Is the Mind of God Found in Quantum Field Theory?

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Abstract

Though no material objects (finite rest masses>0) can travel at or faster than the speed of light, according to the special theory of relativity, I speculate that mind/soul exists as a field embedding itself in space time that communicates with ordinary matter through the intermediary of physical imaginary-mass objects—*tachyons*. The field is: (a) capable of causing quantum wave functional collapse; (b) not confined by movements in the material world, and (c) capable, by traveling faster than the lightspeed, of causing matter to "bubble out" in a vacuum much as a superluminal particle causes Cerenkov radiation in liquids. I speculate that this mind field may be an information field—the tachyonic quantum field—possibly what the ancients called the Akashic record.

According to quantum field theory and the current search for the Higgs Boson we must have both tachyonic and tardyonic quantum fields. It turns out that this prescription can be viewed as interaction between the Akashi record tachyonic field and the tardyonic matter fields or equivalently a quantum field generator of a physical universe with different tardyonic masses. The big problem that this may solve is how different masses come into existence and how a mind is there to know it. In this talk I propose a simple spin-zero bosonic tachyon/tardyon quantum-field-theory model whereby the vacuum expectation value in the Feynman Path Integral formulism is given by:

$$Z(J,K)=\int D\varphi_R\ D\varphi_I e^{i\int d^4x\left(\frac{1}{2}\left[(\partial\varphi_R)^2-m^2{\varphi_R}^2\right]+\frac{1}{2}\left[(\partial\varphi_I)^2+m^2{\varphi_I}^2\right]+J\varphi_R-K{\varphi_R}^2\varphi_I{}^2+\ldots\right)}$$

In the above, φ_R and φ_I are real and tachyonic fields respectively and J and K are unspecified interaction constants. Note the plus sign in the tachyonic term indicating an imaginary rest mass.

So in this equation a particle is born (the $J\varphi_R$ term). As it propagates it interacts with the two fields—a real tardyonic field, φ_R, and an imaginary tachyonic field, φ_I—which has imaginary mass equal in magnitude to its real mass. This sets up a loop which modifies the mass leading to what is called a mass spectrum of different particles which in turn make up the universe.

It is the interaction between these fields that leads to the physical world and the mind/life force. I also propose that the logical order of thought can be seen in this model as the emission of blue-shifted (BSL) and red-shifted light (RSL) from the tachyon to a tardyon. The BSL appears to the tardyon as it propagates into the future as a recording of

the past positions of the tachyon (a tardyon going backward in space) with the RSL appearing to be a record of its future positions (a tardyon going forward in space). In this paper I will go through several implications of the model and indicate how it may explain the logical temporal order of thought, the appearance of a cause-effect world, and certain paranormal phenomena such as the appearance of ghosts, mind to mind communication, and possible spiritual experiences.

If you come to a fork in the road, take it.

Yogi Berra

The Vacuum is a boiling sea of nothingness, full of sound

and fury, and signifying everything.

Anonymous

found in Ch. II.5 of Anthony Zee's

Quantum Field Theory in a Nutshell

Introduction

In this talk I am going to do what is usually forbidden or not discussed in a physics paper. I am going to show you some equations considered today to be of the highest caliber known to the minds of the greatest physicists of our present time and of times that have long since past. These equations are at the current frontiers of quantum physics and constitute what we call quantum field theory.[1] From them all of the latest theories including string theory and cosmology arise and are continually developing. The big question is what does this have to do with the Mind of God, or any mind for that matter, if anything?

Quantum field theory is based on the idea that hidden under the ordinary universe of everyday objects we see in our world there is a matrix made from invisible fields. These fields are capable of generating every object we do see at the minutest level of our existence—the world of atomic, subatomic, nuclear, subnuclear matter and energy. These objects arise like ordered droplets of fog in cold air all around us and as quickly as they do, they evaporate or vanish; all this activity is sometimes thought of as the *zero point*

energy of the vacuum of space. Zero point refers to the temperature of absolute zero—the coldest you can get. This virtual or invisible energy, which persists at this level of coldness even when you remove every tangible source of visible physical energy, generates fields that are the source of everything there is and then some. Now you don't have to have things this cold in order to discuss or use quantum field theory. For it describes things at normal temperature just as well and is used in current models of Hall Fields and ferromagnetic condensed matter calculations.

Recently it has been used to formulate the quark-gluon plasma inherent in every nucleus which led to the discovery of color charge.

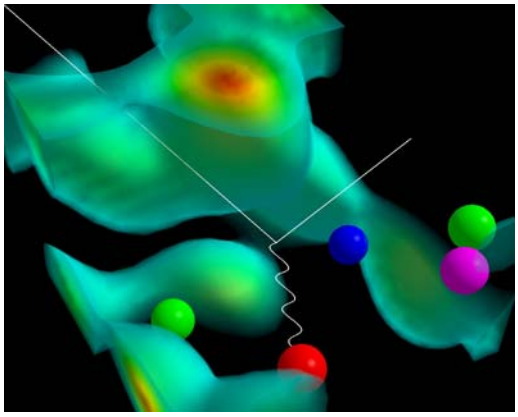

Figure. 1. Quarks and gluons.
Here we see three quarks indicated by red, green and blue spheres (lower left) localized by what is called the action gluon field shown as blue green blobs. This picture was generated by use of lattice quantum chromodynamics. A quark-antiquark pair created from the gluon field is illustrated by the green-anti-green (magenta) quark pair on the right. These quark pairs give rise to a *meson* cloud around the proton. The masses of the quarks illustrated in this diagram account for only 3% of the proton mass. The gluon field is responsible for the remaining 97% of the proton's mass and is the origin of mass in most everything around us. Experimentalists probe the structure of the proton by scattering electrons (white line) off quarks which interact by exchanging a quantum of light (wavy line) known as a photon. (Taken from: Visual QCD.) http://www.physics.adelaide.edu.au/theory/staff/leinweber/VisualQCD/QCDvacuum/index.html.)

We will look at these fields as even more than the birthing matrix of all matter and energy; we will view them as the reflections of what we shall call the Mind of God

and in doing so we will in one fell swoop bring together a number of legends, religious beliefs, and the most modern view we have of the scientific universe. I also hope to explain how it is that not only are there things in the universe, but also why and how there are observers of those things and how and why these observers can and do make logical, objective, temporal, cause and effect, sense of the universe and as well some other related observations about the nature of mind.

