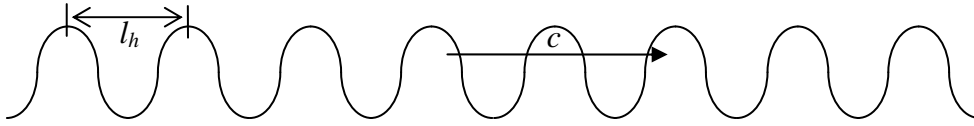
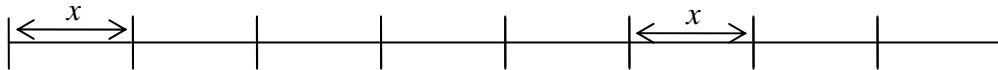


**MOVING DIMENSIONS THEORY EXAMINES THE GRAVITATIONAL REDSHIFT, LIGHT CLOCKS, AND WHY GRAVITY IS NOT QUANTIZED:
ALL HAIL THE UNIVERSE'S FUNDAMENTAL INVARIANT: $dx_4/dt = ic$**

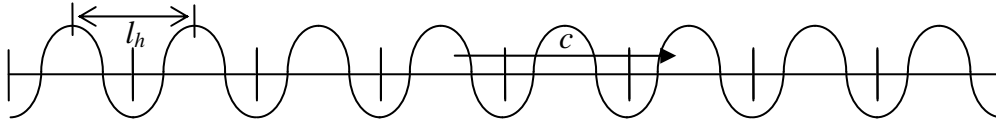
by Dr. Elliot McGucken
drelliot@gmail.com



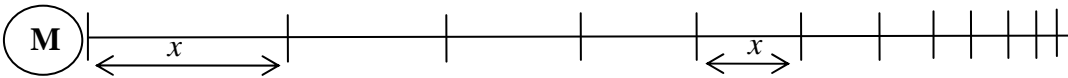
The universe's fundamental invariant is this: the fourth dimension is expanding at the rate of c . This expansion manifests itself as a spherically-symmetric expanding wave-front in 3D with a wavelength of Planck's length l_h . All quantization derives from this expansion of the fourth dimension given by $dx_4/dt=ic$. There is no need to quantize gravity and space is continuous.



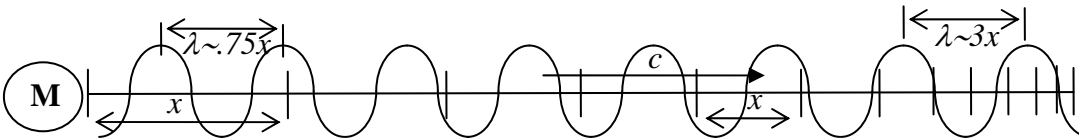
Let us consider a region of flat space.



And let us superimpose the fourth expanding dimension. Any photon (matter propagating by surfing the fourth expanding dimension) will have a velocity of c , and its wavelength will remain constant over the flat space.



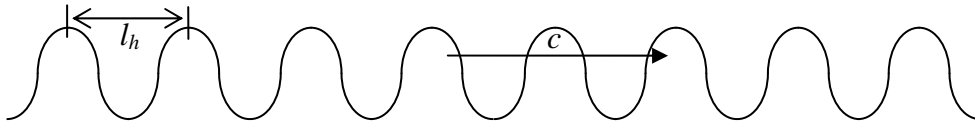
Now let us introduce a mass M of a star into our system of formerly flat space. It will stretch and curve the space as shown above. Now suppose our star emits a photon into the fourth expanding dimension.



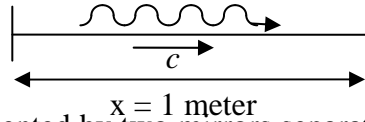
Where the photon is emitted from the star, its wavelength is about $.75x$. After it has traveled away from the star on the right, its wavelength is about $3x$. Hence MDT accounts for the gravitational redshift for photons traveling away from stars, as space is curved, while the expansion of the fourth dimension remains an invariant!

And MDT accomplishes this with its simple postulate and equation, recognizing a hitherto unsung *physical* reality—the fourth dimension is expanding relative to the three spatial dimensions in units of the Planck length! Time has been unfrozen! We have been liberated from the block universe! Entropy, quantum mechanics' nonlocality and entanglement, relativity, and the gravitational redshift, along with time and all its arrows and asymmetries, have been unified with a simple postulate and equation! And yet it—progress in physics—moves!

