A Practical Perspective. It's about time.

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Abstract

Physics, to some, is the study of motion. To others, it is about the underlying essence of reality. But to many practical minded (and some outraged) scientists, contemporary theoretical physics has become an uncontrolled haven for speculative theorizing giving rise to *fairytale physics*. It seems to have "crossed an important threshold of a kind that cannot be tested, that cannot be verified or falsified, a kind that is not subject to the mercilessness of the scientific method. The discipline has retreated into its own small, self-referential world. Its product is traded by its advocates as mainstream science within the scientific community, and peddled (or even missold) as such to the wider public." (Baggott, 2013)

The purpose of this essay is to present a practical perspective of what is meant by "time"– a perspective that opens a window to a better understanding of that "weird" world of quantum mechanics. The error of treating time as a real, absolute, independent, one-dimensional entity (that was created along with the rest of the universe in the big bang) is the source of the unanswerable question, "what happened before the beginning of time". In this paper, by treating time as a measure of motion, quantum theory and relativity theory are integrated into a single model that makes practical sense of the particle-wave duality, the transformation of future into past, hidden variables, the constant that is perceived to be the speed of light, and the Schrodinger wave equation. Finally, it provides a practical basis for studying the holographic nature of physical reality and the field of consciousness.

Introduction

Most of the people I know, who received their degree in physics, are practical people. They are not the stereotype geeks who seem to have a superhuman understanding of the universe. They are certainly smart people, but they spent their time working in applied fields, finding real solutions to real problems. And they don't spend much time, if any at all, thinking about things like black holes or worm holes, the origin of the universe, the many dimensions of String Theory or even the nature of time.

I applied my undergraduate physics degree in nuclear propulsion in the US Navy and then in civilian nuclear power generation. Later I got an MS in physics and a doctorate in Nuclear and Radiological Engineering, which I applied in clinic as a Medical Physicist before I retired in 2014. But I often thought about what brought me to study physics in the first place – a desire to understand the underlying essence of reality. And working in the Oncology clinic with terminally ill patients who are quickly running out of time, who really care about Truth in a way that most of us won't understand until our time comes, has made me feel obligated to find a more profound understanding of the nature of time.

So I read numerous books and articles over the years in hopes that "the real physicists" would answer certain gnawing questions that stirred in my mind. But even those who are the stereotype geeks don't seem to have the answers. They only have a superhuman ability to do math, and a bizarre imagination. And the way they have interpreted reality to match the mathematical models, with multiple unimaginable dimensions, and the big bang – the God hypothesis disguised as science – has made physics less believable to practical physicists.

I am a firm believer that everything physical can be understood in terms of physics, but I also understand that the models we use are just that – models. They are analogies that serve as starting points in our quest for understanding. It is very important, at every level of a physics curriculum and career, to understand the fundamental assumptions of any model as well as the limits within which that model applies. The fundamental assumption that I want to address in this paper is the definition of time. With that said, I realize that many of those practical people I mentioned above may want to stop reading, but I hope that they will read on because I think that this essay is different from any other in that it will provide a very practical perspective that can put an end to what author Jim Baggott calls "fairytale physics" in his book, "Farewell to Reality. How Modern Physics Has Betrayed the Search for Scientific Truth". (Baggott, 2013) And it is not a dissertation ready for defense. It is a work in progress. It is based on what Baggott would call the "authorized version of physics" but in some areas the authorized version provides the right answer for the wrong reason. This paper is my attempt at reverse-engineering: finding the right reason for the right answer. It is also an appeal to young physics majors to think seriously about the fundamental assumptions, to understand and then challenge the "authorized" interpretations, and to take what you can from this model and turn it into the new authorized version for the new generation of physicists.

Max Plank, a very brilliant yet practical physicist said that

> "A new scientific truth does not triumph by convincing its opponents and *making them see the light*, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."

But physicists should not be in competition with "opponents". Physicists have a *responsibility* to challenge even the so-called "scientific truths" by shaking the foundations of the models upon which the structure of science was built. There is nothing more important than the light of Truth and there is no profession nobler than the seeker of Truth.