The master equation

While this gathering of science and spirituality or objectivity and subjectivity may seem surprising to many of us (it certainly was to me) the master equation of quantum field theory describing all of this is also equally surprising. For it indicates, from the idea promulgated by physicist Richard P. Feynman (based on a question arising in a discussion with physicist Paul A. M. Dirac), that a particle—the smallest unit of matter we can imagine—must propagate through space from a single point by moving along every pathway it can regardless of how impossible that trajectory may be until it arrives at its final destination.

The end points of this multi-path journey are boundary conditions in the equations which imply that they are events and as such are fixed by observations. But who set these conditions? Surely we as observers do this when we do experiments. These, then, boundary conditions act as observations and hence imply observers. In fact there is no way we can escape this—we must include acts of observations in our accounting of the physical world. But something even more mysterious is implied. That is, what happens in between the end points? Here no observations take place. The idea is that every particle in the universe impossibly duplicates itself (or possibly reverts to its natural state

of not appearing anywhere) and rides off in every direction it can. This is the real mystery at the heart of quantum physics. From this single idea all of the equations of quantum physics can be derived. In particular the equations describing quantum field theory in which we take this disappearing and reappearing act to be even more fundamental. We'll get back to it in a moment.

Bust how do we account for the setting of boundary conditions? How do we account for the appearance of particles—these seem to come about as the result of acts of observation? Here is where I speculate about such a thing as the Mind of God. I am going to assume that there are two basic quantum fields here—a real field capable of generating real positive mass particles and annihilating them (in this case spin-zero bosons with mass, *m*) and an imaginary field capable of generating/annihilating imaginary mass particles (mirror spin-zero bosons with mass, *im*). Hence these fields if taken together would constitute a complex number field which often is separated into a real and imaginary field.

The use of a complex field theory is well known by those who work in this field. One sets the Lagrangian equal to the difference between the kinetic energy term, *T*, and the potential energy term, *V* or $L=T-V$. Usually one expands the field "potential"[2] around its respective maxima and minima and in so doing one finds a false vacuum state and the existence of what are called massless *Nambu-Goldstone* boson fields and real massive boson fields with masses dependent on the parameters in the theory. Such a procedure is called *spontaneous symmetry-breaking*.

This won't be the approach I'll take here. In a certain sense I wish to maintain the instability in these fields and look to see how their interaction may explain not only the appearance of matter in the same sense that a superluminal charged particle causes Cerenkov radiation or precipitates bubbles in a superheated liquid through which it travels. Let's look at the equation describing the probability amplitude of the evolution of the vacuum state containing these fields from the zero state into all possible states and then returning again to the zero state from which it started.[3] Of course to take into account all possible fields would mean including the electromagnetic field, the quark-gluon field, the Dirac electron field, and I suppose a few other fields. Each of these fields would also interact with their corresponding imaginary mass tachyonic fields.

I will confine myself to the simplest quantum field theory—the field of a spin-zero tardyonic scalar boson having positive mass, *m* interacting with the field of a spin-zero tachyonic scalar boson of imaginary mass, *im*. The probability amplitude for such a tachyon interacting with such a tardyon and generating something from nothing and then annihilating it back to zero again is:

$$Z(J,K) = \int D\varphi_R \; D\varphi_I e^{i\int d^4x \left(\frac{1}{2}\left[(\partial\varphi_R)^2 - m^2{\varphi_R}^2\right] + \frac{1}{2}\left[(\partial\varphi_I)^2 + m^2{\varphi_I}^2\right] + J\varphi_R - K{\varphi_R}^2{\varphi_I}^2 + \ldots \right)}$$

(Equation 1)

Classically, of course, such imaginary mass particles are known to have the speed of light as their lower speed limit and as such are called *tachyons* while real positive mass particles have the speed of light as their upper speed limit and as such are called *tardyons*. Consequently in the quantum field theory, the tachyonic fields are not real—they don't generate real particles of matter—in fact, they generate imaginal mirror

images represented by imaginary numbers. We will find that this characteristic to be extremely important both because of its imaginal or "mind-like" quality and the fact that because such particles with imaginary masses are confined to speeds in excess of light, as we shall see, they cause an interesting phenomena having to do with memory and intent in the orderly process of logical temporal order found in thought construction and memory recall.

This tachyonic element will thereby turn out to be important as a model for a timelike ordered mind which we will see soon when we look at how tachyons interact with tardyons by emitting light as they pass through or by an observer (tardyon). I must admit I hadn't realized this at first and was quite impressed that tachyons can create this kind of order when they interact with tardyons via light signals.

To keep this simple, I haven't included the tachyon-electromagnetic field interaction or the concomitant electromagnetic field-tardyonic interaction in the above although one should do so to make this a better theory. One could also make both the tardyon and tachyon fermions in which case the resulting vertexes would consist of three fields coming together instead of our simple model with four fields. Here we would need a mediating boson to carry the interaction such as the vector boson associated with the photon. I'll have more to say about that in the conclusion.

Just to give you a taste for a fermionic-vector bosonic quantum field theory we would have:

$$Z = \int D\psi_R D\overline{\psi}_R D\psi_I D\overline{\psi}_I DA e^{i\int dx^4 L}$$

(Equation 1a)

In the above the Lagrangian density *L* and electromagnetic field tensor, *A*, are given by:

$$L = \overline{\psi}_R[i\gamma^\mu(\partial_\mu - ieA_\mu) - m]\psi_R - \frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \overline{\psi}_I[i\gamma^\mu(\partial_\mu + ieA_\mu) - im]\psi_I$$
$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu$$

(Equations 1b)

In the above we have used the usual notations for the fermion fields, Dirac gamma matrices, and the vector potential for the photon field. The vertex interactions are $ie\overline{\psi}_R\gamma^\mu A_\mu\psi_R$ and $-ie\overline{\psi}_I\gamma^\mu A_\mu\psi_I$ where the unbarred symbol represents an incoming field and the barred symbol an outgoing field. From here on we won't be using equations 1a and 1b.

Why quantum field theory is difficult

It has to be said at the outset that the study of quantum field theory is a very difficult realm to investigate because the objects and forces that are studied are infinitesimally small. As we descend to the level of sub-atomic particles, we find that they are moving so rapidly that we can't follow them as we would follow ordinary larger objects. Their movements and properties do not follow the old ways of thinking found in classical physics. On this sub-atomic level of existence, Newtonian-classical physics simply doesn't work. So a new form of physics had to be created to adequately account

for the phenomena we observed. Feynman has pointed out that a successful marriage of quantum physics and the special theory of relativity can only occur if one takes into account both annihilation and creation processes thereby involving both matter and antimatter as well as interaction processes that occur virtually (imaginatively real and spacelike) outside the light cones of the interacting particles. It turns out that these processes had to be included for consistency sake which made it impossible to regard matter as composed of a fixed number of interacting fundamental particles.