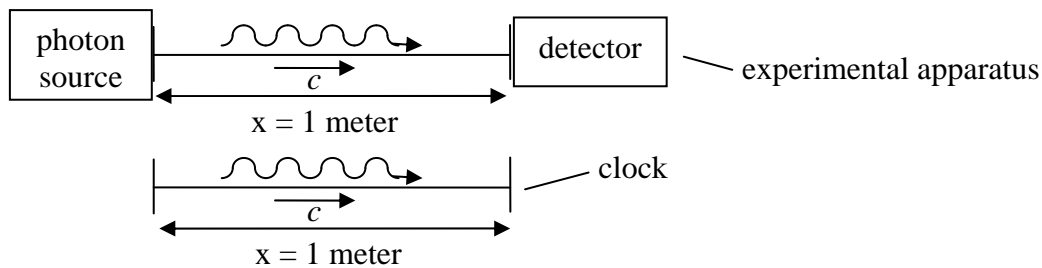
MDT, Clocks, Light, Time, and a Thought Experiment



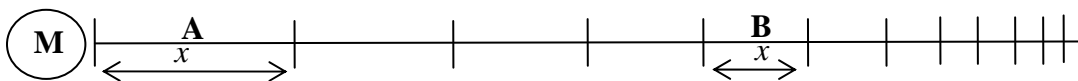
The universe's fundamental invariant is this: the fourth dimension is expanding at the rate of c relative to the three spatial dimensions. This expansion manifests itself as a spherically-symmetric expanding wavefront in our 3D with a wavelength of Planck's length, exactly as every ageless photon, which maintains the same locality in the fourth expanding dimension, suggests.



Consider a light clock represented by two mirrors separated by one meter. A photon bounces back and fourth between the mirrors. A photon travels at 3.0×10^8 m/s, so each time a photon hits a mirror, $.333 \times 10^{-8}$ s have elapsed. Suppose we want to measure the velocity of light with this light clock. We set up an experimental apparatus as pictured below, with a photon source and a photon detector separated by one meter. This tautological definition of time and the velocity of light, which rests upon MDT's fundamental invariant of $dx_4/dt=ic$ is what ensures that c is always c . MDT's invariance underlies Einstein's observation, "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."

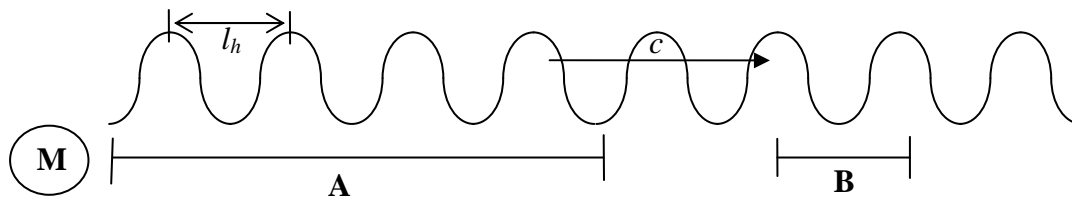


Judging by our light clock, we find that the time taken for the photon to travel one meter, from the source to the detector, is $.333 \times 10^{-8}$ s. Now, let us place our apparatus at two different regions, **A** and **B**, where x represents one meter.



In both regions **A** & **B**, judging by the above "light" clock in each region, we find that the time taken for the photon to travel one meter, from the source to the detector, is $.333 \times 10^{-8}$ s in both regions. In both regions **A** & **B**, the velocity of light is c . In both regions **A** & **B**, the distance x is one meter. But there is a fundamental difference in regions **A** & **B**, that arises because of the universe's fundamental invariant—the fourth dimension is expanding relative to the three spatial dimensions. Even though space is curved in regions **A** and **B** by the massive object **M**, the rate of the expansion of the fourth dimension through both regions is constant— $dx_4/dt=ic$. And so it is that a clock will run slower in region **A** than in region **B**.

A Thought Experiment, PART II, MDT, Light Clocks, The Gravitational Redshift: Time is Curved because Although Space is Curved, the Expansion of The Fourth Dimension is Invariant



Now let us superimpose the universe's invariant—the fourth expanding dimension—over the regions **A** & **B** which represent space curved by the mass **M**. Recall that the fourth expanding dimension carries all photons. Thus the light clock in region **A**, discussed in the above experiment, will tick about 4 times every time the clock in region **B** ticks once. This is because the fourth expanding dimension has to travel four fundamental wavelengths in region **A**, while only a single one in region **B**. Thus, if the two clocks from **A** and **B** are reunited, all observers will agree that clock **A** registered less time, and thus that stronger gravitational fields slow time. Both **A** and **B** represent lengths of one meter, and the mass **M** stretches the space in region **A**. Note also that a wave with a certain frequency in **A**—one that oscillates four times as it traverses the distance, will only oscillate once while traversing the distance in **B**. Both distance are one meter, and thus the frequency of the wave is higher in **A** and lower in **B**, while the wavelength is lower in **A** and longer in **B**, just as the gravitational redshift supposes.

