Universal Field Cosmology

I would like to present a new theory about the structure of the Universe, that leads to simple derivations of the Lorentz Transformation for time and $E = mc^2$, and an explanation of gravity and inertia in terms of the interaction of fundamental particles. The theory also explains some other previously puzzling things about the Universe, including what it is in space that is "bent" by massive objects to create gravitational fields, and how this bending then creates the force of gravity. It goes on to predict that gravity becomes a repulsive force at great distance, explaining why the expansion of the Universe is accelerating without needing to propose the existence of "dark energy." This theory's formula for gravity gives a value for the acceleration of the expansion of the Universe that is close to what astronomers have measured. This theory also explains how the fast solar wind gets its energy, and why areas of the Universe populated by superclusters of galaxies have a "flat" geometry while on a larger scale it is curved, predicts that fundamental particles can, as observed from Earth, have speeds up to about 400 km/s greater than the speed of light, and suggests a function for Cosmic Microwave Background Radiation that explains the puzzling level of organization and complexity in the universe. This theory achieves these things by assuming that the electromagnetic energy of the universe is all a part of a "stationary" field and that all matter is moving at the speed of light, then showing through a simple thought experiment that an absolute frame of reference for velocity is compatible with an isotropic Universe when viewed this way, and following the possibilities these two things open up. Because this is a new way of looking at the universe, it does appear to open up many new possibilities in Physics.

Author:

Mark J. Mason (mark@markmason.net)

Experimental Basis:

This theory is based on the results of many experiments, starting with the Michelson-Morley Experiment, that show that the speed of light in a vacuum is always the same (=c) regardless of the relative speed of the observer and the source. It also assumes the equivalence of mass and energy that the nuclear industry is based on — that matter and electromagnetic energy are two different forms of the same thing.

The Universal Field Theory of Cosmology:

Another way of stating the observed constancy of the speed of light in a vacuum and the equivalence of mass and energy is to say that electromagnetic energy and matter are two different "quantum" states of the same thing, where one is always moving at the speed of light relative to the other. To simplify this it would make sense to choose a frame of reference where one is always at rest and the other is always moving at the speed of light, and consider these two "quantum" states.

Matter is clearly not always at rest, as it is often moving with respect to other matter, and it would be confusing to try to portray it that way. Because of this, I will consider what follows from choosing a frame of reference where electromagnetic energy is always "at rest" and matter is always traveling at the speed of light. From this perspective, the matter/energy of the Universe will always be in one of these two "quantum" states (or rapidly transitioning between them), and will never be observed somewhere in-between them. Because of this, this theory will propose that the apparent reduction of the speed of light in transparent media, such as air and glass, is because it is absorbed and re-emitted by atoms in the media, so that it is effectively "stopped" part of the time, but when it is moving it is exactly at the speed of light.

This way of looking at matter and energy would imply that when beings made of matter, like ourselves, are apparently at rest, we must actually be moving at the speed of light in some way that we can or can't detect. Interestingly, there is a movement we can detect, even when we are apparently at rest, and that is our movement through time. So let's assume that what we sense as a movement through time, when we are "at rest," is us moving through the electromagnetic energy field of the Universe at the speed of light, "c," and look at what this implies.

Seeing the electromagnetic energy of the universe as stationary and matter as always moving at the speed of light, partly though space and partly though time, turns our view of the universe upside down, quite literally. As happened when Copernicus saw the Earth as revolving around the sun rather than being at the center of the universe, it opens up huge vistas of possibilities in physics, and leads to explanations of many previously unexplained aspects of the universe. We will explore some of these in this article. Simply put, the Universe starts making a lot more sense when viewed this way, as we will see.
First, let's look at what this way of looking at matter and energy implies for the speed of passing of time when we are moving though space with a particular speed "v" (with respect to a point that is "at rest," that I'll define soon).

The thought experiment that shows that an absolute frame of reference for velocity is not only compatible with an isotropic Universe, but is also required under the structure of the Universe this theory proposes:

Let's call our speed of travel through time "T". Our speed of travel through time when we are "at rest" compared to a particular energy source, "T_0" is, according to this theory, as just stated, equal to the speed of light, so:

$T_0 = c$ . . . . . (1)

If the direction of travel through time could be specified in the three space dimensions, and we were traveling with a velocity "v" in the same direction as the light from a light source, then the constancy of the speed of light would require that our speed of travel through time plus our speed of travel through space add up to the speed of light. We can express this as: T + v = c or, subtracting v from each side of the equation:

$T = c – v$ . . . . . (2)