Previous to quantum field theory we might tend to think of quantum physics as a chess game in which no piece is ever lost or captured—the pieces are simply moved around a giant board called the universe. No one has any more knowledge about these pieces as to why a queen is queen and a knight behaves like a knight with its funny moves. We would just say the objects had different masses and properties such as electric charge and spin.

With quantum field theory we now see the game is more complex—not only are there losses and captures—we find that objects can completely vanish off the board—we also find that pawns can change into queens in violation of a previously thought rule that an opponent could only have one queen. In quantum field theory particles can change and even weirder they can get lighter or heavier.

On the sub-atomic level, particles don't simply move from point A to point B in a continuous fashion. They appear to be created out of nothing and then annihilated back to nothing again in a very rapid fashion. And as I explained above they also follow all possible paths not just the most probable path.

What the equation means

So in this equation (1) we see a particle (field possibility for producing this particle) is born—the term given by $J\varphi_R$. As it (the field) propagates it interacts with two fields a real tardyonic field φ_R similar to the created particle-field and an imaginary tachyonic field φ_I which has imaginary mass equal in magnitude to its real mass. This sets up a loop which modifies the mass leading to what is called the mass spectra of different particles which in turn make up the universe.

It is these imaginal fields that lead to the physical world and the life force which we feel and know as mind and memory. More on this later.

All things have what appear to be lifetimes that are finite. Hence the relationship between the real and the imaginal also has a finite lifetime. Birth and death of a particle or a person is a kind of lend-lease program.

Just look at eqn. 1. I realize that those of you who have no math may be a little in shock just seeing such a construct as the presumptuous master equation of God's mind and the universe. Before you recoil, take a deep breath and relax. You won't be harmed by learning what it says and you won't feel dumb or stupid. It is only a model and does not take into account many rich details such as the electromagnetic interaction or the quark-gluon field. Now even this "simple" *master* equation is, in general, practically insolvable, so one might wonder to what use it can be put.

Let me at first indicate what it means. We'll begin with the term given by the very first letter *Z*. This stands for a special function in quantum physics, namely the

possibility for anything to occur—in this case the possibility for the vacuum of space to bubble up from zero producing a field and then quiet back down to zero (that what the *Z* stands for—the probability for the zero vacuum to do this) again, and again, and again throughout all space and time. This is the possibility for the zero point energy I mentioned above and represents the ground or fundamental state of nothing—the vacuum state of the universe.

There is more here; there are some sources of real particles already present. Those parentheses next to *Z* surrounding the letters *J* and *K* tell you that this *Z* is a function that depends on *J* and *K* where *J* means anything physical that already exists (called a current in the jargon) and moves in the world of matter and energy and thereby interacts with these hidden fields and *K* means the strength with which these fields are capable of interacting with each other. In this case the fact that we have $\varphi_R^{\,2}\ \varphi_I^{\,2}$ means we have four fields coming together in what physicists call a vertex. This vertex describes the interaction between real and imaginal fields and so constitutes what you may think of as a tardyon-tachyon interaction or a mind matter interaction.

Since physicists call *J* a current; you can think of it as a current of electricity or a stream flowing along a river or a wind blowing across the plains. Here the current passes through a field of possibility as a wind passes through a field of wheat only it shakes the stalks as it does. So what *J* stands for is the possibility of something arising from a current *J* flowing somewhere in the universe. *J* also stands for something that has a beginning, an existence or a flow, and an ending—in other words a source and a sink like your bathroom faucets and drains. Think of *J* as you would think of a water spigot,

water, and a basin drain all together. If you see a *J* you can imagine a kitchen sink with the water turned on and the basin sink open to drain it.

K deals with interactions—things that come together, bump into each other in some way, and then go their separate ways. People interact with each other this way and you can think of *K* as representing all such interactions. I'll tell you more about *K* a little later.

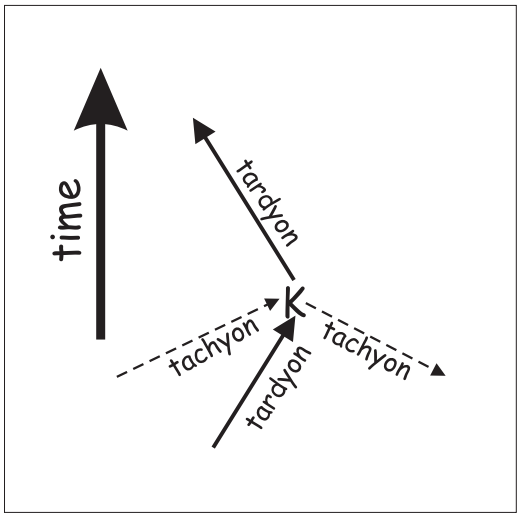

Figure. 2. A simple Feynman diagram interaction between a tachyon and a tardyon.

Briefly we want to know what we can expect to occur when a current *J* is present in our world just as a weather person wishes to know what weather pattern will arise when the prevalent jet-stream coming from the west changes its intensity, altitude, or direction. With *K* we wish to know what happens when any two things interact with each other and then come apart. *Z(J,K)* is just a symbol standing for that prediction which tells us what we can expect to happen—the possibility that it will happen—when *J* and *K* have particular values. However remember this is the result for something happening but then

returning to the vacuum state once again. It is a tempest in a teapot—a temporary imbalance and a quick restoration.

Let me skip across the equal sign (=) a few terms to the letter *e*.[4] This is called an exponential function and *e* is a number that occurs in many fields of mathematics especially when we deal with frequencies and repeating patterns occurring in space and time. It actually has a numerical value of about 2.718281828 . . . The ellipsis stand for missing numbers and since this is known as a transcendental number like the familiar number π which measures the circumference of a circle with a unit diameter, those numbers go on forever and never form a repeating pattern. Rather paradoxically God works with such never-repeating numbers in order to get all of the repeating patterns that we can deal with.

