# Beyond Einstein: non-local physics


(popular format)

## Introduction

Einstein's Special and General Relativity theories, have proven to be very useful in the several decades since the theories were introduced, starting in 1905 and 1907–1915. It is noteworthy, however, that these are "local" theories by design and intent. They simply do not address the "non-local" behaviors discovered by physicists in the decades since SR and GR were introduced.

You have no doubt heard people say things like "according to Einstein, nothing can travel faster than light". But the existence of aberration free forces which appear to have instantaneous effects ("faster than light") even over large distances, was simply not recognized in 1905 when Special Relativity was introduced. Einstein himself noticed some problems in this regard in a 1935 paper which is now referred to as the EPR paradox. In the following decades more and more experiments revealed more and more problems. But these "faster than light" problems are simply outside the scope of SR and GR; a "local" theory cannot treat truly non-local phenomena in a satisfactory manner.

The following analysis gives powerful and fascinating insights about the deep properties of space, time, and motion. It uses one of Einstein's own equations to develop satisfying, intuitive explanations for many of these mysteries and paradoxes raised by Relativity. It is intended for a general science audience—people who "like science". It has been compiled from previously published obscure sources in scattered locations on different themes over the years.



## The Universe has two behaviors: local and non-local

The Universe has two types of physical behaviors. Physicists call them "local" and "non-local".

Local physics is characterized by cause-and-effect being linked by spatial contact or spatial proximity. It limits all speeds to less than that of light or light speed itself. It conceptualizes "space" as a connecting medium (rather than something that separates). It is the everyday physics that is very familiar to us and is widely taught in the schools and has immediate practical applications. It includes Newtonian mechanics, statistical mechanics, chemistry, biology, etc. To the human mind, it "makes sense" and is intuitively understood even by people who are not scientists or engineers.

Non-local physics, in contrast, is virtually unknown to the general public. It is not taught in the schools, except in the form of quantum mechanics (which has a limited but very important scope). It is characterized by cause-and-effect NOT being linked in space ("action at a distance"). Speeds of interaction are instantaneous or at least superluminal, and are not limited by spatial separation, even if the interacting objects are separated by light years. In its full scope, non-local physics is weird, baffling and non-intuitive. It has practical applications that are strange, bizarre, and astonishing.

The usual illustration to help the layman understand the difference between these two types of physics uses a doll. If someone sticks a pin in the head of the doll, the effect is that the doll acquires a pinhole in its head. The cause is direct spatial contact with the pin. Cause and effect

are linked in space, and are easily and intuitively understood. This is "local physics" or "physics of locality".

Now suppose the doll is a voodoo doll. If someone sticks a pin in the head of the doll, the victim immediately gets a headache. The action occurs instantly and at a distance, even if the victim is on another planet, or light years away. There is no propagation in space or traversal of space (as with an arrow or a bullet). Spatial shielding is not possible and the cause is not apparent to the victim. The only apparent connection between cause and effect is one of *time*. The science is baffling and paradoxical; it is sometimes even called "voodoo physics."

Physicists have identified several non-local behaviors. The most obvious ones are gravity and electric and magnetic fields. These display the characteristic "action-at-a-distance" behaviors, and (as we will see later) exert forces that seem to be superluminal.

Another one well-known in physics circles, is the EPR paradox. It was a "thought experiment" in quantum mechanics proposed by Einstein, Podolsky, and Rosen in 1935. Its essence was that under certain circumstances, measurement of one particle's properties could instantaneously affect another particle's properties, irrespective of spatial separation. This was a violation of "causality", and was contrary to common sense and to the "local" views of physicists (including of course Einstein) of that time. Something, was apparently wrong with the predictions of quantum mechanics. Hence, it became a "paradox". Later, Bell's theorem of 1964 allowed this proposition to be tested experimentally. The conclusion was that measurement of one particle does indeed instantaneously affect the other. The effect became known as "quantum entanglement". It could not be adequately treated within the "local" framework of Einstein's Special or General Relativity.

Various other experiments pointed to the conclusion that the Universe really does have non-casual, non-local behaviors:

- Aharonov–Bohm effect 1949-1959)
- Aharonov-Casher effect (1991)
- Chalmers W. Sherwin and Robert D. Rawcliffe experiment (1960).
- Clauser-Horne-Shimony-Holt inequality (1969)
- Stuart Freedman (1972) and Alain Aspect (1981)
- Colella-Overhauser-Werner effect (COW)

These showed, variously, the unexpected influences of "potentials", instant action-at-a–distance for electric or magnetic fields, and that the effects could not be explained by as yet undiscovered "hidden variables" that had a "local" nature. These experiments, along with the non-local behaviors inherent in Quantum Mechanics, led to the conclusion that "local realism" had to be abandoned.

Einstein would not have liked these conclusions. His Special and General Relativity theories were intentionally and purposefully "local" theories and had, and still have, many uses and successes. SR and GR are actually intuitively understandable (if you can keep your head on straight); the mathematics of SR can even be understood by high school students who have a background in algebra and trigonometry. The theories work fine for reference system effects, but are not adequate to deal with non-local phenomena—not even Einstein's own EPR paradox. Additionally, SR and GR still have not been reconciled with quantum gravity.

There is a startling resolution to these problems, however. It is buried in one of Einstein's own equations: $\mathbf{E = mc^2}$ .

## What $E = mc^2$ reveals about gravitation, space, time, and motion

Einstein is especially well known for his equation that expresses the relationship of energy and mass. Written in its usual "local" form it is

$$E = mc^2$$

For our purposes, we need to express it in its "non-local" form:

$$\frac{E}{\left(\frac{1}{c}\right)^1} = \frac{m}{\left(\frac{1}{c}\right)^3}$$

The first form is the one most of us are familiar with. It is simple, computationally friendly, and is the one that students would use on timed tests. The second one still works out to $E= mc^2$ . but gives us some additional insights. It is saying that mass is a three-dimensional form of energy. And it is suggesting that the 1/c term has some sort of special significance that is not normally recognized. Most important to us is that the dimensions of mass can be worked out in pure space/time units. In conventional physics and engineering, space, time, mass, and charge are regarded as the fundamental dimensions. But here we have an opportunity to see what the dimensions of mass would be in terms of pure space and time. The table below shows the dimensions of all terms in pure space/time dimensions.

| Item | Name | Space/time dimensions |
|---|---|---|
| c | speed of light | s/t |
| 1/c | energy | t/s |
| m | mass | $t^3/s^3$ |
| E | energy | t/s |

The 1/c in the denominators of *both* sides in a *fundamental* equation like this one, suggests that 1/c is some sort of "unit quantity". It is like "unit pricing" in the grocery store. You can get so many ounces of nuts for <u>*one*</u> dollar, or a cost of so many cents per <u>*one*</u> ounce. Hence, 1/c is <u>*one*</u> unit of *energy* and $(1/c)^3$ is <u>*one*</u> unit of *mass*. For quantities, we get 1=1 in the numerators and $1^1 = 1^3$ in the denominators.

The same reasoning applies to c itself. It is in the denominator of 1/c, and so it too must be a fundamental <u>*unit quantity*</u>. In this case it would be one unit of <u>*speed*</u>.

Hence, we now have a unit quantity of speed, a unit quantity of energy, and a unit quantity of mass. Also, implied is that there are unit quantities of space and of time. In other words, all these items are "quantized". That is, they exist in discrete, rather than continuous, units, at least at a fundamental level.

And so we discover that the Universe not only has built in mathematics (enough of a mystery), it also has built in unit quantities. And if mass and energy can be expressed in terms of pure space/time dimensions, then apparently everything else can too, if we insist on dimensional consistency (rewrite the textbooks!)

## Non-directional motion

The dimensions of energy (t/s) and the dimensions of mass ($t^3/s^3$) are puzzling. Do they have a physical meaning or are they just mathematical artifacts? Space/time is just ordinary speed or velocity in space with respect to time. So time/space must analogously be a speed in time relative to space. That implies that both space and time must be three-dimensional, and that space must progress like time, and that there must be locations in time just as there are locations in space. So in addition to the concept of spatial motion and position we have the concept of temporal motion and temporal position. But what would a temporal motion look like in a spatial reference system? How could we identify a "when" motion in a "where" type of reference system?