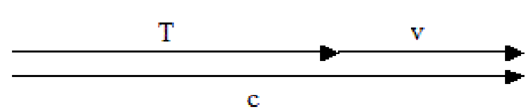

Figure 1: T + v = c or T = c - v

From Figure 1 you can see that if "v" increases, T must decrease, as c always stays the same (you can adjust the lengths of the T and v arrows but they must always add up to the length of the c arrow). In other words, our speed of travel through time would slow down by exactly the same amount as our speed of travel through space increases, since c must remain constant. But if we turned around and traveled in the opposite direction at a speed "v" then you can see from Figure 2 that as our speed through space, "v", increases, our speed of travel through time, T, would also have to *increase* to keep c constant. We can express this as: T – v = c or, adding v to each side of the equation:

$$T = c + v \qquad (3)$$

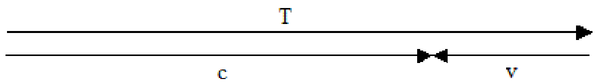

Figure 2: T – v = c or T = c + v

So our speed of travel though time, and hence our perception of how fast time passes and our measurement of how fast time passes with clocks, would *decrease* as we speed up in one direction, but would *increase* as we speed up when going in the opposite direction! Not only has this never been observed, but it is also a long-standing assumption in scientific theories that the Universe is "isotropic," meaning that the laws of science operate in the same way regardless of direction in space. Fortunately, though, there is one possible solution that overcomes this problem and is consistent with an isotropic Universe.

If the direction of travel through time were perpendicular to all three space dimensions, then it would have no component in any of the space dimensions to cause the speed of light or the speed of passing of time to depend on the direction in which we are moving. (To help understand the concept of a direction perpendicular to all three space dimensions, think about how a pencil standing on its end on a map is perpendicular to both of the map dimensions, north and south, and to any line you can draw on the map.) For this to be the case, our experience of time passing must be because of our movement through a fourth dimension perpendicular to all three space dimensions — the "time dimension." This movement must, for a given observer, pass through a single "point in space," since there can be no component of the movement in any of the three space dimensions. This is the point that is "at rest" that I mentioned earlier. We will consider later what the nature of these "points in space" is, where this happens. For now, though, I will just observe that these "points in space" form a rest frame that is, in a very real way, absolutely at rest, and that this rest frame is a requirement of this theory.

The Lorentz Transformation for time intervals, the "Time Dilation Equation," follows from this thought experiment:

In this situation, T + v = c (Equation 2) must be a vector addition, as shown in Figure 3, where the direction of travel through time at speed T is always at right angles to our direction of travel through space at speed v, regardless of the direction we are traveling through space.

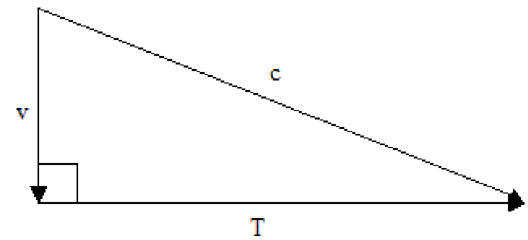

Figure 3: The isotropic solution

To determine how the rate at which time passes for us, "T", varies with our speed of travel through space, "v", for this isotropic solution, we can apply Pythagoras' Theorem to Figure 3. When we do that we get:

$$T^2 + v^2 = c^2 \qquad (4)$$

Subtracting v^2 from each side, we get:

$$T^2 = c^2 - v^2$$

Multiplying both numerator and denominator of the terms on the right side by c^2 we get:

$$T^2 = c^2.c^2/c^2 - c^2.v^2/c^2$$

Taking the common factor of c^2 out of both terms on the right we get:

$$T^2 = c^2(1 - v^2/c^2)$$

And taking the square root of each side (note: $x^{½}$ is a way of writing the square root of x), we get:

$$T = c(1 - v^2/c^2)^{½} \qquad (5)$$

From Equation 1, though, we know that $T_0 = c$, so:

$$T = T_0(1 - v^2/c^2)^{½} \qquad (6)$$

This equation shows how, according to this theory, the speed at which an object travels through time, "T", will slow down, as its speed through space, "v", increases. Already it can be seen as a form of the Lorentz transformation for time, but it is not yet in its most usual form, which is in terms of the duration of an interval of time "t" (such as a second, or an hour). As the speed of passing of time decreases (as time passes more slowly), the duration of each second (or hour) will increase (each hour will last longer). In other words there is a reciprocal relationship between them, where:

$$T = 1/t \qquad (7)$$

Substituting 1/t for T, and $1/t_0$ for T_0 into (6) we get:

$$1/t = (1/t_0)(1 - v^2/c^2)^{½}$$

If two mathematical expressions are equal then their reciprocals are also equal, so we can invert both sides of the equation to get:

$t = t_0/(1 - v^2/c^2)^{½}$ . . . . (8)

where t_0 is the duration of a given time interval at rest (say one second), and t is the duration of that time interval when traveling at a speed of v compared to the "point in space" the observer is occupying, referred to earlier (and, again, we will get to the nature of these "points in space" a little later). This is the most recognizable form of the Lorentz transformation for a time interval. Sometimes it is also written:

$t = \gamma t_0$ . . . . . (9)

where $\gamma = 1/(1 - v^2/c^2)^{½}$, the "Lorentz factor."

The fact that this Universal Field model of the Universe can be used to derive the formula for the time dilation effect, that many experiments have shown to exist, is a reality check for the theory that it passes, and lays a foundation the theory can build upon.

