures and text were edited out due to length limitations.

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