One thing that is apparent is that a temporal motion (or temporal momentum) cannot have a preferred direction in a spatial reference system. It must be non-directional (like time) and have only a magnitude. It is a "scalar" as the mathematicians would say. In contrast, a ***spatial*** speed has both a direction and a magnitude, and is mathematically described as a "vector".

Hence, energy, expressed as t/s, must be a magnitude-only, "scalar" quantity. And mass, expressed as $t^3/s^3$ must likewise be scalar (having only magnitude but no direction). It turns out that both of these are indeed treated as scalar quantities in ordinary physics.

There is one more quirk that we can wring out of this. The speed of light is *c*, and it is a unit quantity and can therefore be expressed as 1/1 or as 1/1. No, that is not a typo. It means that ***at the speed of light***, spatial and temporal speeds are equal. That is, s/t = t/s because they are both 1/1 (one unit of time divided by one unit of space, or vice versa). This is telling us that a temporal motion can appear to us as some kind of energy, especially at speeds near that of light.

So let's look at electrons being accelerated in a large particle accelerator. We are interested in finding a good measure of the "amount of motion" these electrons possess. An electron with a speed of 0.995 that of light, has an energy of about 15 MeV. At a speed of 0.99999995 that of light, it has an energy of 5 GeV. Note that the *speed* has increased by a factor of only 1.0005 but the *energy* has increased by a factor of 300. How can there be such a huge increase in energy with only a tiny (5 parts in ten thousand) speed increase? Physicists say that the mass of the particle increases. The mathematics of this claim are consistent with the behavior, and so this is one possible interpretation.

But in light of the above, an alternative presents itself. The real speed of the electron is a combination of spatial speed and temporal speed. Spatial speed is space/time. Temporal speed is time/space. The former has a direction, is mathematically "vectorial", and is very familiar to us. The latter is non-directional, is mathematically "scalar" and is not at all familiar to physicists or engineers. In fact, it does not seem to make any sense at all. It is not a *speed in space*, but is a *speed in time*.

How these two different speeds combine can be seen in the Lorentz-Einstein correction factor commonly known as "gamma". In local form it is:

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The non-local form is:

$$c^2 = (c/\gamma)^2 + v^2$$

The second form of the equation is saying that everything moves at the speed of light, and that the total speed is composed of a non-local speed and a local speed, or, in other words, a temporal speed and a spatial speed. The magnitude of the temporal speed cannot be directly summed with a spatial speed unless the $\gamma$ correction factor is applied.

It follows that there must be two kinds of speed measurements, one for spatial speeds, and another for temporal speeds. Spatial speeds have the dimensions of c (s/t) but temporal speeds have the dimensions of 1/c, that is, energy (t/s). Spatial speeds are always less than that of light, and temporal speeds are always above the speed of light. Both are equally common and ordinary, as we shall see later.

In the particle accelerator, the measure of motion starts out as a change of position in space with respect to time (velocity). But at higher speeds, the measure of motion includes an increasingly larger temporal component, and its proper measure is *energy*. From the standpoint of non-local physics, the mass remains constant.

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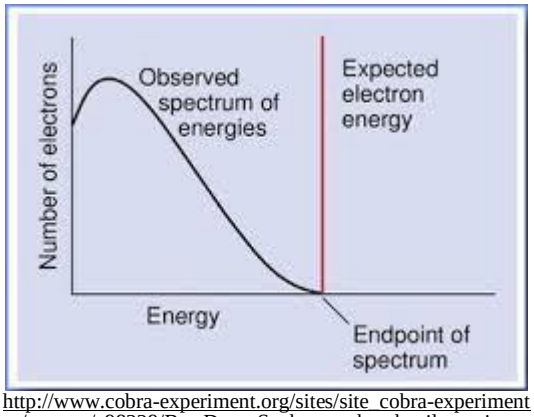
Actually that "increase in mass" stuff is only taught to freshman; to a physicist the issue is momentum/energy increase, not mass increase. I wish I had known about this when I learned about beta decay. Massless particles have momentum, even though they do not have mass.

In beta decay there are supposed to be two end products: an atom and either a positron or an electron which is ejected in the decay process. The energies involved should be discrete and sum to a certain expected value, in accord with the principle of Conservation of Energy. But the observed energy spectrum of the electron (or positron) was continuous, not discrete. Wolfgang Pauli had to invent the neutrino to account for the missing energy. But I could not figure out how that solved the problem.



http://www.cobra-experiment.org/sites/site_cobra-experiment/content/e98229/BetaDecaySpektrum_thumbnail_eng.jpg

The neutrino was massless and moved at the speed of light. How could it vary in energy with a fixed speed and no mass? What I did not know was that physicists in this case are looking only at energy/momentum increase—something more fundamental than mass. The mass can remain at zero and the speed can still change, but the maximum speed that can be portrayed as a *change of position in space with respect to time*, is *c*, the speed of light. Anything beyond that is non-local and will appear as energy (1/c). Problem solved.

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Most people are initially uncomfortable with the concept of non-directional motion, and so-called "dimensions of *motion*", in contrast to dimensions of space or dimensions of time. But we

do in fact experience instances of non-directional motion. You see it every time you watch TV. As the camera zooms in on a scene, all the picture elements move outward and away from each other. This is really just *one motion* but it requires two dimensions of space to describe it.

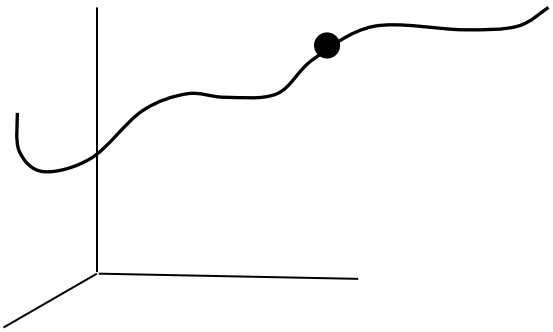
You see it again when using your computer. If you want to expand a Microsoft window, there are two ways of doing it. You can drag one edge, say rightward, and then drag another edge, say downward. We could say that *TWO*, *one-dimensional motions* have enlarged the picture in two spatial dimensions.

You could also drag a corner and accomplish the same thing. In this case you are applying *ONE*, *two-dimensional motion* to enlarge the picture in two dimensions. (Read that carefully.)

Astronomers use these concepts in explaining the expanding Universe. They use the surface of an expanding balloon to illustrate spatial inflation. As the balloon expands, all points on the balloon's surface move away from each other. All have equivalent motion, and no one point is more special than any other point. It is a centerless expansion and there is no "zero" point, or point of origin for the motion (as there would be in an explosion). It is a two-dimensional example of the expansion of space in a three-dimensional Universe.

A distortion is introduced, however, when one point on the balloon is designated as "stationary" and the motions of the other points are referred back to the stationary point. The motion that would have been attributed to the stationary point is now attributed to the other points. One point loses a motion that it inherently has, and the other points now acquire an additional motion that they do not in fact possess, just due to the choice of a reference system. This will skew an astronomer's interpretation of a redshift; part of that redshift is attached to us, and the other part is inherent in the object being observed.

If you survived all that, you are now ready for the heavy-duty, industrial strength stuff. Picture a bead on a wire as in the illustration below.

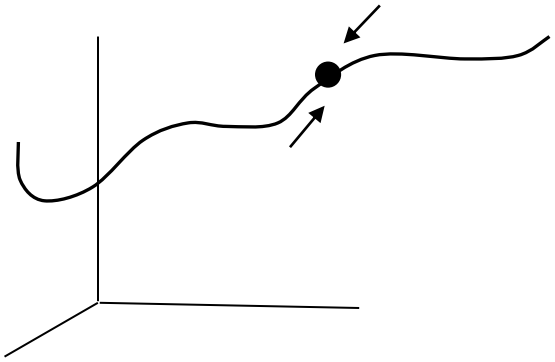


The wire snakes across the room in some arbitrary fashion and defines a path for the bead. Of course, the wire does not really exist; it is simply an aid to visualization. The "dimension of motion" is represented by the wire. The motion itself is one dimensional but requires three dimensions of spatial displacement and one dimension of progressive time displacement to describe its movement.