Implications of this "Universal Field Cosmology" Model of our Universe

To recapitulate, this theory proposes that the matter of the Universe is always traveling at the speed of light with respect to the electromagnetic energy of the Universe. I will call this energy the "Universal Energy Field." This energy field is placed in a reference frame where it is always stationary. When the speeds of material objects through space are slow, most of their speed-of-light movement is through a fourth, time, dimension, which is perpendicular to the three space dimensions. This movement through the time dimension gives rise to our perception of time passing.

If this Universe started at a point, or was once very small, this movement of matter along the time dimension would have to be in a direction outward from the center, and would produce a Universe in the form of, or very close to that of, a four dimensional sphere, expanding at the speed of light, or very close to it, along all possible radii of the sphere, from the center to the "surface." The "surface" of this sphere is our three dimensional Universe, which is also expanding. The rate of this expansion is linked to the radial expansion, so that two points on this sphere one radian (one radius distance) apart will be moving away from each other at the speed of light. It is expanding like the surface of balloon expands when it is being blown up. As a result, this theory is in accord with the observations of astronomy that show that the most distant observable galaxies are moving away from us at almost the speed of light.

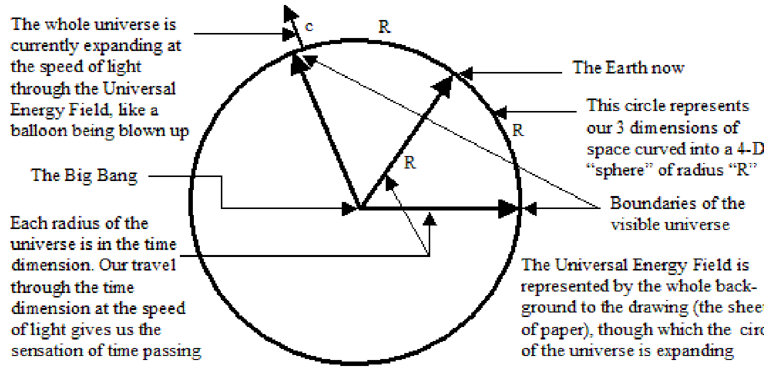

Figure 4: The Universal Field Cosmology Model of the Universe

If the speed of light has always been the same, since the Big Bang, this theory requires the radius of the Universe in light years to be equal to the age of the Universe in years, which runs counter to current astronomical observations that suggest the radius of the Universe in light years is over three times its age in years.

This theory, however, does not require that the speed of light has always been the same since the Big Bang — it just says that, because the apparent speed of light is due to matter expanding through the "stationary" Universal Energy Field of the Universe, the speed of light at a given point in time is equal to the speed of the expansion of the Universe at that time. So, rather than requiring an equal age and radius, this theory suggests that if the radius is larger in (our current) light years than its age in years, it is because the speed of the expansion of the Universe, and the speed of light, were greater in the past than they are now.

And it is not unreasonable to suppose that the speed of expansion of the Universe would have been greater just after the Big Bang, and that it subsequently slowed down to its current speed. This theory suggests, however, that the current speed of expansion of the Universe is the result of an oscillation leading to an equilibrium, which will be long-term stable. This emerges from the mechanism of gravity this theory proposes, so it will be discussed later, after presenting the gravity part of the theory.

While no point on a sphere is special compared to any other point, it is possible to specify a grid showing how each point is related to every other point, in terms of angles subtended to the center of the sphere. We do this with latitude and longitude on the Earth. And even if our world were gradually expanding, latitude and longitude would still correctly specify where everything is — the distance between different places on the Earth, and between grid lines, would just increase over time.

If you start with any one radius line, going from the center of the sphere to the surface (such that the radius line does not move through any internal structure of the sphere perpendicular to the radius line — and the stationary energy field is the internal structure of the sphere in the model of the Universe presented here), then the point at which this radius line intersects with the surface can be specified as a "stationary point" on the surface of the sphere, and a grid can be constructed, in terms of angles from a line drawn through this point, and angles subtended from the center of the sphere from this point.

Any other point on this grid is then also a “stationary point” where another radius from the center of the sphere intersects with the surface. If a train or a ship is traveling along the surface of this sphere, one can specify its speed relative to the point on the ground directly below it, which is a fixed point on the latitude and longitude grid. Each point on the grid is a “stationary point,” and it is valid to talk about how fast an object is moving with respect to that point. And this would still be true if the Earth were a gradually expanding sphere. If the sphere is expanding, though, each “stationary point” (grid point) will be moving away from every other “stationary point,” as these points are only “fixed” in relation to each other in an angular way.

The Universal Field Cosmology model of the Universe is analogous to such a gradually expanding Earth, and has to be for the Universe to be isotropic. Any point at which an object’s (or observer’s) passage through time intersects with the “surface” of the four dimensional sphere of our Universe (the current moment for that observer) is a “stationary point” the object’s speed can be measured against. These lines along which time passes are, by definition, radius lines of the Universe, that originate at its center and intersect the four-dimensional sphere perpendicular to all three space dimensions at every such “stationary point”. And, as we established earlier, in order for the Universe to be isotropic, these lines along which time passes must intersect our three dimensions of space at a “single point.” Not only can the speed of an object be measured with respect to such a “stationary point” as we have described (which if it were on the Earth would be the point “directly below it”), but, it is also a consequence of this model of the Universe that the speed, “v”, used to calculate how much time is slowed down for a moving object (to keep the speed of light always constant), is the speed relative to such a “stationary point.” These “stationary points” are the “points in space” we referred to earlier.