Time is a measure of motion

There have been a lot of books, chapters and articles published about the meaning of time. Whether they are written by physicists, mathematicians or philosophers, most of them that I have found (except perhaps those based on Process Philosophy of Alfred North Whitehead) are based on the assumption that time is one-dimensional, whereas space is three. That seems to be the right answer because it takes three coordinates to describe a position in space and only one coordinate of time. And in all practical applications, that's fine. It works to predict motion in 3-D space, which is all we usually care about. That seems practical. The problem is that it hides the nature of time itself. It may not seem practical to ask "what is time" but some physicist, like Lee Smolin, consider it "the single most

important problem facing science as we probe more deeply into the fundamentals of the universe." (Smolin)

The practical answer that I hope to support in this paper is that time is nothing more than a measure of motion – a scale that has been standardized for use as a denominator. It is used to *denominate* other measures of motion and that is what makes it seem to be different – to have a different meaning. This is in contrast to Smolin's answer (that "Embracing time [as real] means believing that reality consists only of what's real in each moment of time"), which is as impractical as the notion that time is a persistent illusion, as Einstein and many others have said. In his 1999 book, *The End of Time*, Julian Barbour said, "Time does not exist. All that exists are things that change. What we call time is – in classical physics at least – simply a complex of rules that govern the change." (Barbour, p. Loc 2327) But that is not practical either. Time *does* exist, not as a complex of rules, but as a very simple tool. Newton was the tool-maker and the tool was used for nearly 300 years to advance physics to the point that we now realize the limits of its usefulness.

Back when Newton proclaimed time to be absolute and independent, before linear time was engrained in everyone's mind, it was considered by most to be a *philosophical blunder*. Isaac Barrow, Newton's predecessor, explained in his "Geometrical Lectures", published in 1735:

> *"Time is commonly regarded as a measure of motion, and… consequently differences of motion (swifter, slower, accelerated, retarded) are defined by assuming time is known; and therefore the quantity of time is not determined by motion but the quantity of motion by time: for nothing prevents time and motion from rendering each other mutual aid in this respect. Clearly, just as we measure space, first by some magnitude, and learn how much it is, later judging other congruent magnitudes by space; so we first reckon time from some motion and afterwards judge other motions by it; which is plainly nothing else than to compare some motions with others by the mediation of time; just as by the mediation of space we investigate the relations of magnitudes with each other."(Burtt, 2003, p. 158)*

It's true that nothing prevents time and motion from rendering each other mutual aid, but considering time to be fundamental creates the question that no one seems to be able to answer; what is time? *Clearly*, as Barrow said, time is just "reckoned" from some motion – a repetitive motion such as the sun, moon, stars, sands through an hourglass and eventually an international standard measured by the decay of radioactive atoms. The standard was then "minted" as the approved *denomination* (the literal denominator in the equation for motion) to be used as a scale to judge other motions. The more accurate and precise our time standard became, the more real and independent it seemed to be. But don't be fooled; in essence, it is still a measure of motion.

Spacetime

Spacetime, or the space-time continuum is an idea that most people credit to Einstein. But it was actually a mathematician named Hermann Minkowski, who presented it. Einstein even credited him in his book, *Relativity, The Special and the General Theory*:

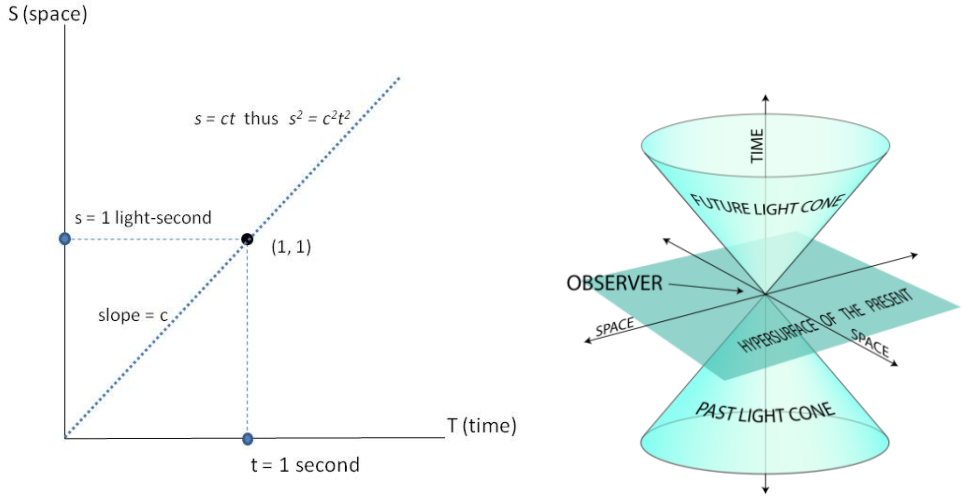
> *"the world of physical phenomena which was briefly called "world" by Minkowski is naturally four dimensional in the space-time sense."* (Einstein, 1952)