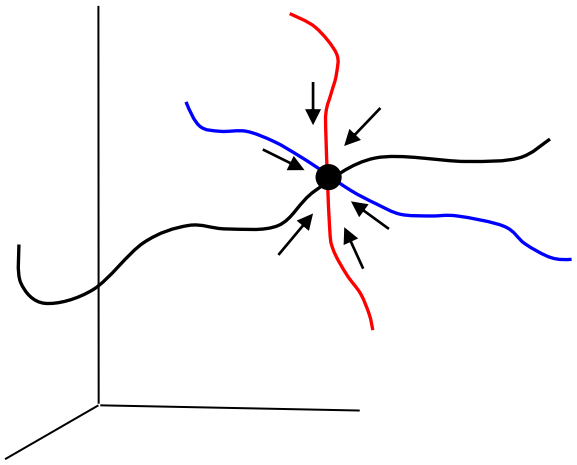
The terminology here is intended to be different from what you learned in high school. Back then you would say "a pyramid is three-dimensional" but you would not mean that there are three dimensions of "pyramidism". You meant that the pyramid extends itself in space in three independent ways. In the illustration, the wire represents the *one* dimension of motion as seen by the bead. You could also call it one "motional dimension".

Suppose instead of the bead moving on the wire, the *wire* is moving and the bead is stationary relative to the room. The bead can only "see" the wire, and as far as the bead is concerned, it is still moving.

Now let's split the wire into two pieces inside the bead. Now we can have the *wires* move inwards or "towards" the bead. (We will say that the wire is "consumed" inside the bead, because the wire does not really exist anyway.) There is still only one dimension of motion, but now the motion is *non-directional* in the only defined dimension of motion. It still has a "polarity" in that the motion can be "towards" or "away". But otherwise it is non-directional.



Suppose we now add two more wire paths and make them all mutually perpendicular, each with a split segment that is moving into the bead.



We now have *three dimensions of motion* which are all non-directional.

This is not just an academic exercise in mental gymnastics. It illustrates the way gravity actually behaves. This kind of motion does not have a "trajectory" but instead the word "potential" is used (as in "gravitational potential"). In fact, we can derive Newton's law of Universal Gravitation from it.

## Derivation of Newton's gravitational equation from $E = mc^2$

Replace the bead with a planet. Let *m*, stand for mass or motion. Then because this motion is non-directional, its intensity will be inversely proportional to the distance between *m* and a detector. It is like light from a light bulb. When you hold your hand (a detector) near the bulb, you feel a certain amount of heat. As you move your hand away from the bulb, you feel less heat. The total amount of light emitted is constant, and the area of your hand is constant also. What changes is the distance. The light is effectively being spread out on an invisible spherical surface. Your hand is part of that surface. As your hand moves away, the surface gets rapidly bigger relative to your hand. The surface area of a sphere is proportional to the radius squared, and so the intensity at your hand is inversely proportional to the square of the radius. Hence, we have a reduction factor of $r^2$ and so:

$$\text{Motional potential} = m/r^2$$

We need to adjust this form so as not to introduce extraneous units, like square meters, into what at this point is purely a geometry problem. Hence, we will divide out the units (meters, feet, etc.) by using a radius that represents a unit area. We will call it $r_0$. Hence, we have

$$= m/(r^2/r^2_0)$$

This leaves *m* as pure motion, multiplied by a pure number that accounts for the geometry. (The $r^2_0$ term is numerically equal to one; it represents the area of your hand, treated as one unit.)

What if we had twice as much mass? Obviously, we would have twice as much motion. We have to account for this too. We have to multiply *m* by another factor that accounts for a multiplicity of mass units. Again, we use a unit mass and create a pure number just like we did with r, except now we will rename the original mass, *m*, and call it $m_1$. Then we have:

$$\text{Motional potential} = \frac{(m_1/m_0)}{(r^2/r^2_0)}$$

If we have two separate masses with this behavior (like the Earth and the Moon), they will behave as though each acts on the other. This results in a multiplicative effect. If we call the additional separate mass $m_2$, then we get:

$$\text{Motional potential} = \frac{m_2\,(m_1/m_0)}{(r^2/r^2_0)}$$

This is equivalent to Newton's Universal Law of Gravity equation without G as the proportionality constant (which is not needed if unit quantity amounts are used).

So here we have derived the Law of Gravity by using the concept of temporal motion, which in turn came from $E = mc^2$. Note that there are no gravitons, gravity waves, space warps, four dimensional space-time or eleven dimensional strings. The only thing needed was the concept of temporal motion—a simple explanation for a simple phenomenon. Gravity *is* temporal motion.

But temporal motion is not the *cause* of gravity. More on this later.

You may, in general, suspect temporal motion is operative when physicists use the term "force fields".

# The speed of gravity is MUCH faster than the speed of light

There are still a lot of questions that need to be asked and answered at this point. First and foremost is about the speed of gravity. How fast is it? Specifically, is it faster than light?

According to Einstein, as well as most of today's physicists, the answer would definitely be, No! But Einstein's Special Relativity of 1905 was specifically and intentionally a "local" theory, which limits all speeds to that of light. Speeds greater than light are simply "out-of-scope" and are not addressed by the theory. Non-local effects like the action-at-a-distance of gravity and electric and magnetic fields were conceptualized back then as "local" by the Faraday/Maxwell "field" concept. This treated space as a connecting medium, instead of something that separates. Additionally, this was all before Quantum Mechanics (1925-1927) and other non-local behaviors began to be noticed, even, ironically, Einstein's own EPR paradox of 1935.

Today we have more facts at hand to help resolve this question. Consider what astronomer Dr. Tom Van Flandern says about the speed of gravity.

> "The most amazing thing I was taught as a graduate student of celestial mechanics at Yale in the 1960s was that all gravitational interactions between bodies in all dynamical systems had to be taken as instantaneous. . . .Indeed, as astronomers we were taught to calculate orbits using instantaneous forces; then extract the position of some body along its orbit at a time of interest, and calculate where that position would appear as seen from Earth by allowing for the finite propagation speed of light from there to here. . . . That was the required procedure to get the correct answers." (" The Speed of Gravity - What the Experiments Say" , Tom Van Flandern, *Physics Letters A*, 250 (1-3) (1998) pp. 1-11; see also http://www.metaresearch.org/cosmology/speed_of_gravity.asp )

The most obvious and incontrovertible experimental evidence for an extremely high speed of gravity is that gravity has no aberration (see figure below). Gravity from an object always coincides with that object's position. If the object moves, there is no gravity still on its way from the "retarded position", as there would be from a light or sound source. Evidence from the motions of celestial bodies, from radar ranging, and from a binary pulsar lead to the conclusion that the speed of gravity is at least 20 billion times ($20 \times 10^9$) faster than the speed of light.

Other experiments have led to similar conclusions. Consider this from "Measurement of the Speed of Gravity", Yin Zhu (2013) http://arxiv.org/ftp/arxiv/papers/1108/1108.3761.pdf

> Appendix B
> The speed of Gravity:
> An Observation on Satellite Motions
> Abstract
> "The radius of orbit of the geosynchronous satellite can be observed at the precision of less than 8cm. And, a force about ~$10^{-9}$m/s$^2$ can make the orbit of satellite shifted. Here, the gravitational forces of the Sun acting on the satellite from the present and retarded positions are calculated respectively, assuming that the retarded position is determined with that the speed of the gravitational force is equal to the speed of light. It is shown that the difference of the force between the present and retarded positions of the Sun acting on a geosynchronous satellite can be larger than $1\times10^{-7}$m/s$^2$ . And, the difference of the radius of the orbit of the satellite perturbed by the gravitational force of the Sun from the present and retarded positions in 3000s can be larger than 8.2m. It indicates that the gravitational force of the Sun acting on the satellite is from the present position of the Sun and that the speed of the gravitational force is much larger than the speed of light in a vacuum."