The funny terms atop *e* represent its exponent and that is where all of the really important creation and destruction in the universe takes place. Here is that exponential with its exponent once again:

$$e^{i\int d^4x\left(\frac{1}{2}\left[(\partial\varphi_R)^2-m^2{\varphi_R}^2\right]+\frac{1}{2}\left[(\partial\varphi_I)^2+m^2{\varphi_I}^2\right]+J\varphi_R-K{\varphi_R}^2{\varphi_I}^2+\ldots\right)}$$

(Equation 2)

Those terms represents a vibrational pattern. In fact anytime you see *e* with an exponent like:

$$e^{i\,A}.$$

(Equation 3)

Think of it as a repeating pattern with a repetition rate that depends on *A*—the larger *A* is the faster the pattern repeats. Now let's look at what this pattern in the exponent of equation 2 represents. Here is that pattern once again:

$$i\int d^4x\,\left(\frac{1}{2}\left[(\partial\varphi_R)^2-m^2{\varphi_R}^2\right]+\frac{1}{2}\left[(\partial\varphi_I)^2+m^2{\varphi_I}^2\right]+J\varphi_R-K{\varphi_R}^2{\varphi_I}^2+\ldots\right).$$

(Equation 4)

Here we need to be as little careful and explain that we are working on a time space scale that is far removed from the everyday world. When we think about time for example, we use the letter, *t*, and when we think about space we usually use the letter, *x*. Here we are looking at a scale where the speed of light has the magnitude of 1 unit on this scale of spacetime. Hence since the distance one measures can be measured in terms of how far a light signal would go in one unit of time, we can say that all distances will be measured in terms of this fundamental distance. That unit will depend on either the time scale or the space scale we choose to use. If we use the letter *c* to stand for the speed of light, then since we have distance $x=ct$ and if $c=1$ on this scale, then time and space are measured as equal and we can say they are on equal footing and we can use the single letter, *x*, to measure either space or time. So to represent taking into account all of space and time we use the symbol dx^4.

The scale of the universe depends on mass

But there is more. Eqn. 4 has a name and a meaning. It is called the action integral. Action has a very important meaning in physics. It is represented as a product of quantities that we can measure. It can be expressed as the product of the energy of an interaction times the time over which the interaction took place or as the momentum change of an object during the interaction times the changes in location of the object. This action integral determines what we call the action inherent in the quantum field itself and all action is measured with respect to a fundamental unit of action known as Planck's constant, $\hbar$ (called h-bar).[5] Since action is a product of momentum times distance and momentum is a product of mass times speed then we have the following scale equation to use, $\hbar=mcx$, which we can invert to set our spatial scale as, $x=\hbar/mc$. Hence distances are measured in units of $\hbar/mc$ and time is measured in units of $\hbar/mc^2$. Thus we see that ultimately since Planck's constant and the speed of light are known, we are making measurements on a scale which is purely dependent on the mass, m, of the objects that come into existence in the field. If we are working with electrons which have mass 9.1×10^{-31} kilograms, for example, the time units are measured in units of 7.32×10^{-33} seconds and the space scale is measured in units of 2.19×10^{-24} meters. This is the tiny scale upon which the stage is set to bring electrons into existence.

Thus since in the integral in eqn 4 we use the simple letter x to stand for space and time then dx^4 stand for a four dimensional tiny cube of measure 2.319×10^{-95} quadruple meters. This is the scale upon which God creates electrons. Hence we can then determine all physical units and scales for all masses in terms of the mass brought into existence.

Time and space would have the dimensions of inverse mass making dx^4 have the dimension of inverse mass quadrupled and since eqn (4) must be of zero dimension—that is a pure number—the fields, φ_R and φ_I, must each have the dimension of mass. This does makes sense if you think about it.

Now we'll look at everything here term by term so that you can understand where I am coming from in my descriptions of the Mind of God. The first letter *i* you may remember from reading any of my earlier books. It is the square root of minus one. Whenever we see it, we are dealing with imaginary numbers and it turns out that these numbers when put into an exponent above the letter *e* always mean that a vibration is afoot.

That funny squiggly line, $\int$ —which looks like a stretched-out letter *S*—is called an integral sign; it is a shorthand symbol. In a calculus course in higher mathematics it means summing over or adding up; it is called integration. That sign signifies that we are to integrate or bring together or sum up everything indicated to the right of the sign.

Remember the term dx^4 is a very, very, tiny measure of a four-dimensional (4D) cube which has three spatial dimensions and one time dimension (*ala* the popular saying that we live in a four-dimensional world) which means we are looking at the tiniest volume of space and time we can imagine. Hence this integral sign together with the tiny 4D volume (dx^4) tells us that we are going look into every nook and cranny, every corner of space and time we can possibly look into, namely every cube that exists, has existed, or will exist—the whole universe—and examine what is taking place there and then; that

is, as far as what is inside of those large rounded brackets to the right of the integral sign. Oh in case you are wondering about the 4D since we live in a 3D universe, the 4th D is the time dimension and it is very important as it turns out to have something to do with the action of mind.

Now let us look at what is inside of those large rounded brackets to the right of the integral sign. First let me point to that Greek letters, φ_R^2 and φ_I^2, and what they mean.[6] They stand for two quantum fields—the progenitors of all this—and you can think if them as you would think of two different fields of wheat interspersed together. As you see we find *K* present along side $\varphi_R^2\ \varphi_I^2$ so you might get the idea that these fields are being disturbed by currents from the *J* term and by their constant interaction with each other and you would be correct. Think of the currents as winds blowing across the field and think of the interactions as groups of wheat stalks hitting one another. However one of these fields is really invisible and imaginal. You get the picture.

Propagators and currents

Inside of the square brackets ([,]) we find another pattern. This one is very important for it deals with the movement of vibrations across the field on its own without any currents or interactions. These field vibrations move around the field propagating from one place and time to another. In fact when we actually calculate what is going on in this field (and we will because when you see the answer you will see how God's mind works to create the universe) we find this part of the whole scheme is called a *propagator*. Propagators move field vibrations around—getting the whole field vibrating

in lively patterns from which the so-called real magic emerges as the matter/energy and mind of the whole universe.

As you see there are two propagators—one for the real tardyonic matter field and for the imaginary tachyonic mind field. The two are essentially identical except for the sign in front of the m^2 term. Let me go into each propagator carefully because each has a tale to tell. The first term in the real propagator is $(\partial\varphi_R)^2$. This term tells us that the field is undergoing a change—something is making it do so. The change is taking place over a tiny 4D cube of spacetime. Hence this change moves about. The appearance of the square is also important. It means that the change multiplies itself as it moves. When you write out everything within that squared first term you find the following terms:

$$(\partial\varphi_R)^2 = \left(\frac{\partial\varphi_R}{\partial t}\right)^2 - \left(\frac{\partial\varphi_R}{\partial x}\right)^2 - \left(\frac{\partial\varphi_R}{\partial y}\right)^2 - \left(\frac{\partial\varphi_R}{\partial z}\right)^2 .$$

(Equation 5)

Hence this equation tells us that we are dealing with an organized movement of the field which propagates at a speed. This is a well-known wave equation and when $(\partial\varphi_R)^2$ comes out to be exactly zero we have the equation describing a wave moving at the speed of light. Hence a light wave moves in such a way that the change in the field is zeroed out at every point along its path.