In fact, before Einstein started using it he called Minkowski's approach "superfluous learnedness" and said, "since the mathematicians have invaded the relativity theory, I do not understand it myself any more." (Minkowski, p. 2) But he decided to use the concept because it provided an invariant and the laws of physics must be invariant regardless of the observers' state of motion. However, he said, "space-time does not claim its existence on its own, but only as a structural quality of the field." (Einstein, 1952, p. 155)

The reason that the math is so complicated is that the four-dimensional spacetime equation itself is lopsided; it describes spacetime as a mixture: 3 parts space and 1 part time. But doesn't this assumption force the interpretation to be lopsided as well? If time truly is nothing more than a measure of motion in 3-dimensional space, then isn't there actually a component of time to accompany each dimension of space?

The Minkowski model

The Minkowski four-dimensional space-time (ST) formalism is used to illustrate spacetime as a continuum. I'll briefly describe a few points, beginning with the Minkowski diagram of space (S) versus time (T) in Figure 1a. We imagine a flash of light at that expands spherically outward in space ($S = s^2 = x^2+y^2+z^2$) at the speed of light $S = CT$ or $s^2 = c^2t^2$, represented by the diagonal line from the origin.



a. b.

Figure 1 (a) A normalized plot of space vs. time that illustrates the point that light travels one unit of distance (light-second) in one unit of time (second)

(b) Minkowski's time vs. space diagram is normally shown with time as the verticle axis and space as a horizontal plane. The time axis is mirrored to include the past as negative time and the future as positive time. However there is no representation of direction in space since 3D space is represented as a 2D "hypersurface of the present".

Note that I use upper case S and T to mean the modulus or absolute value of space and time, where $S = s^2$ and $T = t^2$ which are both positive[1]. Lower case *s* then represents the radius (one dimension) of the light sphere and therefore, the distance that the surface of the sphere travels in a given amount of time as one dimension, lower case *t*. In Figure 1b the axes are rotated just to show the Minkowski diagram as it is normally presented. Keep in mind that $s = ct$ represents the radius as a single dimension that increases with time as a single dimension. But Minkowski treats time as if it is actually one-dimensional so he uses *t*, which is $\pm\sqrt{T}$ and claims that the negative axis represents the past. Then he tries to represent 3D space on the same diagram, but 3D space cannot be represented as three dimensional in the diagram, so it is portrayed as a "hypersurface" (a major problem with this model in my opinion). The intersection of the time axis with this "hypersurface" is said to represent an event, i.e. the present. A "light cone" is formed by revolving the line, (the diagonal in Figure 1a) that connects the origin with the point (1, 1), around the T axis to represent the limit of causality.

Next, the equation$(s^2 = c^2t^2)$ is expanded on one side to give $(x^2+y^2+z^2 = c^2t^2)$ and rearranged to give the four-dimensional spacetime: $x^2+y^2+z^2 - t^2 = 0$, with $c = 1$. No physicist or mathematician would blink an eye when they saw the equation that describes a spherical expansion of light $(s^2 = c^2t^2)$, written as $(x^2+y^2+z^2 = c^2t^2)$. It seems mathematically correct, because the equation for a sphere is $S = s^2 = x^2+y^2+z^2$ and everyone knows that time is one dimension. Right? <u>But if we are to reevaluate the fundamental meaning of time, we cannot make the assumption that time is one-dimensional while space is three.</u> The variables *s* and *t* represent the radius, not the entire sphere. If the term for radius is unfolded to represent space, then time must be also, which would mean that time flows in all directions. Doesn't that make perfect sense?

There is certainly an advantage to unfolding space as $s^2 = x^2+y^2+z^2$: it fits our perception of 3D space, making the model seem intuitive. But the problem with unfolding one side of an equation without doing the same to the other (leaving it "enfolded" as David Bohm might say (Bohm, 1980)) is that it creates an artificial asymmetry – a lopsided perspective that complicates the math, requiring parameterization in terms of hyperbolic functions (Jackson, 1975, p. 517). The result is a transformed coordinate system that must be calibrated by using the original $(c^2\Delta t^2 + \Delta x^2 = n^2)$ to mark increments on the distorted axes. (Penha & Rothenstein, 2007). The equation is warped, so of course the interpretation will be that space is warped.

There is also a problem with mirroring the time axis to represent the past as *negative time.* That is how it has always been done because the past is conceptually the opposite of the future. It seems to agree with our sense of past, present and future as we experience time, but it centers on zero as the reference, which introduces a singularity. That's because there is no such thing as zero time or zero space. When we say, $t = 0$ we mean the start time or reference time, not the magnitude. And coordinates on the *S*-*T* graph represent increments, i.e. magnitudes. So representing $t = 0$ on the graph incorrectly represents zero time and zero space.