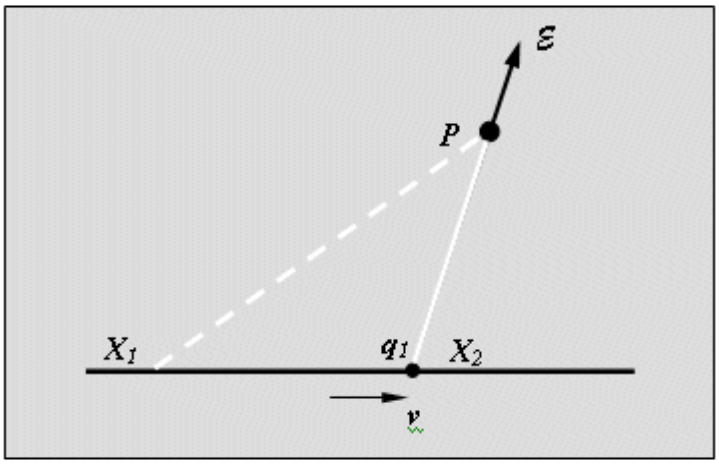
And this one from “The Cosmic Ether: Introduction to Subquantum Kinetics” Paul A. LaViolette . (2012) http://www.sciencedirect.com/science/article/pii/S1875389212025205 :

> “ . . . a moderately simple experiment performed by Alexis Guy Obolensky has clocked speeds as high as 5c for Coulomb shocks traveling across his laboratory (LaViolette, 2008a). Furthermore Podkletnov and Modanese (2011) report having measured a speed of 64c for a collimated gravity impulse wave produced by a high voltage discharge emitted from a superconducting anode.”

Professor of Physics, A. P. French, has a relevant note in his very informative book, *Special Relativity* (1968), p. 242-243; 267 "Relativity and electricity":

> "Now the electric field due to a stationary source charge is radial and, of course, spherically symmetrical; that is, it is the same in all directions. It is simply the Coulomb field . . . . If the source charge is moving uniformly, the electric field is no longer spherically symmetrical. Its strength is different in different directions. But, at each instant, the direction of the electric field is still radial with respect to the position of the source charge at that same instant.
>
> If you think about this last result a bit—that at each instant the electric field due to a uniformly moving source charge is directed radially away from the position of the source charge *at that same instant*—you may begin to realize that this is a very surprising result."

To see why this is so surprising, consider the following illustration:




The electric field from a moving electric charge has no aberration.

Electric charge, $q_1$, is moving at high speed in a particle accelerator from $X_1$ to $X_2$. A charge detector is located at $P$ and it can detect both the intensity and direction of the field associated with $q_1$. Hypothetically, $q_1$ is emitting an electric field which propagates at the speed of light. As $q_1$ passes through location $X_1$, the field is on its way to $P$, but takes a finite time to get there. But by the time the field reaches $P$, $q_1$ has actually moved to $X_2$. From what direction then does the detector at $P$ see the electric field as $q_1$ arrives at $X_2$. Does it see the field as though it were at the "retarded position" of $X_1$? Or does it see it as emanating from $X_2$ where $q_1$ is presently located?

French continues:

> "Nevertheless, the field at *P* points away from the *present position* of $q_1$. Nature behaves in such a way that, for a uniformly moving source charge, even though the field produced at some point *P* originated from the location and behavior of the source charge at an *earlier time*, nevertheless the field points away from the position of the source charge at the present time. It is as though nature calculates where the source charge should be at the present time and acts accordingly. . . . Thus a result which at first glance may seem rather obvious is seen, upon closer examination, to be quite surprising—but nevertheless true."

But it is surprising only if, as French says, "if we believe that no effect—no mass, no energy, no force—can be transmitted with a speed greater than *c*". If the electric field propagates instantaneously, then the lack of aberration is no surprise at all. We just simply have a different problem requiring a different explanation, namely, how can electric fields propagate instantaneously?

The answer to that problem is simple. Electric fields don't propagate. They are "non-local" in a spatial reference system, much like the concept of time, which is not affected by spatial position. Gravitational fields are likewise.

## Reference system effects

**Photons have no motion:**
Einstein said that the photon does not experience the passage of time. Objections to Special Relativity have been raised on this point because it implies that photons have no trajectory. In other words, photons are stationary. Yet physicists freely manipulate photons with mirrors, lenses, diffraction gratings, etc., as though they *do* have trajectories. Therefore, it is argued, Special and General Relativity must be fundamentally flawed.

The only obvious counter argument is that if the trajectory cannot be attached to the photon, then it must attach to the reference system. But this is like saying if the photon were a basketball, the ball would be stationary and *the court would move* instead. At first that seems ridiculous. But on second thought, it reminds us of the bead on the wire illustrations. And so maybe it is not so ridiculous.

In non-local physics, you have to get used to some really weird thinking patterns. Suppose, just suppose, that we require the reference system to do the moving instead of the photon. What would be required? Two things seem to be clear: First, because the photon can be deflected in any direction, the reference system must be moving in any and every direction. Secondly, photons move at the speed of light. If the photon is to be stationary, then the reference system must be moving at the speed of light. Are those insurmountable requirements?

No. The concept of temporal motion makes it all possible. As has already been explained, gravitation, is non-directional temporal motion ($t^3/s^3$). That means that the reference system actually *is* moving in all directions simultaneously. If I jump out of a tree, I am temporarily in "free fall". There are no forces acting on me. I am in an "inertial reference frame" (as per Einstein). It is the Earth that then moves up to meet me (as per Einstein). But if I jump out of a tree from another spot on Earth diametrically opposite to the first one, the same thing happens. In fact, I could do this anywhere, and get the same result. The Earth—the reference system we are using—is engaged in the very kind of motion that is needed to assign a seeming trajectory to the photon, exactly as required.

That gravitation acts in all directions has also been shown by experiments performed by Colella, Overhauser, and Werner (the "COW effect"). They used a neutron interferometer to show that gravity has an active horizontal component. In other words, this means that gravity has three

"motional dimensions", but the effects of only one of those can be represented in the common spatial reference system.

Ok. Now how do we get a laboratory to move at the speed of light. Simple. We attach it to Earth! Again, Earth has that $t^3/s^3$ temporal motion. We can assert that the reference system "stays put" *in space*, but that it moves at the speed of light *in time.* That means that even though the *spatial* coordinate remains fixed, the *time* coordinate associated with that position continually changes. When I sit stationary in a chair, I am actually still moving, because time is progressing, and my time coordinate keeps changing. We sense this intuitively. All we need to say is that *time* is progressing at the speed of light. Remember that equation with the gamma factor (above). It said that all things move at the speed of light, and that the total speed is composed of a temporal speed and a spatial speed. Compared to the speed of light, the spatial speed of the Earth is nearly zero. Hence, the vast majority of its motion is in time, and that is in fact the meaning of $t^3/s^3$.

**The static Aether was not detectable**

There is yet another consequence to this non-directional, non-vectorial, scalar, isotropic, motion the Earth is engaged in. Remember the Michelson-Morley experiment? It attempted to detect the absolute motion of the Earth through the Aether, which was supposed to be some sort of invisible substance which filled the Universe as a medium for light waves and which was thought to be stationary. But as the Earth moved around the Sun, no "Aether wind" could be detected by this clever experiment. Physicists then concluded that the Aether did not exist, nor did absolute motion, and that all motion must therefore be "purely relative".

This experiment depended on vector addition of velocities, but the *fundamental* (or "absolute") motion of the Earth is *scalar* (in all directions, like an expansion). The design of the experiment was simply not capable of detecting this kind of motion. There may still be an "ether" (a specific structure of space and time), but it must be a dynamic, non-directional one, quite unlike the static Aether of the 1800s. Space and time must be "emergent" at the speed of light. The Ether is like the wires in the wire/bead illustration, but with the wires moving *out* of bead instead of inward. Objects with mass move "anti" to this outward motion (which originates everywhere and everywhen). And we call that motion "gravity".

What about the photon? It has no mass. It is therefore motionless, as we have already concluded. The photon is swept along in the "Expansive Ether", or "Emergent Ether" like a leaf in a river, having no motion relative to it. The photon does not experience the flow of time, and does not even experience the flow of space. Photons are *fundamentally* stationary!

**The speed of light is invariant in a vacuum**

If space and time are three-dimensional (as has been noted), then all things must have a location in space and a location in time. Because the photon has no independent motion, it is locked into a location in space and in time and the Expansive Ether moves these locations away from their original locations. The speed of separation in the underlying reality is the total spatial separation divided by the total time separation. If two photons progress directly away from each other, the speed thus calculated becomes 2/2. 4/4, 6/6, etc. which always reduces to 1/1, the speed of light. Note that the speed is constant, even though the values in the numerator and denominator are continually changing.