This simple thought experiment brings to light several remarkable features of MDT. MDT explains why clocks run slower in stronger gravitational fields where space is stretched. It shows that time, as measured on a clock, is also stretched. But even though time and space are stretched, the expansion of the fourth dimension remains a constant: $dx_4/dt = ic$. And too, it shows that space is continuous, and all quantization arises from the quantized expansion of the fourth dimension relative to the three spatial dimensions, or $dx_4/dt = ic$.

So it is that the invariance of the expanding fourth dimension, when superimposed on space stretched by a mass, results in clocks ticking more slowly in stronger gravitational fields.

By now it should be seen that the velocity of light is always measured to be constant because the velocity of light is always measured relative to a clock whose timekeeping is based on distance and the propagation of light. It is the actual expansion of the fourth dimension relative to the three spatial dimensions that is the true invariant; and generally, for all intents and purposes, this can be seen as the velocity of light, as photons surf the fourth expanding dimension. However, MDT is novel in that it shows time's curvature—the slower ticking of a clock in a stronger gravitation field, arises from the invariance of the expansion of the fourth dimension superimposed over the three stationary spatial dimensions. Yes—time's curvature arises from the fundamental invariance in change— $dx_4/dt=ic$ —superimposed over continuous space that can stretch.

Furthermore, also note that Planck's length never changes. While space is curved in regions **A & B**, Planck's length l_h remains the exact same. Planck's length is defined by the fundamental motion of the universe—the fourth dimension is expanding relative to the three spatial dimensions in units of the Planck length at the rate of c .

Planck's length and the rate of c may change over large periods of time, which could account for dark matter, dark energy, and an accelerating universe, and differences in the universe's rate of expansion over time.

WHY GRAVITY IS NOT QUANTIZED, WHILE E&M IS, PART II

Gravity is not quantized as there is nothing to quantize. In the above thought experiments, a photon traveling away the massive star experienced a gravitational redshift—it lost energy. In losing energy, no energy was emitted in the form of photons nor mass nor matter nor any other form. The photon lost energy because it surfs the expanding fourth dimension, preserving its original length in the fourth dimension where it was emitted, while entering space that is not quite as stretched—hence its wavelength becomes longer. *But this loss of energy was accompanied by no physical emission of photons nor matter*, nor any entity that can be quantized. Hence gravity does not rely on the emission and propagation of physical entities to transmit forces, nor alter energies, and it cannot be quantized, as both empirical evidence and hundreds of millions of funding have demonstrated over the past thirty-odd years.

Likewise, a photon heading towards a star is blue-shifted. *No physical matter nor photons are added*, but rather, the underlying curvature of space results in the photon gaining energy.

So it is that in altering the energy of objects, *gravity neither adds nor extracts physical entities*, including matter nor photons nor gravitons.

Contrast gravity to E&M. In order to accelerate an electron via an electromagnetic wave, we must add photons to it. Physical entities—photons—must be added to a charge in order to accelerate it; and too, a decelerating electron emits photons as it slows down. And these are of course quantized because the fourth expanding dimension, which carries photons, is quantized in its expansion.

So it is that forces in electricity and magnetism *require the exchange of physical entities*, whereas gravitational forces arise entirely because of the invariant expansion of the fourth dimensions superimposed over the curvature of space, which is continuous. Photons, are but matter surfing the fourth expanding dimension, and thus, like the fourth expanding dimension, they are quantized proportional to the Planck length. The fourth dimension continually takes a local point and distributes it nonlocally; and so it is that physical entities such as photons and electrons have nonlocal properties (wavelike), as well as local properties (particulate).

But the gravitational field does not need particles to transmit energy to photons nor any other entity, as we have seen. Gravitational forces rely entirely on the curvature of space relative to the invariance of the fourth expanding dimension. Because gravity does not need particulate nor physical entities to transmit energy, there is nothing to quantize.

So it is that MDT explains both gravitational forces and QED; while showing that they both derive from a deeper physical reality—a hitherto unsung **physical** invariant—the expansion of the fourth dimension relative to the three spatial dimensions—that unifies phenomena in quantum mechanics, relativity, and statistical mechanics, while accounting

for time and all its arrows and asymmetries, while not requiring the quantization of gravity.

MDT offers a most powerful, simple unifying theory. Expect the Inquisition!

See <http://fqxi.org/community/forum/topic/238> for more.