The alternative approach presented below, as the Space-Time-Motion (STM) model, is to represent a unit of measurement (i.e. the first increment on either scale) as the

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[1] "Any circle can be described uniquely by giving three points, but many different sets of three points give the same circle: the correspondence is many-to-one. However, circles are uniquely parameterized by giving their center and radius: this is two real parameters and one positive real parameter… The moduli space is therefore the positive real numbers." https://en.wikipedia.org/wiki/Moduli_space

reference with magnitude of one, i.e. $s = 1\ and\ t = 1$. This reinterprets the origin of the graph (where the axes appear to cross, which actually means zero *motion*) as being the "at-rest" state (which will apply to the quantum model). The region between zero and the first unit of measurement on either axis S or T will be revealed as the window, within the relativistic framework, through which we can better understand quantum physics.

The Space-Time-Motion (STM) Model

The Space-Time-Motion or STM model (which was first introduced at http://vixra.org/abs/1402.0045) uses the same idea of a light flash at some position, s_0 and time, t_0 expanding in a sphere as ($s^2 = c^2t^2$), but neither side of the equation is unfolded. The squared terms represent space as a whole and time as a whole (moduli), which are symbolized by upper case $S = s^2$ and $T = t^2$. The first important result of this is that $s^2 = c^2t^2$ can be written as

$$S = Tc^2. \tag{1}$$

In this form, the equation means that ***space and time are equivalent*** – not the same, but *equivalent* – in exactly the same way that $E = mc^2$ means that *energy and mass are equivalent*. They are equivalent because they are two different ways of representing the same phenomenon. They are simply different scales for the same *process*[2]. Equation (1) suggests that time (T), is transformed into units of space (potentiality into actuality) just as energy is converted into mass. The term c^2 is simply the factor that relates the units of measurement.

Graphically, $S = CT$ is a line on the S-T plane through the origin with a slope of C, the same as in Figure 1a above, which represents the motion of a spherical wave front. In contrast to the Minkowski diagram, the STM model considers change (both S and T) to be positive (a modulus, an absolute value) so there are no negative axes. Just as the radius of a sphere (lower case s) is a positive *measure* from the center outward to the surface of a sphere, positive S values represent (un-measurable) outward-directed motion of the entire surface in space. Similarly, positive T values represent "outward-directed" change in time, i.e. the future. The "arrow of time" simply means that regardless of which direction motion happens in 3D space, once movement or any event happens, it can never "un-happen". In other words, the information in every event does not just go away. It becomes something – it becomes part of the particle (discussed below). That is not evident in the Minkowski model because it is hidden in the singularity, at the point of reflection, where the positive is mirrored as negative.

Mathematically, it is not incorrect to use negative variables[3], such as $-s$ and $-t$ because the magnitudes of $S = (-s)^2 = s^2$ and $T = (-t)^2 = t^2$ give the same result. So it seems to make sense to use the negative as the opposite direction, but this mirror-image

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[2] The fact that the word "process" can be used as both verb and noun form is germane. The verb form of process refers to an action of change and the noun refers to an object such as a bony protrusion (e. g. spinal process). Perhaps it would be appropriate to call a quantum particle a "quantum process." This is much like the process philosophy of Alfred North Whitehead.

[3] Actually, "negative number" is a misnomer. Numbers are positive quantities. The negative sign is an operator that means something, like a deficit or removal of the quantity that the number quantified.

method hides the point of reflection, where the quantum model applies. For the STM model, positive *s* means radially outward from the flash point of the light. Likewise, positive *t* is the time corresponding to the direction, so it also means radially outward from the center. And the opposite of radially outward is radially inward. Knowing that the energy of a quantum particle, such as a photon, is directly proportional to frequency, which is the inverse, or opposite of time, it makes more sense to use $1/t$ to represent the past. And $1/s$ then represents radially inward. Lower case *t* is the scalar value that we read from the clock. It is always positive and represents time that will elapse or has elapsed. The concept of negative time does not apply.

Therefore, rather than using the negative reflection, the STM diagram superimposes an axis representing the inverse of time, so the region between the zero-motion point and "1" (one unit of measurement where $t = \frac{1}{t} = 1$) on the *T* axis represents the past, the inverse of the future as shown in Figure 2. The measurement event effectively inverts or "enfolds" what was the future (potentiality) into the past (actuality) and transforms *t* into $1/t$ or frequency of vibrations (an actual particle with energy $E = hf$ and information)[4]. On the *S* axis, the region between the zero-motion point and "1" corresponds to inner space, beneath the apparent surface of the sphere, as a wave number or spatial frequency ($1/s$) a concept commonly used in medical physics referring to image quality (Bushberg, p. 269ff). Small objects correspond to higher spatial frequencies. In particle physics, smaller, higher-energy particles correspond to higher temporal frequencies.