**The EPR paradox is resolved**

Suppose the two photons in the above example were created in the same event, that is, at the same *time*. This can be done by "down converting" one violet photon into two red photons. The two photons then separate in space (in the context of the reference system) but they still remain in the same *time* location. An action on one photon can therefore produce an instantaneous action on the other photon, even though they may be separated by miles or light years of space. This seems to be the resolution of the EPR paradox, and Einstein's discomfort with "spooky action at a distance."

I think Einstein would have been thrilled.

**The twin paradox is resolved**
Anyone who studies Special Relativity soon encounters the Twin Paradox. This one has all sorts of versions but here is the essence: One twin stays on Earth and the other goes away in a rocket ship at some significant fraction of the speed of light. Upon his return, he has aged *less* than his twin on Earth.

But this is not the official paradox; this is just a simple prediction of Special Relativity. The paradox is that *either* twin can be viewed as being younger (or older) than the other, because the motion can only be "purely relative". The fact that the *cause* of one type of motion can be distinguished from the other is irrelevant to the paradox.

Observations of muon lifetimes and actual experiments with clocks do indeed show that clocks moving at high speed run slower than those that are "stationary". But this is only true of clocks that measure time. Remember that gamma correction factor? It shows that there are two kinds of motion: temporal motion and spatial motion. If you are going to mix these two kinds of motion, then you need to have two kinds of clocks: one that measures the flow of time and one that measures the flow of space. At high speeds the flow-of-time clock slows down, but the flow-of-space clock speeds up; at low speeds the opposite is true: time proceeds at its regular rate, and the flow of space is essentially zero. To get the total amount of "progression", the values on the two different types of clocks have to be added together with a Pythagorean-like "orthogonal sum". According to this reasoning, both twins age at the same total rate, but the different kinds of clocks individually show different times. If the comparison is done ***between the two different reference systems*** —one on a time clock and one on a space clock—then the ages will conflict. But back on Earth, with ***one reference system***, they will be the same age. And so there is no paradox.

What is needed here is an "***orthogonal sum clock***" that incorporates *both* time and space progression effects. The effects of ***both*** local and non-local behaviors need to be taken into account.

## Accelerated reference system effects

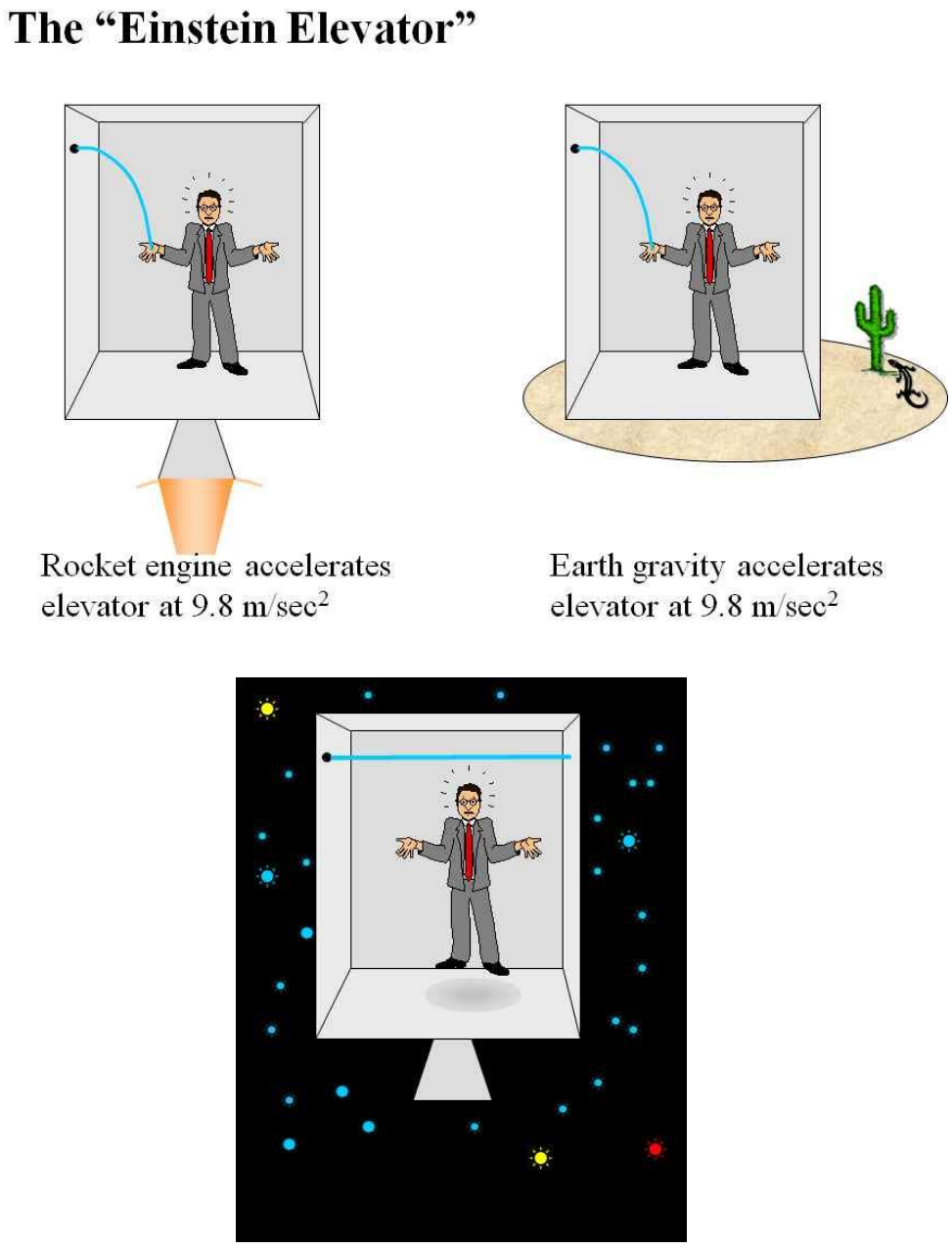
**Apparent bending of light by a gravitational field**
Einstein used an elevator to illustrate his Principle of Equivalence in General Relativity. The Principle can be stated as: "A homogeneous gravitational field is completely equivalent to a uniformly accelerated reference frame." In layman terms, that means that gravitational acceleration is equivalent (indistinguishable) from ordinary linear acceleration.

This is important because, although some of you don't know it, you are living on an accelerated reference system. When you stand on the floor or sit in a chair, "gravity" is accelerating you upwards at 9.8 m/sec$^2$ ; If this were not the case, you, and everything else would be floating around inside the room.

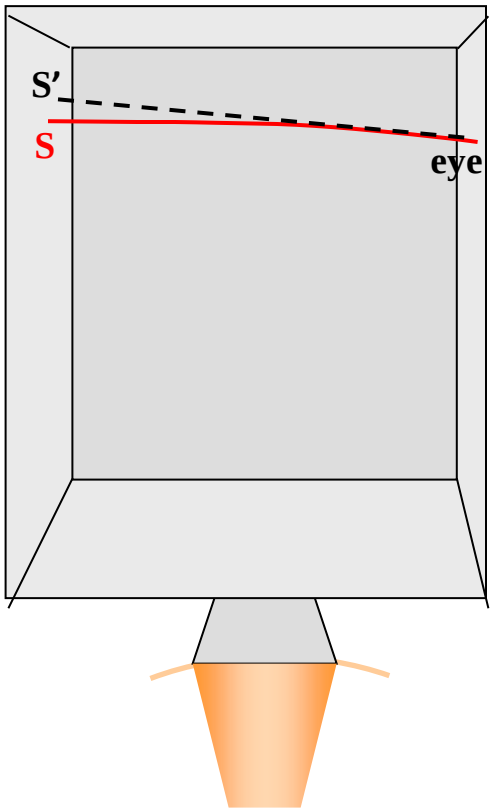
People understand elevators more readily than gravitation, so we'll stick with the elevator analogy, with a few Space Age modifications.

So if you were in a closed room inside a rocketship, and your acceleration meter (bathroom scales) indicated an acceleration of 9.8 m/sec$^2$ , you would not, from this one piece of information, be able to tell whether the rocketship was accelerating in outer space or whether it

was still on Earth. (Presumably nobody is performing the Colella-Overhauser-Werner experiment which would detect a horizontal component of real gravity). This is shown in the illustration below. (The blue stuff is a stream of water squirting out of the wall.)