But we don't have that situation here. There is another term in the squared brackets [. . .], namely $m^2\varphi_R{}^2$, and since we know that the field φ_R has dimensions of

mass this term represents the inertia of the field once a mass particle has been created. Thus the field propagates, but against the grain so to speak. In other words the fact of its own existence drags against it and keeps it from moving at a freeing light speed. Later we will see that this drag has an important consequence—it also tends to keep the fields propagating *on the mass shell* which means any field which moves in such a way that if the object generated violates the fundamental equation of mass energy, it tends to dampen out.

This equation is just another form of Einstein's famous $E=mc^2$ equation. Using units where $c=1$ gives it as:

$$E^2 - p^2 = m^2$$

(Equation 4a)

Putting everything together between those large rounded brackets we find a single term for the real field:

$$\left(\frac{1}{2}\left[(\partial\varphi_R)^2 - m^2{\varphi_R}^2\right] + J\varphi_R - K{\varphi_R}^4 + \ldots\right).$$

(Equation 5)

This term is called a name and since it was discovered a long time ago you can guess that the name comes from the person who discovered it some time ago. It is called the *field Lagrangian density*. We often write at with the single letter, *L*, and since it can change as the field, φ, changes we indicate that by writing it as $L(\varphi)$.[7]

Feynman's path integral quantum field theory

Let me tell you about Richard Phillips Feynman briefly. I do this because Feynman was very influenced by Lagrange even as a high school student and from this influence was able to develop what he later called *the path integral formulation of quantum physics* which as the story goes is very important to understanding both quantum field theory and how God's mind enters into it. I will explain Feynman's idea briefly here. The *path-integral formulation* has to do with why quantum physics tells us that anything is possible and that there are parallel possibilities for all things that take action. Maybe that's what Yogi Berra means in the epigraph.

In doing quantum physics we had to begin to look at not only *a* possible way that objects were behaving, but *all* possible ways an object could behave. For example, if an object goes from A to B, we might, in the normal way of thinking, think of it as following a path—a trajectory, like a straight line or a curve. If you hit a baseball it follows a curved line, if you throw a ball it follows a kind of parabolic arch, as when you throw a football for example. We can understand those kinds of things.

The quantum way of describing it is that when you throw the ball it follows every possible path you can conceive of to get from A to B—and you have to take all those paths into account if you want to know where it will go. And it turns out that you needed all these paths, including imaginary ones that you certainly didn't see, because they helped you explain what you finally did see when you did look.

So now let me explain the most important quantum physics part of this equation. To the right of the integral sign we see the symbol $D\varphi$ and it stands for the following sequence:

$$D\varphi = d\varphi(x_1)d\varphi(x_2)\cdots d\varphi(x_n)\cdots = \prod_{i=1}^{\infty} d\varphi(x_i) .$$

(Equation 6)

The integral $\int D\varphi$ is known as a Feynman path integral and it describes the summation of all the fields arising at each spacetime point x_i and then continuing along until the next spacetime point x_{i+1}. Normally when one wishes to perform an integral one deals with a single measure such as $d\varphi$ which means one moves along a straight line path made of increments $d\varphi$ long starting with an initial value of φ and continuing along until you reach a final value. In this Feynman path integral you pick out a point in space and time such as x_i and you watch the field $\varphi(x_i)$ fluctuate even perhaps wildly so and you add up all of that field fluctuations and then move on and do the same thing at the next spacetime point. You do this throughout the whole infinite universe of time and space and lo and behold such a plan as this actually comes up with an answer.

The interaction picture

When we carry out the path integral calculation shown in eq. 1 following the Feynman diagram point of view we find the following relation for the change in the probability amplitude:

$$\Delta Z(k) = K^2/(2\pi)^8 \iint dp^4 dq^4 \frac{1}{p^2+m^2} \bullet \frac{1}{q^2+m^2} \bullet \frac{1}{(p+q+k)^2-m^2}$$

(Equation 7)

Where in the above remember, $s^2 = E_s{}^2 - \vec{s} \bullet \vec{s}$. This Feynman diagram interaction appears as shown in Fig. 3. In the picture we are adding up over all intermediate tachyonic states corresponding to, if you will, the formation of logical thought processes seeking out the correct mass of the incoming tardyon. You might say this is a tardyon in search of its identity. Of course this interaction continues for as long as the tardyonic current exists—the tardyon is in constant interaction with the tachyonic *mind field.* I propose that something like this occurs for all tardyonic matter including you own body and brain.

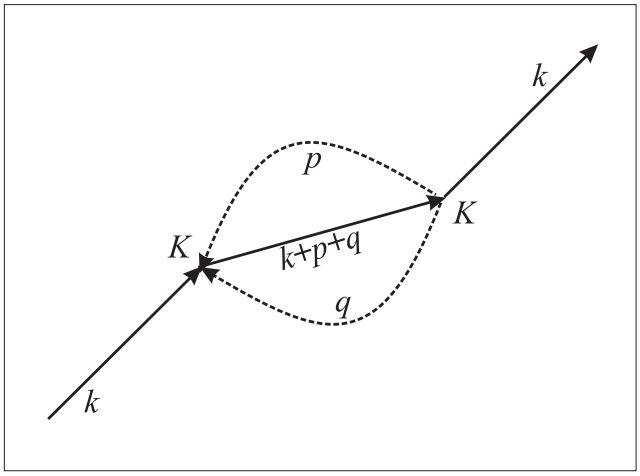

Figure 3. A tardyon interaction with two tachyons—the mind of God in action.

A first refinement would be to include the quantum field theory of the tachyon-photon-tardyon interaction with virtual or real photons carrying the messages from tardyon to tachyon. Before I show this let's consider the important logical order that a tachyon-tardyon interaction using photons as the mediator, brings to the party. I was surprised to discover this and you don't really need quantum field theory to understand

how it works. All you need is some special theory of relativity and the Doppler shift to get it.

Are tachyons information?