Some ways in which the Universal Field Cosmology Model fits in with known facts about the Universe, and explains some previously inexplicable ones.

1/ Absence of the twins paradox

One happy consequence of the somewhat “absolute” way of measuring speed that is required for calculating time dilation in this model of the Universe is that the “Twins Paradox” that plagues special and general relativity, and has never been explained in a convincing way, doesn’t even arise. The twin who accelerates off to a distant star (or the muon in a particle accelerator) after a while closely approaches the speed of light as measured against the “stationary points” he (or it) passes. Time passes more slowly for the fast traveling twin (or muon) according the Lorentz transformation for time intervals (Equation 8, above). The same is true for the return journey of the traveling twin (and the muon heading back around the circular path of the particle accelerator). Again he is traveling close to the speed of light with respect to the “stationary points” he passes through, so time again slows down for him. Meanwhile, the other twin on Earth (or the scientist observing the muon) has continued to travel at the same very low speeds (compared to the speed of light) that he always has done in relation to the “stationary points” he is passing by, so time continues to travel at the normal rate for him on Earth, that includes little or no time dilation. On return, the traveling twin’s clock will show much less time has passed for him than for his brother.

Note that this theory doesn’t suggest the Earth is a “stationary point,” only that it, like most of the matter of the Universe, is traveling at a very tiny fraction of the speed of light compared to the “stationary points” it is passing through, so is subject to only extremely tiny amounts of time dilation. Even if the highly unlikely possibility were true that the Earth, along with the sun and our galaxy, had the very large speed with respect to the grid of “stationary points” of say 42,000 km/second, so that we had a Lorentz factor of 1.01 (1% of time dilation compared with some other place in place in the Universe), we would just experience it as being normal, anyway.

Our actual speed with respect to “stationary points” is likely to be much smaller than that. For instance, the Earth moves around its orbit at the, for us huge, speed of 108,000 km/hr, or 30 km/second. The speed of light, though, is 300,000 km/s, 10,000 times greater. The Lorentz factor for the speed of the Earth around its orbit is equal to:

$$1/(1- (0.0001)^2)^{½} = 1/(1 – 0.00000001)^{½} = 1/(0.99999999)^{½}$$

$$= 1/0.999999995 = 1.000000005$$

That is one two millionth of one percent time dilation. As you can see, this is totally negligible, and, for all practical purposes, unmeasurable. This amount of time dilation would cause one’s clocks to run slow by less than 1 second in six years!

The solar system orbits around the galactic center at 220 km/s. The Lorentz factor for this speed is 1.00000027 — still extremely small.

Finally, the solar system moves at a speed of about 400 km/s with respect to the Cosmic Microwave Background radiation (CMB) rest frame (the same as the grid of “stationary points” of this theory?). The Lorentz factor of this speed, though, is still only: 1.00000089 (which would cause about one second of time dilation each two weeks).

2/ $E = mc^2$ is not only a natural consequence of this theory, but the way in which it is a natural consequence leads to an explanation of the phenomena of inertia and gravity in terms of the movement of fundamental particles, and explains where the energy/matter that fed the Big Bang came from.

According to this theory, all matter is moving at the speed of light with respect to the “Universal Energy Field” frame of reference, even if most of this movement is through the time dimension, and is experienced by us as the passing of time. Since kinetic energy is given by the equation: $E = ½mv^2$, it follows that the amount of kinetic energy held by a piece of matter of mass “m”, that would be released if it made the quantum transition to being electromagnetic radiation, which is stationary with respect to this frame, would be:

$$E = ½mc^2 \quad . \quad .. \quad . \quad . \quad . \qquad (10)$$

But if a piece of matter, an atom or a subatomic particle, is traveling at the speed of light, how can it be suddenly slowed down to zero speed, so its energy can be released? The obvious, and only apparent, way would be if it collided with another particle of the same mass, traveling in the opposite direction through the time dimension at the same speed, “c”.

So let's examine what would happen in this situation. This head on collision would release the kinetic energy in both particles, and reduce the speed of both particles to zero, the quantum state of electromagnetic energy, and so release the energy as electromagnetic radiation. Since these particles would be traveling at twice the speed of light relative to us, backward through time, and would be extremely tiny, we would presumably not be aware of them, except when they make these collisions. Such a collision would release an equal amount of kinetic energy from both particles into the Universal Energy Field we see as electromagnetic radiation. The total energy released, in terms of the mass of the particle we are aware of, which has mass "m", would be:

$$E = \frac{1}{2}mc^2 + \frac{1}{2}mc^2$$

And adding the two terms on the right, we get:

$$E = mc^2 \quad . \quad . \quad . \quad . \quad . \quad (11)$$

The existence of "backward through time particles" (BTTPs), in this way allows the release of the kinetic energy held in matter, and explains why the energy released is mc^2 not $\frac{1}{2}mc^2$. As we shall see, the existence of BTTPs also explains many other things about the Universe, including gravity and inertia.