I used a stream of water in these illustrations because it is intuitive. Einstein used a light beam, as shown below.




Here a light beam shines left-to-right across the elevator which is being accelerated by a rocket engine (the curvature of the light beam is greatly exaggerated).

Note the following effects:

1. The light beam seems to bend downward.
2. The source of the beam, when viewed from the right end, seems to be displaced from S to S′.
3. The curvature adds extra length to the path.

It is important to understand the three effects noted in the illustration.

Effect #1: The light beam, or pulsed water stream if you will, is actually going straight relative to an ordinary reference system outside the elevator. Once it leaves the accelerating source at the wall, there are no more forces acting on it. We say it is in "free float". The room (i.e., the reference system) is still accelerating. Its vertical velocity is changing, and no longer matches the (zero) vertical speed of the (detached) water. To an observer in the room, the water *appears* to be moving on a curved path, but this is due to the accelerating room, not the water itself.

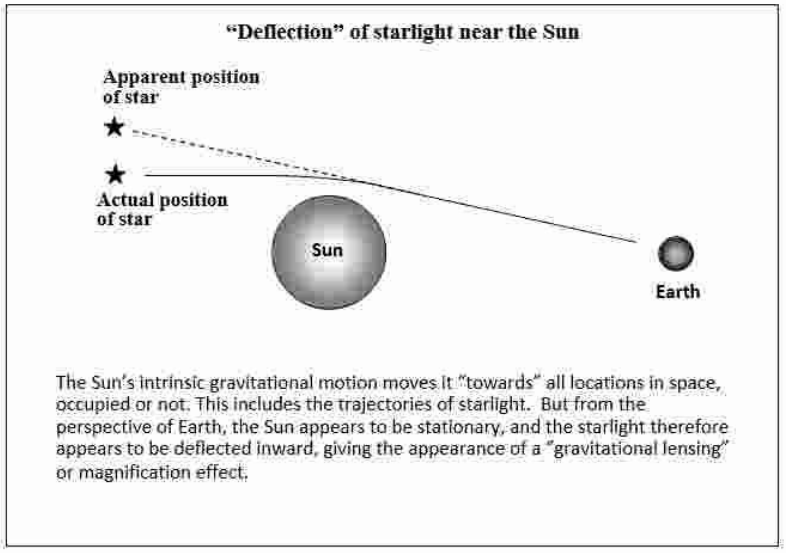
Effect #2: The image displacement should be intuitively obvious.

Effect #3: The extra path length should be intuitively obvious.

These effects will still occur irrespective of the source of acceleration (gravity or the rocket engine).

**Gravitational lensing or image displacement**

Effect #1 in the elevator has an equivalent in astronomy. Starlight seems to curve slightly in the presence of a strong gravitational field such as that near the Sun. See the illustration below.




In General Relativity, the effect is supposed to be due to the presence of mass causing a warping effect on space. But the critics don't regard this as an "explanation"? How can mass grab ahold of space and warp it? This is like explaining a mystery with an enigma.

A much better explanation is simply that of effect #2 in Einstein's elevator. If the acceleration is upwards, the displacement of the source is upwards. If the acceleration were sideways, the displacement of the source would be sideways. What we need is an elevator that accelerates in all directions simultaneously. But Aha! That is what we would call gravity. Remember it is a non-directional motion. It is that $t^3/s^3$ thing again.

When starlight passes the Sun, the Sun is moving "towards" the star light in the two dimensions that our telescope sees. But from our perspective, Sun is stationary and the starlight is being "deflected inward". This displaces the images in the star field outward (away from the Sun) and is equivalent to a magnification effect. The light is not actually bent. The apparent bending is just a reference system effect.

The effect near the Sun is only about an arcsecond of deflection and is difficult to detect. Far more precise measurements have become possible with radio astronomy. A radio source that is 90 degrees away from the Sun will show a deflection of a millarcsecond –very small but still detectable. These observations are within 1% of Einstein's predictions.

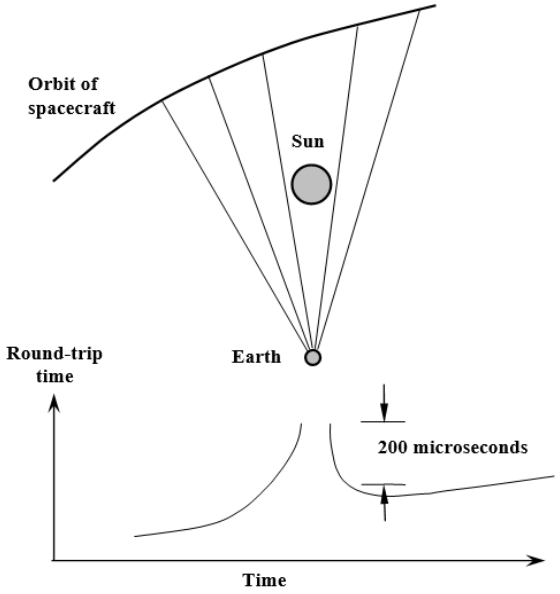
If you still have trouble visualizing all this, it might help to create your own version of curved space. When I was a kid, I went to a school that had a miniature merry-go-'round. We kids would sometimes play "catch" on this rotating merry-go-'round by throwing a ball straight across the center to another kid. To an observer on the ground, the ball traveled a straight path once it left our hands. But to us kids on a rotating platform the ball's path was strongly curved, and was very difficult to catch. The same effect could be produced by a kid on the stationary ground throwing a ball to a kid on the merry-go-'round. We understood these effects because the mechanics of the situation could be clearly seen. But if we did not know the merry-go-'round was rotating, we would have had to invent some other explanation. It probably would have been something like "Space becomes curved in the vicinity of merry-go-'rounds".

**Shapiro time delay**

In the 1960s Irwin I. Shapiro predicted that there would be a time delay introduced into the round trip time of radar signals as they reflected off a planet passing behind a massive body like the

Sun. The delay would be caused by the warpage of space due to the presence of the Sun's mass. (Shapiro, Irwin. I., 1964, Physical Review Letters. 13: 789; Shapiro, Irwin I. et al., 1971, Physical Review Letters, 26, 1132) . This was another good test of General Relativity.

The tests were originally performed by reflecting radar signals off the planets Mercury and Venus. Decades later, the use of a transponder on the Viking Mars lander greatly improved the precision of the time delay measurement. See diagram below.




As a spacecraft moves behind the Sun, the roundtrip time (shown greatly exaggerated here) of its radar tracking signal becomes increased by hundreds of microseconds beyond that accounted for by the orbit itself. This additional delay ("Shapiro time delay") is believed to be due to the warpage of space in the vicinity of the Sun. (See *The New Physics*, Paul Davies, ed. 1989, p.14)

The 200 microseconds is the radar distance equivalent of about 40 miles (roundtrip). So this is like saying that the spacecraft, with a planet attached to it, jumped 20 miles out of its normal orbit as it passed behind the Sun. The observations are "explained" by claiming that the Sun's mass causes a warp in space, and consequently the path of a radar beam passing near the Sun has to go through space that is stretched out, and this causes the additional time delay.