Tachyons[8] interacting with tardyons provide the necessary mind-matter interaction. As we shall see this interaction has a certain important logical property. It leads to a natural explanation of how we organize our thinking processes into a past, present, and future. It also may lead to an instability—namely the existence of an unstable tachyonic vacuum state which decays into a stable tardyonic vacuum state with zero mass bosons.[9]

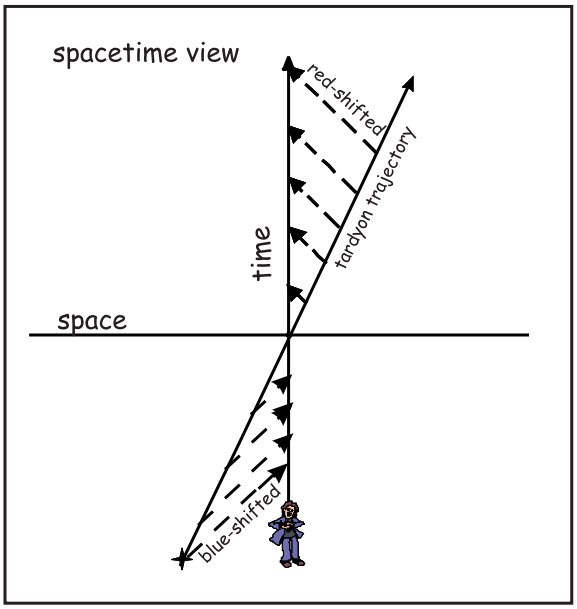

Figure. 4. A tardyon emits light absorbed by another tardyon acting as an observer.

We begin with something fairly well-known called the Doppler shift. You are already familiar with this effect even though you may not know its name. It occurs when you are listening to a train's whistle as the train approaches you when you are stopped at a railroad crossing. The train-whistle's pitch gets higher as it approaches and lowers as it

moves away. The same thing happens with light emitted from a moving source only instead of a changing pitch we see a change in color.

Here we see a real object—a particle of matter—speeding through the universe emitting light as it goes. We call any object that moves slower than light speed a tardyon. We have placed a tardyonic observer in this picture—which is called a spacetime graph. Both the tardyonic object and the tardyonic observer move in this diagram as they both journey through time. The difference is that relative to the observer, the object appears to move toward him and then away from him while emitting light as it goes. The observer sees the light as he make his journey in time and determines where the light is coming from and whether it is approaching him or receding from him. As the object approaches the light rays appear bluer and as they recede they appear redder just like the train-whistle's pitch.

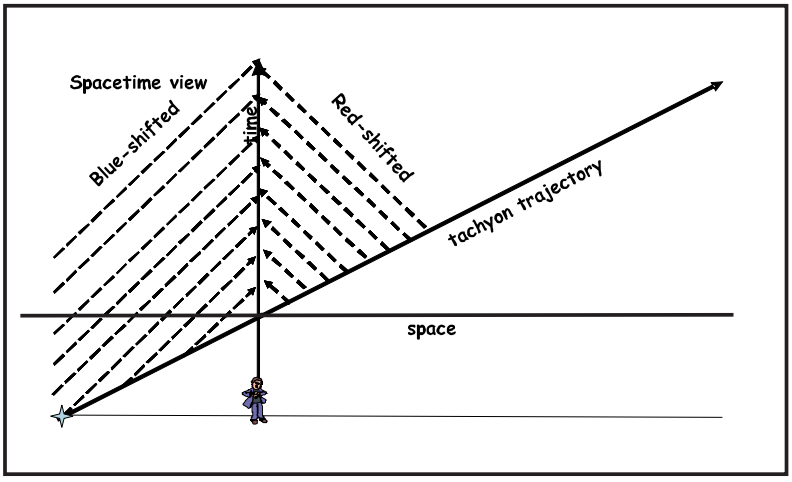

Figure. 5. A tachyon emits light absorbed by a tardyon acting as an observer.

Though no material objects travel faster than the speed of light, according to the special theory of relativity, I speculate that the tachyonic mind field, which is non-

physical and therefore not confined by movements in the material world, communicates with our brains using tachyons as carriers of information. Indeed it must if my idea is correct. As such these tachyons are not limited in their direction through time—they can go backwards and forwards. I speculate that not only can we find the mind matter interaction in this tachyonic realm, we can find the source of all matter and energy put there as information or as an information field—the quantum field—possible what the ancients call the Akashic records.

For those who may have forgotten this Akashic is a theosophical term referring to a universal filing system which records every occurring thought, word, and action. The records are impressed on a subtle substance called Akashi (or ether). In Hindu mysticism this Akashi is thought to be the primary principle of nature from which the other four natural principles, fire, air, earth, and water, are created. These five principles also represent the five senses of the human being.

Some researchers indicate the Akashic records are similar to a cosmic or collective consciousness. These records have also been referred to by different names including the Cosmic Mind, the Universal Mind, the collective unconscious, or the collective subconscious. Others think the Akashic records make clairvoyance and psychic perception possible.

Look carefully and note that no light from the tachyon comes to the observer until the tachyon has actually crossed his path. Whereas for a tardyon (slower than light speed particle), the observer observes light coming from the tardyon well ahead of when they cross paths. Note also that the red-shifted light (RSL) is seen after the tachyon has

crossed his path, so he sees it coming to him from its past positions just as if it were an ordinary tardyon.

We also see that as the tachyon approaches the observer the earlier-emitted blue-shifted light (BSL) arrives after than the later-emitted BSL. Thus as time goes one we see the BSL coming from farther back in time appearing as if it was emitted from something moving backward from the crossing point. This gives us the illusion that the tachyon is going backward away from us yet emitting BSL.

We can see this tachyon's light analogous to the sound made by a supersonic jet. Since a tachyon moves faster than the speed of light, we can not see it approaching. So, after it has passed, we would be able to see two images of it, appearing and departing in opposite directions. Surrounding the tachyon a shock wave of Cherenkov radiation (analogous to a sonic boom), would appear at each moment of time. This tachyonic double image effect is most dramatically illustrated for an observer located directly in the path of a faster-than-light object. Behind the observer a bluish shape is formed by the blue-Doppler shifted light arriving at the observer—who is located at the apex of the Cherenkov cone—from the faster-than-light tachyon as it *approaches*; consequently it moves "backwards" or towards the rear od the observer as light arrives from earlier and earlier positions of the tachyon before it arrives at the observer. A reddish image is formed from red-shifted light that leaves the tachyon *after* it passes the observer; it moves "forward" at lightspeed following and falling behind the tachyon. Since the tachyon arrives before its Cherenkov light, the observer sees nothing until it starts to pass the observer, after which the image-as-seen-by-the-observer splits into two—one of the

spherical volume of light moving ahead of the observer and another moving in the opposite direction to the rear of the observer.