What appears to be the intersection of the two axes is neither zero time nor zero space, so the axes can't be thought of as intersecting. The zero point actually represents the zero-motion-perspective or at-rest state. This is the realm of time-independent quantum mechanics. The word *state* in "at-rest state" refers to the particle's perspective of itself. From an observer's perspective, it can either refer to the particle's position in space ("Here" using the *S* axis) in relation to clock time ("Now" using the *T* axis), or it can refer to the particle's energy ($E = hf$) or momentum ($E = pc = h\frac{c}{\lambda}$) in relation to its temporal or spatial frequency, as we will see. This is the same as in quantum mechanics, where "a quantum state is a conglomeration of several possible outcomes of measurement of physical properties." (Morrison, 1990, p. 7)

[4] Note that E is energy, m is mass, p is momentum, h is Planck's constant, λ is wavelength and f is frequency

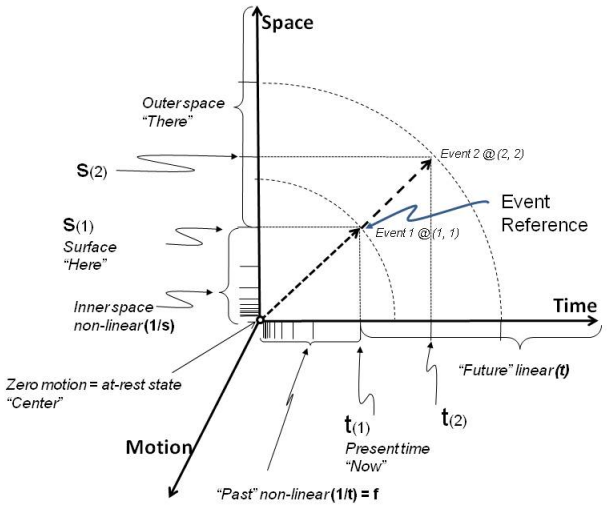

Figure 2 **Event Reference from the at-rest perspective of the flash bulb. A light bulb flashes at some time before t1 sending a spherical wave outward toward S1. *Event 1* (at position 1 and time 1) represents the measurement of the light at radius s1 (1 light-second) in 1 second. Every event that comes before *Event 1* (the "past") is thus represented as a point closer to the origin. Event 2 represents the radius and time that the sphere will be in the future.**

Suppose that the "light flash" is radiation, which emits spherically out from the nucleus of an atom. The at-rest state is represented by the *atom's* own frame of reference (as if the atom was the center of the expanding universe). It is also the frame of reference for the radiation sphere, even though it is moving outward. From light's perspective, the atom is at its center and if it could see its own surface it would not appear to be expanding or moving. It would appear to itself to be a particle – a photon – a time-independent quantum function, a unit of energy that does not change with time. It perceives itself as a constant size and sees the atom shrinking, collapsing into its center. This "observation" is represented in Figure 2 as Event 1, say at 1 second after the flash. It sees itself at a given moment, which is shown as the "event reference" s_1 and t_1.

The event reference represents the observation as "now", where $t = 1/t = 1$. Note that, multiplying both sides of the equation $t = 1/t$ by t gives $t^2 = 1 = T$, so at this point, the value of measured t is equal to the concept of "time as a whole" (T), which is why we tend to think of t and T as being the same. Regardless of what happens in the "outside world", where the moving frame experiences the flow of time, each time the photon observes itself (say Event 2 in Figure 2) it looks the same, so *the model has to reset*[5] to show that Event 2 has become the new event reference. As mentioned above, it inverts or enfolds what was perceived to be the future (t - potentiality, looking outward) into the past, $1/t$ or frequency of vibrations (actuality, looking inward) – what it perceives to be its physical form in space at $s = 1/s = 1$.

By representing the past, before Event 1, as the inverse of time (frequency domain) rather than the negative, the inside of the observed surface represents (in the language of

[5] Notice that the *model* is reset. The observation doesn't change the light sphere. And a measurement collapses the quantum wave function, which is the mathematical model, not the particle itself.

quantum mechanics) the *energy state* of the particle, $E_0 = hf$ and this can be represented on the STM diagram as the segment of the T axis as shown in Figure 2.