These energy releasing collisions would have to be totally "inelastic" for all the kinetic energy to be absorbed in head-on collisions. This theory proposes that these particles repel each other with a force that is electrical and magnetic in nature. As a result, the kinetic energy would be absorbed into an electromagnetic wave structure of alternating electrical and magnetic fields as the particles rapidly slow down to zero speed and become photons. This explains why electromagnetic energy has a wave nature, propagating (as we'll discuss later) with four degrees of perpendicularity, as well as a particle nature.

Basic Particles of Matter

In these energy releasing collisions, the mass of a single colliding particle would have to be small enough that the energy in the least energetic possible photon of electromagnetic radiation would correspond to its mass. Then the simultaneous collisions of multiple particles (possibly in clusters) would lead to the release of higher energy photons. If we call the energy in the least energetic possible photon E_{min}, then the mass of this particle, which I will call the "basic particle" (BP) would be:

$$m_{bp} = E_{min}/c^2 \quad . \quad . \quad . \quad . \quad (12)$$

The least energetic electromagnetic radiation (EMR) known appears to be ultra low frequency radio waves with a frequency of about 1 mHz (0.001 Hz). The Planck-Einstein Equation, E = hf, gives the energy of photons emitted at a particular frequency, "f," where "h" is Planck's Constant (6.62×10^{-34} Joules.s). For this least energetic photon, with a frequency of 0.001 Hz:

$$E_{min} = hf = 6.62 \times 10^{-34} \times 0.001 = 6.62 \times 10^{-37} \text{ Joules.} \quad (13)$$

Substituting this in (12) we get the mass of a basic particle:

$$m_{bp} = E_{min}/c^2 = 6.62 \times 10^{-37} \text{ J}/(3 \times 10^8 \text{ m/s})^2 = 6.62 \times 10^{-37}/(9 \times 10^{16})$$

$$= 0.7 \times 10^{-53} \text{ kg}$$

So, to the nearest order of magnitude the mass of a "basic particle" is:

$$m_{bp} = 10^{-53} \text{ kg} \quad .. \quad . \quad . \quad (14)$$

If EMR with a frequency less than 0.001Hz is discovered, this mass would have to be lowered further to take account of it, but it is a useful figure to work with.

Since the mass of an electron is about 10^{-30} kg (9.1×10^{-31} kg), this means an electron would be made up of about 10^{23} "basic particles." Likewise, a proton, weighing 1.67×10^{-27} kg, must consist of about 10^{26} "basic particles." Interestingly, the most powerful EMR, gamma rays, have a frequency of about 10^{20} Hz, 10^{23} times the frequency of the least energetic EMR. Since the least energetic EMR photon is produced when one "basic particle" (BP) collides with one "backward though time particle" (BTTP), a cluster of 10^{23} BPs, a whole electron's worth, would have to collide with an equally large cluster of BTTPs to produce a gamma ray photon. This is not to say that gamma rays normally come from the annihilation of electrons — most seem to come from nuclear reactions, where the 10^{23} BPs are less than one thousandth (1/1836) of the mass of a proton or neutron.

These "basic particles" (BPs) would presumably be the smallest subatomic particles out of which all other particles are made. Since they would be the basic building blocks of matter, this theory proposes that they have electromagnetic attractive forces between them when they are traveling forward in time together that would, when they are combined in various ways to form the various fundamental particles of Nature, explain the strong and weak nuclear forces and electromagnetic forces that Quantum Theory currently explains (and we will see later how gravity can be explained by the interaction of BPs and BTTPs). Basic particles could be one and the same as the "string" loops that superstring theory proposes, or they could be linked together like strings of pearls to produce these strings. I propose, though, that when they are traveling backward through time (when they are BTTPs), these particles repel the same kind of particles going forward in time (BPs), as they approach each other and pass. (An attraction going forward in time must be a repulsion going backward through time, when you think about it. Consider a movie scene of a couple rushing into each other's arms. If it is played backwards, the couple will be retreating from each other.)

Because of this repulsion, it would only be particles approaching each other on a direct collision course that would actually collide and release their mass as energy in the form of electromagnetic radiation (EMR), as particles even slightly off to one side would repel each other and pass clear of each other. Since excited atoms produce EMR equally well wherever they are in space, it is clear that these particles traveling backward through time must either be aligned by some common causality with matter in our Universe, or be present in close to an equal density everywhere in their domain, though they would need to be clumped together in groups of the various sizes needed to explain the photons of various different energies that are emitted when collisions between groups of particles occur.

This explains how photons of EMR are created at a source, and carry away an amount of mass from the source equal to E/c^2. Light waves in the visible spectrum have a frequency of about 10^{15} Hz, which would require about 10^{18} BPs within an electron to switch quantum states to the Universal Energy Field to become one photon of light. This is just one particle in 100,000 within an electron, which would reduce the mass of the electron by 0.001%.