Perhaps what we call ghosts may have something to do with this. It may also explain what happens to us at the moment of death. This also may have a lot to do with how memory works. The RSL anticipates the future and the BSL recalls more and more of the past detail as time goes on. This may also indicate how we can form sentences—it is a tachyonic action field with our deepest thoughts—those from the deeper past occurring to us later as we proceed with our spoken thoughts. Hence out thoughts grow in length and complexity based on recalls from the ever-deepening past.

Conclusion

In this paper I have sketched out what a quantum field theory of mind and matter may look like. I have used a very rudimentary theory involving only spin zero scalar particles for both tardyon and tachyon.

According to Gerald Feinberg[10], spin-zero *tachyons* (he actually gave this name to faster-than-light particles) must satisfy anti-commutation relations in order that their field theory satisfies Lorentz invariance. Consequently these particles obey Fermi-Dirac statistics and are therefore *fermions* even though they have spin-zero and are certainly scalars. Such a contradiction in the spin-statistics theorem is due to the fact that microcausality is not assumed to begin with—these particles do not have unique time directions. On the other hand George Sudarshan[11] has indicated that spin-0 tachyons would be able to satisfy Bose-Einstein statistics and their concomitant commutation relations provided one uses normalizable rather than plane wave solutions for the field. I

have chosen not to get into this by any insistence on the form (statistics) of the field theory wave functions for the tachyon field.

It may be of interest to consider how spin-zero tachyons and tardyons would interact through a vector boson intermediary such as the photon in a full quantum field theory. The formulation in terms of a Feynman path integral might appear like the following,

$$Z(J,K)=\int D\varphi_R D\varphi_I DA e^{i\int d^4x\left(\frac{1}{2}\left[(\partial\varphi_R-ieA\varphi_R)^2-m^2{\varphi_R}^2\right]+\frac{1}{2}\left[(\partial\varphi_I+ieA\varphi_I)^2+m^2{\varphi_I}^2\right]+J\varphi_R+\ldots\right)}$$

(Equation 8)

Such as interaction might appear in a Feynman diagram like that show in the next figure.

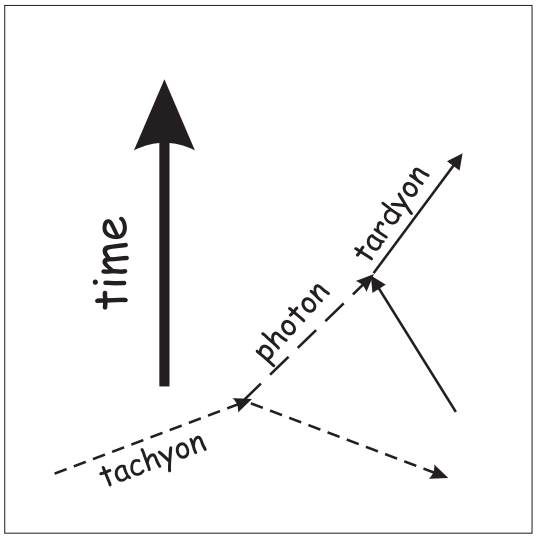

Fig. 6. A tachyon-tardyon interaction using a photon.

One could also argue that the fields representing the bosons could be complex variables or fermionic (spinors) with the more complex Lagrangian as indicated in equations 1a and 1b. Fig. 6 would also represent this interaction.

My interest here is not on the physical properties of the tachyon field, but on its *mental* properties so to speak—its ability to communicate with a tardyon field and thereby influence it. It is the interaction between these fields that leads to the physical world as a matrix of fundamental particles and their interactions with each other and the mind/life force which acts as a monitor to this activity at many levels including our own conscious experiences. The logical order of thought and the possibility of a time direction and cause-effect relationship between events may arise in such a model. For example, the tachyon to tardyon real photon emission of BSL and RSL may indicate normal time order and imply cause effect relationship. While the tachyon-tardyon interaction provided by virtual photon emission of BSL and RSL may indicate an acausal, synchronistic, or reversed time order relationship which arise naturally in quantum physics as entanglement.

For real photons, the BSL appears to the tardyon, as it propagates into the future, as a recording of the past positions of the tachyon (information coming from past positions in space and a recall of those past locations going back deeper in time as the tardyon moves forward in space and time. The RSL appears to be an ongoing record of the tachyon's future positions (a tardyon going forward in space). Hence the model may also explain certain paranormal phenomena such as the appearance of ghosts and mind to mind communication and possible spiritual experiences of the BSL "brings to mind or memory in the tardyon" unforeseen past events.

Notes

[1] For those of you more interested in going deeper into quantum field theory I recommend reading A. Zee's book, *Quantum Field Theory in a Nutshell.*

[2] For example in the equation $L = T - V = \partial\phi^\dagger\partial\phi + \mu^2\phi^\dagger\phi - \lambda(\phi^\dagger\phi)^2$ where $\phi = \varphi_R + i\varphi_I$ we treat $V = -\mu^2\phi^\dagger\phi + \lambda(\phi^\dagger\phi)^2$ as a "potential" which has a maximum at $\phi = 0$ and minima at $\phi = \pm\mu/\sqrt{2\lambda}$.

[3] Anthony Zee puts an anonymous quote in his book (see end note 1) *Always create before we annihilate, not the other way around.*

[4] The number *e* is sometimes called **Euler's number** (see http://en.wikipedia.org/wiki/Euler%27s_number) after the Swiss mathematician Leonhard Euler, or **Napier's constant** in honor of the Scottish mathematician John Napier who introduced logarithms. Since *e* is transcendental, and therefore irrational, its value cannot be given exactly as a finite or eventually repeating decimal. The numerical value of *e* truncated to 20 decimal places is: 2.71828 18284 59045 23536.

[5] The numerical value of $\hbar$ is given by 1.05459×10^{-34} joule-seconds. (See http://en.wikipedia.org/wiki/Planck_constant) In comparison one joule is the small amount of energy: (a) required to lift a small apple one meter straight up, (b) the energy released when that same apple falls one meter to the ground, (c) the amount of energy, as heat, that a quiet person generates every hundredth of a second, (d) the energy required to heat one gram of dry, cool air by 1 degree Celsius, (e) one hundredth of the energy a person can get by drinking a single drop of beer, (f) the kinetic energy of an adult human moving 17 cm every second.