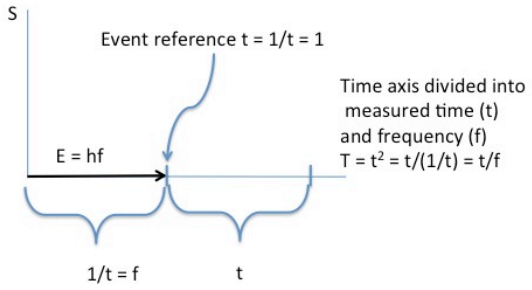

Figure 3 Time axis divided into measureable time, t, and frequency (f). The energy state of a particle is represented as E=hf

By superimposing the frequency domain over the time domain, the STM model can be used to show other relationships between quantum energy, relativistic energy, and total energy. The relations for particle's rest energy are $E_o = hf = mc^2 = pc = \frac{hc}{\lambda}$. Some of these relations are used in a mnemonic device on page 1122 of the Fundamentals of Physics text as shown in Figure 4 (Halliday, Resnick, & Walker, 1993)

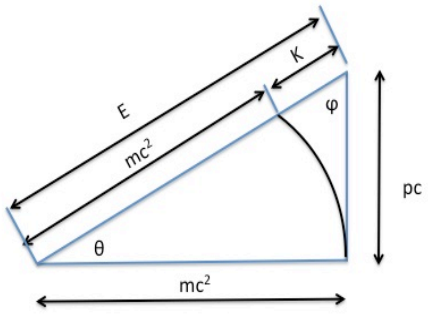

Figure 4 A relational triangle offered as a mnemonic device to help with remembering the relativistic relations among the total energy, rest energy, kinetic energy and momentum. (Halliday, Resnick, & Walker, 1993) The arc in the figure is meant to illustrate that the magnitude of mc^2 on the hypotenuse is the same as that on the horizontal leg, regardless of the angle θ. It can be shown that the angles θ and φ are related to $\beta = \frac{v}{c}$ and γ as $\sin(\theta) = \beta$ and $\sin(\varphi) = 1/\gamma$

Since $E_o = hf = mc^2$ the horizontal leg of this triangle (in Figure 4) can be represented on the STM diagram as shown in Figure 5. This puts the vertical leg parallel to the S axis. In this way, the hypotenuse of the triangle represents the total energy of a quantum particle or a photon in its own rest frame. The vertical leg then represents the inverse de Broglie wavelength or spatial frequency, because $E_o = pc = \frac{hc}{\lambda}$, and the momentum that could be measured for the particle.

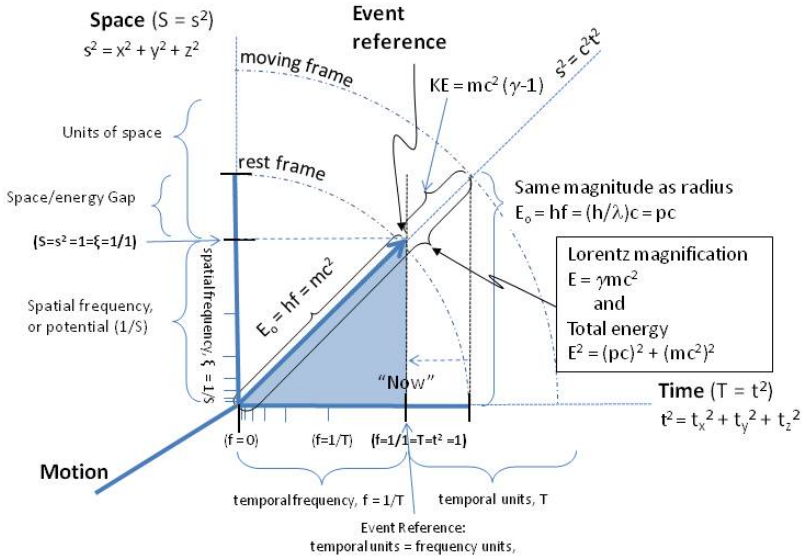

Figure 5 Space-Time-Motion (STM) model. By superimposing the frequency domain over the time domain, the STM model can be used to show other relationships between quantum energy, relativistic energy, and total energy.