**Time as an Emergent Phenomenon: Traveling Back to the Heroic Age of Physics
In Memory of John Archibald Wheeler
by Dr. Elliot McGucken**

ABSTRACT

In his *1912 Manuscript on Relativity*, Einstein never stated that time is the fourth dimension, but rather he wrote $x_4 = ict$. The fourth dimension is not time, but *ict*. Despite this, prominent physicists have oft equated time and the fourth dimension, leading to un-resolvable paradoxes and confusion regarding time's physical nature, as physicists mistakenly projected properties of the three spatial dimensions onto a time dimension, resulting in curious concepts including frozen time and block universes in which the past and future are omni-present, thusly denying free will, while implying the possibility of time travel into the past, which visitors from the future have yet to verify. Beginning with the postulate that time is an emergent phenomenon resulting from a fourth dimension expanding relative to the three spatial dimensions at the rate of c , diverse phenomena from relativity, quantum mechanics, and statistical mechanics are accounted for. Time dilation, the equivalence of mass and energy, quantum entanglement, nonlocality, wave-particle duality, and entropy are shown to arise from a common, deeper *physical* reality expressed with $dx_4/dt=ic$. This postulate and equation, from which Einstein's relativity is derived, presents a fundamental model accounting for the emergence of time, the constant velocity of light, the fact that the maximum velocity is c , and the fact that c is independent of the velocity of the source, as photons are but matter surfing a fourth expanding dimension. In general relativity, Einstein showed that the dimensions themselves could bend, curve, and move. The present theory extends this principle, postulating that the fourth dimension is moving independently of the three spatial dimensions, distributing locality and fathering time. This *physical* model underlies and accounts for time in quantum mechanics, relativity, and statistical mechanics, as well as entropy, the universe's expansion, and time's arrows and asymmetries in all arenas.

"More intellectual curiosity, versatility and yen for physics than Elliot McGucken's I have never seen in any senior or graduate student. . . Originality, powerful motivation, and a can-do spirit make me think that McGucken is a top bet for graduate school in physics. . . I say this on the basis of close contacts with him over the past year and a half. . . I gave him as an independent task to figure out the time factor in the standard Schwarzschild expression around a spherically-symmetric center of attraction. I gave him the proofs of my new general-audience, calculus-free book on general relativity, *A Journey Into Gravity and Space Time*. There the space part of the Schwarzschild geometric is worked out by purely geometric methods. "Can you, by poor-man's reasoning, derive what I never have, the time part?" He could and did, and wrote it all up in a beautifully clear account. . . his second junior paper . . . entitled *Within a Context*, was done with another advisor, and dealt with an entirely different part of physics, the Einstein-Rosen-Podolsky experiment and delayed choice experiments in general. . . this paper was so outstanding. . . I am absolutely delighted that this semester McGucken is doing a project with the cyclotron group on time reversal asymmetry. Electronics, machine-shop work and making equipment function are things in which he now revels. But he revels in Shakespeare, too. Acting the part of Prospero in the *Tempest*. . ." --John Archibald Wheeler, Princeton University, Recommendation for Elliot McGucken for Admission to Graduate School of Physics

Dr. Elliot McGucken's Biography: "Dr. E" received a B.A. in physics from Princeton University and a Ph.D. in physics from UNC Chapel Hill, where his research on an artificial retina, which is now helping the blind see, appeared in *Business Week* and *Popular Science* and was awarded a Merrill Lynch Innovations Grant. While at Princeton, McGucken worked on projects concerning quantum mechanics and general relativity with the late John A. Wheeler, and the projects combined to form an appendix treating time as an emergent phenomenon in his dissertation. McGucken is writing a book for the Artistic Entrepreneurship & Technology (artsentrepreneurship.com) curriculum he created.

"The most beautiful thing we can experience is the mysterious. It is the source of all true art and all science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead: his eyes are closed." -- Albert Einstein

Yes--entanglement, entropy, time, nonlocality, Huygens' Principle, relativity--how mysterious are all these! And yet if you ask foundational questions such as *why* entanglement, *why* entropy, *why* time, *why* nonlocality, *why* Huygens' Principle, *why* relativity, the richest, wealthiest establishment in the history of physics, which also happens to be the establishment which has contributed the least (perhaps money cannot buy physics and philosophy?), sends forth anonymous postdocs and grad students to launch the snarky, ad-hominem attacks they perfect under the guidance of their pseudo-physicist political mentors.

But hey--everyone's got to make a living.

Behold MDT--the great unifier and invariant source underlying all these *physical* phenomena--in relativity and quantum mechanics--in statistical mechanics and entropy.

For the first time in the history of relativity, *change* has been *physically* woven into the fundamental fabric of spacetime, with $dx/dt = ic$. And that's where change needs to be! For can you name any branch of physics in which change, and time, do not exist? Without change, no measurement can be made.

MDT is unique in that it offers a *physical* model underlying entropy, entanglement, and nonlocality, and too, all of relativity can be immediately derived from its simple postulate and equation.

I expect MDT to bring additional boons for years to come!