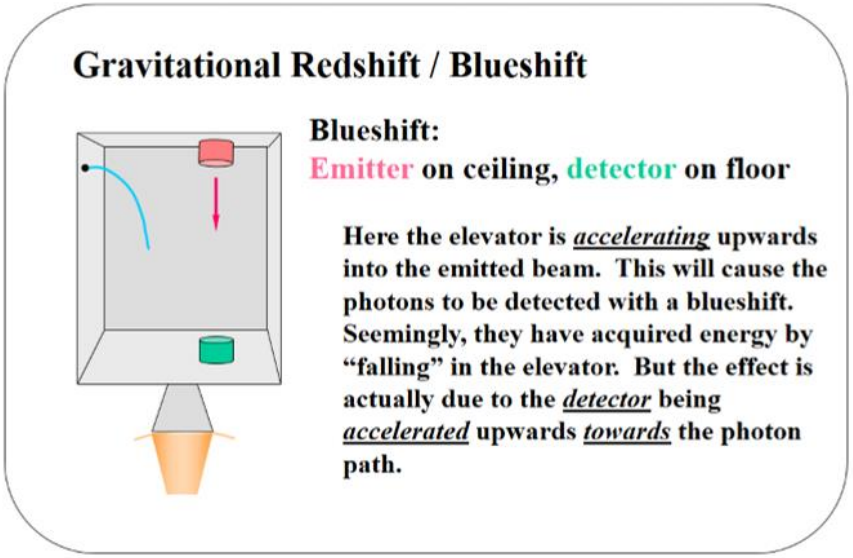
You have probably seen the illustrations of this effect. They show a rubber sheet stretched out across a hoop (like the top edge of a garbage can). Straight lines are then drawn on the sheet and some lines pass near the center of the sheet, and others are closer to the edge. A weight is then placed in the center of the sheet. The sheet deforms downward, with the greatest deformation being at the center. The lines are still at their same positions on the sheet, but the ones near the center are stretched out longer than the ones near the edges. The time delay for a radar beam is thus due to a change in the geometry of space itself, not to fluctuations in the orbital path, and is greatest for signal paths grazing the Sun.

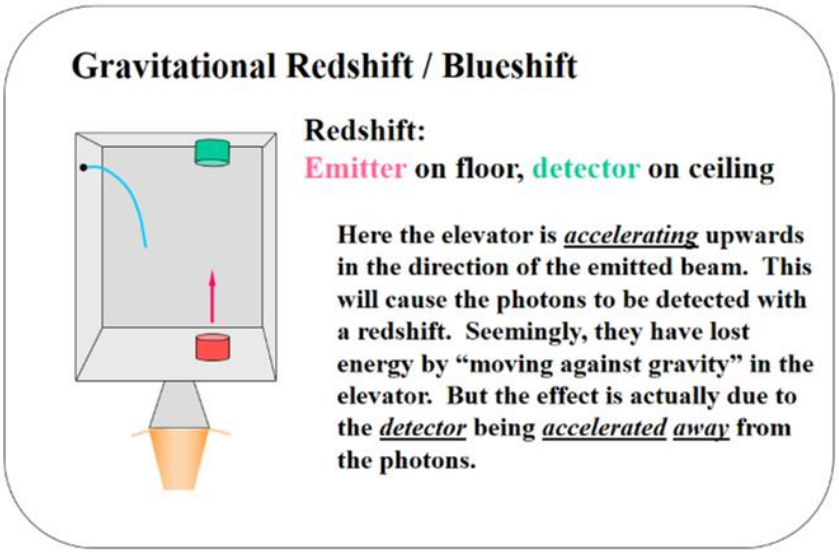
But there is a better explanation for this effect. Let's return to the Einstein elevator and forget about warps in space. This situation involves effect #3. In the elevator, the path of the light beam is actually straight, but the *acceleration* of the elevator and the observer within it, causes the path to appear curved. In the reference system, the curve adds extra length to the path, and therefore a time delay beyond what would be expected.

**Gravitational redshift/blueshift, kinematic time shift**

Experiments by Pound, Rebka, and Snyder at the Jefferson Physical Laboratory at Harvard circa 1960 have verified the existence of the gravitational redshift/blueshift effect to within one percent of the theoretical value. Those fascinating experiments were done with an extremely high resolution energy spectrometer that utilized the Mössbauer effect in iron 57.

The conventional explanations for the gravitational redshift and kinematic time shift are still valid, and are illustrated here only for completeness. Note that the explanations are actually intuitive, as is most of GR




# Cosmology

**The "gravipause"**

Einstein recognized that a "static" Universe (the accepted view in the early 1900s) could not be a stable one. The Universe would eventually collapse due to the action of gravitation. To counter that problem, Einstein introduced the "cosmological constant" to General Relativity in 1917. It represents what is now viewed as "dark energy" which keeps the Universe from collapsing. However, it was recognized that its inclusion still did not lead to a static Universe, because the equilibrium was unstable. If stars moved closer, the gravitational force would increase, moving closer still. If stars moved farther apart, then the gravitational effect would be lessened, and "dark energy" would more readily move them even farther apart. The whole situation was unstable, and to this day the cosmological constant is still regarded as an "outstanding theoretical challenge" in cosmology.

In 1929 Edwin Hubble uncovered evidence that the Universe is actually expanding. Decades ago, this was thought to be caused by a "Big Bang" that blew a tiny dense something-or-other

apart, resulting in the observed Universe and its redshifts. Besides being ridiculous, the Cosmological Principle points to an additional problem with that view. If everything is supposed to look statistically the same from all viewpoints, then observers in other galaxies must be seeing the same kind of redshift behavior. In other words the redshift must result from a *centerless* expansion of space, not from an explosion.

The view that is gaining currency today is that space itself expands or is "emergent" (new spatial units are being generated by some unknown process). It is like time, in that it progresses. But it progresses in three dimensions, and we call that an expansion.

Opposing the expansion is gravitation, which is centered on an object (planet, star, galaxy). We interpret the resulting motions in terms of forces, the cosmological expansion force, which is not affected by distance, and the gravitational force, which has a $1/d^2$ dependence. Because of this, there is necessarily a distance where the forces are at equilibrium, a distance I call the "gravipause" (which, in this definition, involves only *one* body, and space itself). For stars it is apparently a few light years, and for galaxies it is apparently a few million light years. Inside this distance, objects come together, and outside this distance, objects move apart. This is the "beyond Einstein" view that reconciles the issues of stability and instability. It explains why globular clusters are stable, even though they do not rotate sufficiently to keep them from collapsing. It explains why stars are separated by light years, but not by light weeks. It may explain some of the problems in calculating the Hubble constant, because the "constant" would be dependent on the location from which the observations are made (a large versus small galaxy). And the Big Bang now needs to be thrown in the trash can, especially since there are other explanations for the diffuse microwave background, (and the diffuse X-ray background, and the diffuse gamma ray background, and the diffuse cosmic ray particle background, etc.)

Gravitation seems to have three regions. Gravitational force near a star starts out strong but declines rapidly with distance (the $1/d^2$ region). At the gravipause, gravitation is still present, but falls off less rapidly (the $1/d^1$ region, or "Hubble space" as it could be called). Beyond that, quantization causes the gravitation to disappear completely (the $1/d^0$ region, where it does not decrease at all, because there isn't any).

**Galactic rotation: no "dark matter" is needed**

The existence of "dark matter" is inferred mostly from the characteristics of galactic rotation: "most stars in spiral galaxies orbit at roughly the same speed. . . . These results suggest that either Newtonian gravity does not apply universally or that, conservatively, upwards of 50% of the mass of galaxies was contained in the relatively dark galactic halo.
( http://en.wikipedia.org/wiki/Dark_matter#Galactic_rotation_curves )

But no dark matter is needed, just an alternative conclusion: Stars in a galaxy do not "orbit" the central bulge. Their motion is NOT comparable to planetary orbits in a solar systems. This is a much different situation.

Picture two small galaxies approaching each other. The chances are good that the approach will be off-center (not co-linear). Two effects will become apparent immediately. The differential effects of gravitation will cause the galactic blobs to "string out" into a line of stars. The off-center approach will cause the system to rotate around its barycenter (forming a spiral). The barycenter core is initially formed from the stars on the leading edge of each galaxy which experience a stronger gravitational pull and form a central nucleus of stars, usually accompanied by a visible "bar" of stars connecting the leading edges of the strung-out stars. Gravitation changes the *direction* of the stellar motion far more than the speed. The result is that, as quoted

above, "most stars in spiral galaxies orbit at roughly the same speed". And they do so because their original *speed* of approach remains mostly unchanged.

It is not rotation or "centrifugal force" that keeps the stars separated. The separation is maintained by the same mechanism as with non-rotating star structures like globular clusters. There is a mass-dependent distance where gravitation and the outward expansion of space are at an equilibrium. Gravitation has an inverse square force distribution, but the expansion of space is centerless and uniform. There is necessarily an equilibrium position for these forces. For stars it is a few light years; for galaxies, it is a few million light years. Hence, the galactic stars will not coalesce with each other, but they are still stuck inside the galaxy's overall gravitation.

## Two kinds of non-locality

There are two kinds of non-locality. One originates from a unit space boundary and the other from a unit speed boundary. The first is addressed by Quantum Mechanics, and the second is addressed partially by Special and General Relativity.