This theory thus predicts that electrons in higher (more energetic) orbitals would weigh slightly more than those in lower orbitals, in proportion to the energy of the photon emitted when the electron moves between the orbitals. This tiny weight loss would presumably not adversely affect the function of the electron, and may even be tied in with its function. (For a detailed explanation of how the interaction of Basic Particles and BTTPs is in accord with Quantum Theory, please see Appendix A.)

In opaque or semi-opaque media, light photons are absorbed and re-emitted by atoms as described by Quantum Theory. The re-emitted photon is not usually of the same energy or propagated in the same direction. As mentioned earlier, this theory proposes that the apparent reduction of the speed of light in transparent media, such as air or glass, is due to photons being effectively "stationary" for a small amount of time as they are being absorbed and re-emitted by atoms in the media. This would allow the photons, while they are moving, to be moving at exactly the speed of light. In the case of transparent media, however, the process of absorption and re-emission would have to be such that *most* of the re-emitted photons would be of the same energy and direction of propagation as the absorbed photons. This absorption and re-emission is required by this theory because, under it, matter/energy must be in one or other of its quantum states (stationary or moving at the speed of light) and not somewhere in-between. Structures of matter are, according this theory, transparent to particular frequencies when the energy of those frequencies correspond to energy transitions within electrons that cause absorbed photons to be rapidly re-emitted in the same direction and with the same frequency. Consequently, this theory predicts that this kind of very rapid absorption and re-emission takes place in transparent media, and that, with the right experiment, it may be possible to verify that it is happening.

How BTTPs Explain Gravity

I mentioned in the last section that if two opposing "basic particles," one a part of a piece of matter in our Universe, and one a BTTP, traveling backward in time, are not on a direct collision course they will repel each other and pass by each other. Let's look what happens in this situation if there are two objects, of mass m1 and m2 in our Universe (going forward in time) that consist of a number of "basic particles" bonded to each other, so that the bonding forces cancel each other out, or are forces of such close range that there is no significant attraction or repulsion between m1 and m2 at the distance they are apart.

The attractive strong and weak nuclear forces and electromagnetic forces between basic particles (BPs) hold together the structures of matter, and as a result do, in fact, resolve themselves over very tiny distances. This theory proposes, however, that the repulsive forces between BTTPs and BPs, though they are the same forces operating in reverse, can operate at much greater distances, since these repelling forces do not resolve themselves within the structure of matter, but operate between two complementary domains of matter: forward through time and backward through time.

Based on this, let's look at what happens when two basic particles traveling backward in time, p1 and p2, are on a collision course with m1 and m2.

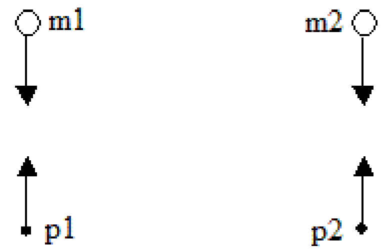

Figure 5: BPs and BTTPs set to collide

If m2 were not there, p1 could collide with a basic particle in m1 (if there were an "unprotected" one available to collide with), and a photon of energy would be produced. But because of the presence of m2, p1 is repelled, be it ever so slightly, by m2, and it will shift direction slightly, and start to be repelled by m1 as well, in a direction perpendicular to its backward travel through time, and pass m1 on the side away from m2. p2 will likewise pass m2 on the side away from m1. As they are passing, p1 will repel m1, and since it is closer to it than p2 is, p1's repulsion of m1 toward m2 will be greater than p2's repulsion in the opposite direction. So there will be a net force pushing m1 toward m2. Likewise there will be a net force pushing m2 toward m1. Figure 6 illustrates this:

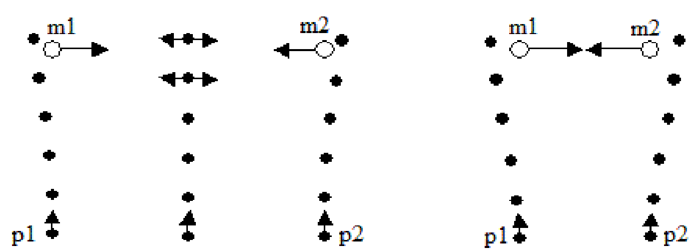

Figure 6: How BTTPs cause gravitational attraction

The more particles are involved, the stronger the force will be, but since there is close to an equal density everywhere of the particles traveling backward in time (or, as previously discussed, they have a common causality with forward through time particles of matter), the strength of the attraction will be proportional to the mass of m1 and the mass of m2. I believe that when a detailed analysis is done, it will also show that the attractive force will also be inversely proportional to the square of the distance between the particles in most (but not all) situations found in our Universe.

(For a discussion of why the attractive force in this situation should depend on the inverse square of the distance between the particles, but the angles of deflection of BTTPs should vary with the simple inverse of the distance from the objects that are repelling them, see Appendix B.)