The smaller triangle in Figure 5 (rest frame) and the larger triangle (moving frame) are similar right isosceles triangles. Geometrically, the horizontal and vertical legs of the larger triangle have the same magnitude, E_o, as the hypotenuse of the smaller one (the semi-circular dashed lines are drawn to show this: $E_o = mc^2$ for the horizontal and $E_o = pc$ for the vertical). Using the Pythagorean theorem gives total energy:

$$E^2 = (pc)^2 + (mc^2)^2. \tag{2}$$

The larger hypotenuse represents total energy $E = mc^2 + KE$ where KE is the relativistic kinetic energy

$$KE = mc^2(\gamma - 1). \tag{3}$$

and

$$\gamma^2 = c^2/(c^2 - v^2) = \frac{1}{\left(1 - \frac{v^2}{c^2}\right)} \tag{4}$$

is the Lorentz factor. Combining equations, the total energy is thus

$$E = mc^2 + KE = mc^2 + mc^2(\gamma - 1) = mc^2 + mc^2(\gamma) - mc^2. \tag{5}$$

or

$$E = mc^2(\gamma). \tag{6}$$

The Lorentz factor squared γ^2 is a scaling factor $c^2/(c^2 - v^2)$, which is simply the relative magnitude of a particle at rest, c and a particle with relative motion, v. It describes the

distortion (parallax in motion) caused by perceiving the image of a particle at rest from the moving reference frame.[6]

The practicality of the STM model

Is it practical to think of "past" time as the inverse of future time? My short answer of course is yes. What does not make sense is the idea of negative time. The use of numbers to represent time is the same as the use of numbers to represent objects. Objects are numbered for the purpose of counting them. The number we assign does not represent the object. It represents a quantity. Negative numbers don't even represent a quantity. They represent a deficit or removal. In fact, there is no such thing as a negative number because negative is not part of the number, it is a mathematical operation.

You might argue that the inverse is also an operation and I agree, but I think it is more appropriate to model the transformation that occurs when an observation collapses the future into the past. Imagine a pulse of light from a star traveling directly toward a quantum particle. Let's say it is 1 light-year away. Using our standard clock we say it will take 1 year to reach a point at which we stop the clock to define the interaction (event reference) with the particle. It makes perfect sense to use positive time and say that it is going to take 1 year (future tense) to travel the distance, but once it does, we now say that it travelled 1 light-year within that year. "Within that year" means per year and "per year" means inverse year, so it makes perfect sense to use the inverse when referring to the past. Then you might argue that this also applies when speaking of the future, by saying the next pulse is going to travel 1 light-year per year, but that refers to motion, not the event. Once you have observed it, it has happened, there is no more velocity, no more change as such. The interaction is done. Now there is energy, information absorbed by the particle, which can be quantified by frequency. Potentiality has transformed into actuality.

This also makes the mathematical model of a wave fit the physical model of a particle as follows: One unit of space, $s = \int \frac{1}{s} ds = \ln(s) -\succ s = e^s$, in one unit of time, t= $\int \frac{1}{t} dt = \ln(t) -\succ t = e^t$, produces ${}^{s}/_{t} = {}^{e^s}/_{e^t} = e^{s-t}$. Normalizing s and t (which just means scaling them to one unit: wavelength, λ and period, T) with $k = \frac{2\pi}{\lambda}$ and $\omega = \frac{2\pi}{T}$ makes them cyclical to model repetition of events, $\psi = e^{(ks-\omega t)}$, which is a classical wave. It can be shown (see http://vixra.org/abs/1401.0218) that the free-particle Schrödinger equation is simply a partially evaluated classical wave equation, with de Broglie relations inserted and the imaginary symbol i, used to represent the function as a spinor[7]. (Hestenes, 2003)

The STM model provides a practical interpretation of David Bohm's terminology (Bohm, 1980) referring to "enfolded" and "unfolded" order. In Figure 5 the horizontal axis inside of the event reference can be seen as "enfolded" i.e. laid down on the f and t axis, (not

[6] It is shown geometrically in (http://vixra.org/abs/1401.0218) using the STM model for two particles, how the relative velocities create a back-projection just like an image on a screen.

[7] In Geometric (Clifford) Algebra, i is called a spinor that acts as a rotation operator to rotate an axis by 90°. Spinors are also used in quantum mechanics to operate on complex multi-dimensional tensors. It may be more complete to say it represents a "flipper-spinor" since $\left(i = \frac{i^2}{i} = -\frac{1}{i}\right)$.

projected but with the axes rotated to represent zero motion) when not being observed. And at the event reference, it is "unfolded" or stood up horizontally to appear as a projection in space (on the S axis), at a new location beyond the space/energy gap, analogous to where electron orbitals appear.