[6] For those of you that wish to go even farther into this, there are also different kinds of fields. Some of them are called *scalar fields* which means they don't act in any particular direction of space. An example of a *scalar field* is well-known to any of you that visit a swimming pool after a child has unfortunately relieved his or her bladder in the pool. That uncomfortable feeling of relative warmth you feel while wadding in the pool is a scalar field. There are also *vector fields*. These are like scalar fields only they point in a direction in space. The field you feel when playing with two bar magnets is an example of a vector field. There are also *tensor fields*. These fields also have directions; however they can act along a given direction and also sideways to a direction. When you skid along an icy patch in winter you are experiencing a tensor field in which you wish to direct your feet down to the ground below you but as you do so you skid to the side. There are also some very special fields called spinor fields and these are not like anything you can imagine—loosely speaking spinor field are like ice-skater spinning on their skates only they must go through two complete turns to get back to where they started! Hence they are weird and hard to imagine. Nevertheless they may be the most important of all. We will have more to say about them later on.

With these different kinds of fields *J* can become a more complex thing to match the field in which it moves. So *J* can be a scalar, vector, tensor or spinor as well.

[7] Actually this Lagrangian is a Lagrangian density since it is to be integrated over space and time. Now before I tell you more about the Lagrangian let me tell you a little about the man for whom this has been

given a label. Joseph Louis Lagrange (January 25, 1736–April 10, 1813) was born Giuseppe Luigi Lagrangia in Turin, Italy. (See http://en.wikipedia.org/wiki/Joseph_Louis_Lagrange) Being a young genius, before the age of 20 he was made a professor of geometry at the royal artillery school at Turin. By his mid-twenties he was recognized as one of the greatest living mathematicians ever because of his numerous and ingenious papers on wave propagation and his calculations of the maxima and minima of many different curves.

He moved to Paris in 1787, became a French citizen, and adopted the French translation of his name, Joseph Louis Lagrange. This French-adopted Italian mathematician/astronomer became even more famous after moving to Paris for his important contributions to classical and celestial mechanics and to a, then, new field called *number theory* and consequently was considered by many as arguably the greatest mathematician of the 18th century.

It was between 1772 and 1788 that Lagrange re-formulated Newton's Classical/Newtonian mechanics to simplify the formulas and ease calculations one does with them. Today this way of viewing mechanics is called Lagrangian mechanics and it is published in his greatest work, *Mécanique Analytique* (Analytical Mechanics) (4. ed., 2 vols. Paris: Gauthier-Villars et fils, 1888-89. First Edition: 1788). Even today it is a mathematical masterpiece and the basis for all later work in this field including quantum field theory and Richard Feynman's 1948 formulation of spacetime physics.

Under Napoleon's rule, Lagrange was made both a senator and a count; and upon his death was buried in the Panthéon. Over and above many papers, in his great treatise, the *Mécanique analytique*, he provided a new and abstract look at the Newtonian world of machines that began to spring up around him. One such creation was the law of virtual work—work that actually isn't performed but could be imagined to be done, From that one fundamental principle, it was possible to create the calculus of variations—a method for calculating the effect of varying conditions on any mathematical function, such as the Lagrangian from which one deduced the mechanics of nearly everything that existed, both solids, gases, and fluids.

The object of his book was to show that the behavior of the mechanical universe is implicitly included and derivable from a single principle, and to give a general formula from which any particular result can be obtained. Lagrange thus invented a way of thinking abstractly about the world—a means that for many of us unskilled in such thinking remains mysterious. This form of thinking represents anything of interest by abstract symbols which in turn can be varied to give any specific concept desired. This is in fact no more mysterious than letting *x* stand for any number as is well know in algebra classes.

Lagrange's method is brilliant analysis. Instead of following the motion of each individual part of a material system, as others before like Newton had done, he showed that we can divide the energy of the mechanical system into two parts: the energy of motion or so-called kinetic energy and the energy available for use but not actually expressed called the potential or virtual energy. Then he considered the

expressions for those energy terms as functions of two very important general concepts—where things are (their positions) and how fast these things are changing those positions (their movements expressed by momenta or velocities). By doing this he found an equation that made *L(φ)* an extreme—a number that had to be as large as was possible or as small as was possible.

[8] In quantum field theory, a tachyon (see http://en.wikipedia.org/wiki/Tachyon) is a quantum of a field—usually a scalar field—whose squared mass is negative, and is used to describe Spontaneous symmetry breaking: The existence of such a field implies the instability of the field vacuum; the field is at a local maximum rather than a local minimum of its potential energy, much like a ball at the top of a hill. A very small impulse (which will always happen due to quantum fluctuations) will lead the field to roll down with exponentially increasing amplitudes: it will induce tachyon condensation. It is important to realize that once the tachyonic field reaches the minimum of the potential, its quanta are not tachyons any more but rather have a positive mass-squared, such as the Higgs boson.

Technically, the squared mass is the second derivative of the effective potential, at a point where the first derivative is zero. So for a tachyonic field the second derivative is negative, meaning that the effective potential is at a local maximum rather than a local minimum. Therefore this situation is unstable and the field will roll down to another point, stopping only at a local minimum, where its quanta have a non-negative squared mass, so that it is not tachyonic any longer.

Since a tachyon's squared mass is negative, it formally has an imaginary mass. This is a special case of the general rule, where unstable massive particles are formally described as having a complex mass, with the real part being their mass in usual sense, and the imaginary part being the decay rate in natural units [4].

However, in quantum field theory, a particle (a "one-particle state") is roughly defined as a state which is constant over time, i.e., an eigenvalue of the Hamiltonian. An unstable particle is a state which is only approximately constant over time; However, it exists long enough to be measured. This means that if it is formally described as having a complex mass, then the real part of the mass must be greater than its imaginary part. If both parts are of the same magnitude, this is considered a resonance appearing in a scattering process rather than particle, since it does not exist long enough to be measured independently of the scattering process. In the case of a tachyon, the imaginary part of the mass is infinitely larger than the real part, and hence no concept of a particle can be attributed to it.

It is important to stress that even for tachyonic quantum fields, the field operators at spacelike separated points still commute (or anticommute), thus preserving causality. Therefore information never moves faster than light.

Examples for tachyonic fields are all cases of spontaneous symmetry breaking. In condensed matter physics a notable example is Ferromagnetism; In particle physics the best known example is the Higgs mechanism in the standard model.

[9] These are known as Nambu-Goldstone bosons which arise in a complex field theory. One interesting consequence of this arises from noticing that for a quantum field theory with dimensions less than 3 spontaneous symmetry breaking is not possible.

[10] G. Feinberg. "Possibility of Faster-Than-Light Particles." *Physical Review.* Vol. 159. No. 5. pp 1089-1105. July 25, 1967.

[11] E.C. G. Sudarshan. "Lorentz Invariance, Local Field Theory, and Faster-than-Light Particles," Phys. Rev. **173**, 1622 (1968); with M. E. Arons.