Let's assume, for now, that the force of attraction does, in fact, vary with the inverse square of the distance. In this case, the force attracting pieces of matter of mass m_1 and m_2 at distance "d" from each other could be expressed as:

$F = IGm_1m_2/d^2$ . . . (15)

This force would be an attractive force between objects with mass in our Universe. It is, of course, the force of gravity, and G is the "universal" constant of gravity. "I" is a Gravitational Intensity Factor I have introduced, which in most usual situations = 1.

How, according to this theory, gravity should work at very great distances that are a significant fraction of radius of the Universe

I mentioned in the last section that the inverse square law attraction of gravity may not apply in all situations in the Universe. One situation where this theory suggests it should break down is over very large distances that are a significant fraction of the radius of the Universe.

Looking at Figures 5 and 6 again, the presence of m2 repels p1 slightly so that it passes m1 on the side *away* from m2, causing p1 to repel m1 and push it toward m2, creating (one half of) the attractive gravitational force between m1 and m2. As the distance between m1 and m2 increases, the angle of deflection of p1 is going to reduce, until at very great distances it will be very tiny. At small distances the directions of movement of m1 and m2 are effectively parallel, but at very great distances, that are a significant fraction of the radius of the Universe, the direction of movement of m1 and m2 will cease being parallel, due to the curvature of the three dimensional "surface" of our four dimensional spherical Universe. Instead they will "splay" outward. When this angle of splay becomes larger than the tiny deflection caused by m2, p1 will repel and be repelled by m1, and pass m1 on the side *toward* m2, and continue to repel it *away* from m2. Thus, at these huge distances, gravity should, according to the Universal Field Theory of Cosmology, become a *repulsive* force, rather than an attractive force. In this situation, "I" in Equation 15, above, becomes *negative*. In general, the Universal Field Cosmology says the force of gravity is described by Equation 15, where I is not always equal to one, but reduces in value, then turns negative, at great distances (and in another important situation described below). Figure 7, below, illustrates this situation where gravitation becomes a repulsive force.

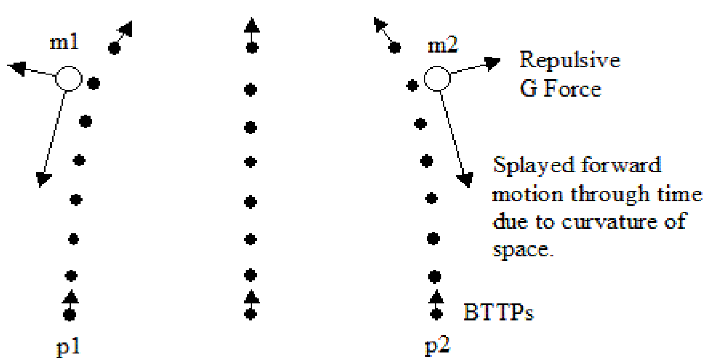

Figure 7: How splayed BPs and BTTPs cause repulsive gravitation

For tiny pieces of matter, such as hydrogen molecules, isolated from other gravitational fields (or in orbit or free fall), the deflection of p1 by m2 would be extremely tiny, even at relatively short distances. This could mean that the "splay" in the direction of movement of the hydrogen atoms could become greater than the repulsive deflection of the BTTPs when they are only a tiny fraction of a meter apart, causing the gravitational force between them to become one of repulsion, rather than attraction, when they are further apart than this critical distance. This is the other situation where this theory suggests the inverse square law attraction of gravity should break down, and "I" (in Equation 15) would become less than one then turn negative. This would help explain why there are still large numbers of isolated atoms and molecules of matter floating around in space, especially intergalactic space, that haven't been attracted to each other to form stars.

These two situations where gravity is a repulsive force would also explain why gravity isn't slowing down the expansion of the Universe, as one would otherwise expect it to do. The evidence is that the speed of expansion of the Universe is currently actually increasing. Gravity turning into a repulsive force at very great distances, and at even quite small distances for very tiny particles, as this theory suggests, could certainly explain the accelerating expansion of the Universe, and do so much more elegantly than by proposing the existence of vast quantities of undetected "dark energy" that repels matter and itself rather than attracting it. Later, once we have derived a formula for the force of this repulsive gravity, we will show it can also fairly accurately account for the observed rate of acceleration of the expansion of the Universe.

One could, if one wished to, say that the BTTPs are the "dark energy." They certainly have the required quality of dark energy of repelling matter. The function of BTTPs, though, goes far beyond that proposed for dark energy, so I believe it would be confusing and misleading to equate them in any more than a superficial way.

We should note here that the expansion of the Universe has not always been accelerating. For the radius of the Universe to be over three times greater in light years than its age in years, the Universe must have had an average speed of expansion over its lifetime of over three times its current speed. The evidence suggests that the Universe has been expanding for about the last five billion years, just over one third of its age. This means that the speed of expansion of the Universe must have started off, after the big bang, many times faster than it now is, and have slowed down for about nine billion years, after which its speed of expansion began to increase again.