The STM model also makes sense of the speed of light being constant regardless of the speed of its source. Imagine you are a particle. If you could not see anything around yourself, you could *not* perceive uniform motion. But if you pulsed a flash of light, you would see light that seemed to be moving away from you at a constant speed, reflecting off of objects and returning to your eyes. If I then come whizzing by you and flash my bulb, and you measured the speed of light coming from mine, you would not measure the sum of my speed and the speed of my light. It would be the same speed as the light coming from your flash bulb. That just doesn't make sense if the light photons are actually moving. According to the STM model, if you look at the problem from the perspective of the light, from its at-rest frame, it makes perfect sense. Light, whether it comes from my bulb or yours, is a field that does not move. It appears to you to radiate out in all directions, but from its perspective, you are the one that collapses. So the reason the speed of light is constant is because it is the real, fundamental constant – the only thing that is *not* moving. In a sense, it is not the speed of light that we measure; it is the speed of darkness receding.

This perspective may also provide a practical model for understanding consciousness – something that has not been a welcome topic in physics. As Max Planck said "The laws of Physics have no consideration for the human senses; they depend on the facts, and not upon the obviousness of the facts." But from the perspective of anyone who has had to face the reality of death – the end of time as they know it – there is nothing more practical than the human senses matching the Truth, especially about the only part of them that has any hope of living on.

So suppose I am a quantum particle. I can be mathematically described as a wave function. And when I observe myself, I define event references so I experience the passage of time and appear to have a definite form in three-dimensional space. But when I observe the world around me, I am not observing myself. So in essence, my wave function expands. I seem to be "out there" at one with my surroundings. I immediately correct myself, lest I lose my identity, and collapse back to my own, personal-event reference "here" and "now". Now I have to wonder, is it really the light that travels from the source, reflecting off of objects and hitting my retina? Or is that just a very useful model that is based on the most useful perspective? Perhaps it is really the wave function of my body that is expanding and collapsing with each observation. What's wrong with saying that, as a collection of quantum particles, I expand (call me awareness) and collapse drawing in information that I perceive as light. But I also get information from the contrast between light and dark. So in order to include both light and dark, it is better to refer to "*the field*" of vibrations. As Einstein said, "The field thus becomes an irreducible element of physical description." (Einstein, 1952, p. 150)

As I said, when any event happens, it can never "un-happen". The information in every event does not just go away. So what happens to it? Don't we carry information-storage molecules in every cell of our bodies? I propose that the information becomes an integral part of every cell. We know that DNA molecules contain all the information necessary to form, nourish, reproduce and heal the cell, but do we know where the information came from in the first place? And is the genetic code fixed for a particular organism or does it evolve so we can adapt?

If information from events around us collapses into and becomes part of the cells of our bodies, then every cell of a particular body would have nearly the exact same information, but a slightly different perspective than every other cell depending on its

location and function in the body. Perhaps that is how cells are able to differentiate and produce individual parts of the body. This could also be tested if there is a sensitive enough instrument to detect the differences, by using PCR[8] to multiply DNA molecules from different parts of the body. It seems to agree with Karl Pribram's "Holographic Hypothesis of Brain Function" (Pribram, 1984) to explain why memories cannot be eradicated by removing individual parts of the brain.

On that note, the STM model also helps to understand how physical form can be considered holographic. Physical form is the manifestation or perception we observe when motion separates the field into four base pairs (s and 1/s); (t and 1/t). Are these somehow related to DNA base pairs? Each pair of inverses move in opposite fashions; as t increases, 1/t decreases so one moves outward as a quantum particle wave function and the other moves inward as the collapse of the same (and thus coherent) wave function modulated with information (that is stored in the DNA?). So the boundary of every particle is effectively the *holographic interference pattern* forming the apparent surface of the volume in space. The volume contains the back-projection of energy ($E_o = pc$) and is what we perceive as the physical particle. The space/energy gap represents momentum and inertia – a distinct, quantized difference between the particle at rest and in motion.

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As a dedication to those patients who passed through my Radiation Oncology clinic, I hope they made it up "North" as one sailor referred to heaven. I couldn't relate to his concept of heaven because to me, the word God means Truth. Truth is what happens… what really happens in the world around us, and what really will happen when we die. Truth is the only thing that is real. We are made out of Truth, our bodily functions are all controlled by Truth, and Truth is what we will find if we have the courage to find ourselves. Jim Baggott is not the only one who thinks that modern physics is off course, having "betrayed the search for scientific truth". So I hope that the ideas presented here will inspire the new generation of physicists to regroup and set a new course for "True North".

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[8] Polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a segment of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence. https://en.wikipedia.org/wiki/Polymerase_chain_reaction

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