The need for Quantum Mechanics arose because the "mechanics" of the microphysical realm proved to be very different from the "mechanics" of Newton. The problem, in the oversimplified version, is that two atoms can approach each other in space until the one unit spatial boundary is encountered. At this point the atoms cannot come closer in space, because the space is fixed at one unit. There is no "inside" to this space, and therefore no spatial positions or trajectories are definable. The momentum continues in three-dimensional time but it cannot vary in space. However, time in our ordinary reference system is both scalar and non-local. Vectorial directions in three dimensional time are meaningless from the standpoint of a spatial reference system. Temporal motions in that realm map into the ordinary spatial reference system with a sort of "definite randomness". The overall behavior can be precisely predicted, but behaviors at an individual level are seemingly random. Quantum Mechanics (1925-1927) was developed to address these problems, which were not understood at the time, and which still baffle many physicists.

The other kind of non-local physics arises from a unit *speed* boundary. It does not have the spatial restrictions of quantum mechanics and remains non-local even at the size of stars and galaxies.

We have seen that at c, the relationship with our reference system inverts. The measure of speed, represented by c (s/t) inverts and becomes energy (t/s). Instead of a matter/antimatter Universe, we have a local/non-local Universe, or a space/time and time/space Universe. Our perception of the non-local Universe, or non-local phenomena in a local setting, becomes inverted. Low density temporal stars still in the spatial system are seen as ultrahigh density stars. High frequency radiation (gamma rays) from the temporal system becomes low frequency (microwaves) from our standpoint. The intuitive relations become non-intuitive

**Example:** What would non-local infrared radiation look like to our telescopes? The inversions have to be worked out in terms of unit quantities. The Rydberg frequency is a possible unit quantity for frequency. So for approximations we will take infrared as $10^{12}$ Hertz and Rydberg as $10^{15}$ Hertz. The calculation is thus $1/(10^{12}/10^{15})$ times $10^{15}$ or $10^{18}$ Hertz. That is in the X-ray range, and so there should be a diffuse X-ray background appearing in our skies. There is in fact such a background, and for a diffuse background, it is even rather bright.

Special and General Relativity addressed the behavior and perception of phenomena that have high speeds but which are still below that of c. That met the scientific needs of 1905, when things like the diffuse X-ray background and the diffuse cosmic microwave background were not known. But both SR and GR are specifically "local" theories by design and intent: the speed of light cannot be exceeded *in space*; cause and effect are *in space* (which is conceptualized as a *connecting*, rather than separating, medium). The theories work fine for coping with reference

system limitations (especially at high spatial speeds), but they are simply out-of-scope when applied to fundamentally non-local phenomena.

**Example1:** The speed of gravity and electric fields are clearly above that of light (as presented above). But SR insists that gravity and electric fields can propagate no faster than light speed. But in fact these fields are non-local; they have no spatial velocity at all, and act instantaneously, even over long distances.

**Example2:** Consider Faraday's law of induction:

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \Longleftrightarrow \oint_C \mathbf{E} \cdot d\mathbf{l} = -\frac{d}{dt} \iint_S \mathbf{B} \cdot d\mathbf{S}$$

This says that a time-changing magnetic flux through the area enclosed by a loop of wire will induce a voltage in the loop (a principle used in the Betatron to accelerate a ring of electrons in a vacuum). In other words, a change in a magnetic flux is "felt" instantaneously everywhere by a wire loop enclosing the flux, even if the loop is extremely large. There is no mathematical term suggesting a propagation delay. In fact the integral sign, depicting a global quantity, implies that the voltages in each segment of wire appear all at once.

The out-of-scope restrictions imposed by mistaken beliefs about SR and GR limit are limiting our imagination and the actual use of non-local science.

**Example:** there are two kinds of position and two kinds of velocity. Remember those two terms in the non-local form of gamma? We are using only one of them for propulsion—the spatial velocity one that depends on Newtonian mechanics. The other possibility, that of non-local motion, has been left unexplored. Using that, an aircraft could move from one position in the sky to another without traversing the intervening space. It would appear at one location, then disappear, then re-appear at another location. It could move at extremely high speeds without generating a sonic boom. It would use "field propulsion" based on the non-local characteristics of electric and magnetic fields. It would be completely self-contained because there is no action/reaction (exhaust) as in conventional propulsion (in this case, the reaction forces are radial, and cancel out within the structure of the aircraft, making the preferred shape one of something with radial symmetry, like a saucer or cigar).

Utilization of field propulsion technology has been the dream of engineers and scientists for many decades. But research into such possibilities gets labeled as "science fiction" and "junk science" because of mistaken ideas about the scope of SR and GR.

Incidentally, these two different types of non-locality make SR and GR irreconcilable with quantum gravity. Gravity would "invert" at the unit space boundary

## The cause of gravity

We have seen how gravity ***behaves*** and how it gives rise to numerous reference system effects. But what is the ***cause*** of gravity? We have seen that the space/time dimensions of mass are $t^3/s^3$. But that is not much of a clue. How does that turn into ***acceleration*** which has the dimensions of $s/t^2$ ? Furthermore, the $t^3/s^3$ seems to be saying that the overall observable motion of mass is "anti" to the progression of the Expansive Ether, which is $s^3/t^3$ from our perspective. There does not seem to be anything in these dimensions that says a planet sized chunk of mass will ***accelerate*** objects placed on its surface.

We need to know more about the structure of mass, and that can be derived from the Periodic Table.

The number of elements on each row of the Periodic Table are commonly displayed as 2, 8, 8, 18, 18, 32, 32. This can be expressed as the following pattern:

$$2x1^2 = 2$$
$$2x2^2 = 8$$
$$2x2^2 = 8$$
$$2x3^2 = 18$$
$$2x3^2 = 18$$
$$2x4^2 = 32$$
$$2x4^2 = 32$$

This makes a total of 118 elements. The pattern is based on four integers (1,2,3,4) and squares of those integers, and a factor of 2. If we worked out all the details, we would find that any element in the Periodic Table can be designated by a set of three numbers: $\{n_1, n_2, m\}$. These three numbers apparently correspond to three discrete "physical" structures within the atom. What are they?

If the atom is going to be made from structures of space/time ratios like mass, they must evidently be the $4\pi$ and $2\pi$ spin systems (well-known to physicists). They would be organized as "shells" like in layers of an onion (spins of spins).

But is this going to answer the question of acceleration? First take this pre-employment exam for physicists: There are three controls in your car that allow you to smoothly control acceleration. Can you name them?

They are the gas pedal, the brake pedal, and the steering wheel. What? The steering wheel? Yes, a change of speed *or a change of direction* result from acceleration.

Spin is rotation and rotation is acceleration. So intrinsic spin *is* accelerated motion.

What is it that is spinning? Nothing really. Intrinsic spin is not a spin *of something*. It is just pure spin, an unusual relationship between space and time. Time progresses but the space does not (like in a centrifuge). In the ultimate reality intrinsic spin is a "direction that has no motion" and it moves against the Expansive Ether, which is a "motion that has no direction". Well, *that* is certainly Beyond Einstein!

## Conclusion

We have seen how Einstein's equation of $E = mc^2$ gives fascinating insights into the deep nature of time, space, motion, and reference system effects. For the nature of gravity, a simple phenomenon, has been given a simple explanation. There were no gravitons, space warps, gravity waves, 11 dimensional strings, etc. There were no built-in mysteries like how mass grabs space-time and warps it. There were no bottomless questions like "What are particles made of?" The concepts are very different from what is taught in the schools, but are not hard to understand.

You can see why non-local physics is not published in the mainstream science journals. When an editor sees statements like "photons are stationary" and "Motion that has no direction" and "Direction that has no motion", he will simply throw the submission into the trash can. The article will never even see peer review, let alone publication. The public would pass it off as "junk science" and have no idea what they are missing out on. The physics of non-locality is basically "stuck" back in 1905 (quantum mechanics excepted).

Control of gravity and control of locality, would give us the ability to travel to the stars without traversing the intervening space. It would give us new forms of energy, and new ways of shaping our world, as well as many other astonishing things. But, clearly, there is a lot of work to do before we get there. At a minimum the currently "reigning paradigm" in physics must change and include things that are Beyond Einstein.