I believe the Universal Field Theory of Cosmology is capable of explaining why the rate of expansion of the Universe slowed down for the first nine billion years, then has been accelerating for the last five billion years. I believe a detailed analysis will show that a high speed of expansion of the Universe favors the attractive gravitational forces over the repulsive gravitational forces that operate over large distances, and that this would slow down the speed of expansion of the Universe. Perhaps this is because the BTTPs would be racing through faster when the Universe is expanding faster, reducing their ability to interact over large distances, while attractive gravity, which operates over smaller distances, would be less effected by this.

Conversely, a low speed of expansion of the Universe would favor the long distance repulsive gravitational forces, which would tend to accelerate the rate of expansion of the Universe. This should, in time, after the initial very high speed of expansion of the Universe created by the Big Bang, lead to an equilibrium where the attractive gravitational forces balance the repulsive gravitational forces, and the speed of expansion of the Universe settles down to being constant. This speed could, however, oscillate for some time around the equilibrium speed while it settles down, just like a compressed spring does when the tension on it is released. The current five billion year long acceleration of the speed of expansion could be the first major return oscillation after an initial nine billion year slow down. Figure 8, below, illustrates this.

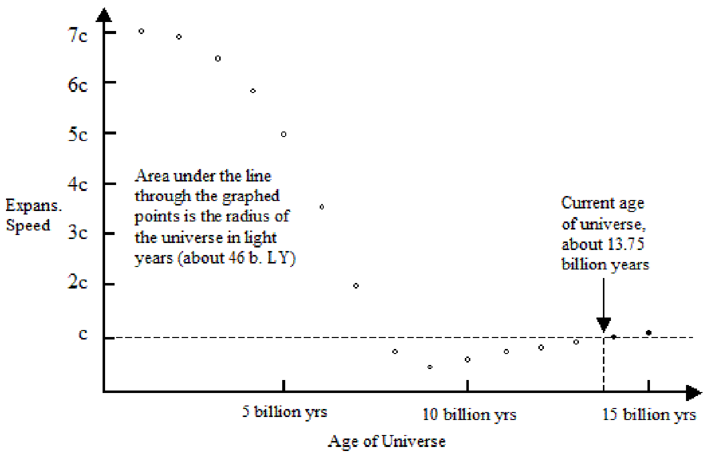

Figure 8: Variation of the expansion speed of the universe over time

The favoring of attractive gravitation over repulsive in the first seven billion years or so after the big bang, due to the speed of expansion of the Universe being much greater than it is now, would have had another consequence, quite apart from slowing down the speed of expansion. It would also have meant that the "critical distance" below which small accumulations of matter would attract other matter rather than repel it would have been significantly higher then than it is now, encouraging the formation of galaxies and stars at a faster rate.

Inertia

A body at rest or in uniform motion will have an equal number of backward-through-time particles (BTTPs) being deviated on all sides of it, so there will be no net force on it. But as soon as there is an attempt to change its speed, there will be more repulsion from the BTTPs against the direction of the acceleration, and less repulsion from the BTTPs in the direction of the attempted acceleration, and this will cause a net force to resist the acceleration, that works in just the same way as the deflection of BTTPs causes gravitational force. Since it operates cumulatively on all the "basic particles" in the object, this net force will be in proportion to its mass. This is, I suggest, the reason why bodies have inertia and momentum, and that the force needed to accelerate a body is proportional to its mass (m) and to the acceleration applied (a). The result is Newton's formula for force:

$$F = ma \qquad . \qquad . \qquad . \qquad . \qquad (16)$$

When the force of gravity on an object is matched by an equal and opposite force of inertia, as when an object is in free fall, or in orbit, then there will be no net forces acting on the object, and it will seem, apart from its motion relative to other objects, to not be in a gravitational field at all. A Spinning body also has angular momentum for the same reason, and resists changing the direction in which its axis of rotation points because it would disrupt the flow of BTTPs past the spinning body, causing a great acceleration with even a small change in direction of the axis of rotation, because of the high speed of rotation. It should be noted that the gyroscopic effect of a spinning body will tend to keep its axis of rotation aligned at a constant angle to the direction of BTTPs flowing past it, rather than with a particular direction in space, though these are usually very close to being the same, because, as we will see later, the angle of deflection of BTTPs around even quite large objects like the Earth is quite tiny.

Raw Materials to feed the Big Bang

So where are these BTTPs traveling backward in time going? Since they are traveling back in time at the same speed we are traveling forward in time, and they are, as we pass them, at the same distance out from the center of our four-dimensional spherical Universe as we are, they are going to get to the very center, where the Big Bang occurred, at the exact time when the Big Bang occurred. So these particles, presumably undifferentiated and spread uniformly across space, are traveling back in time to provide the material to feed the Big Bang, after which, because of the Big Bang, it will become the matter that will differentiate into the galaxies, stars and planets of our Universe.

The Dual Nature of Matter

We just mentioned that BTTPs are traveling backward in time at the same speed as the BPs in matter they are now "passing" are traveling forward in time, and that this means they will get to center of the Universe at the exact time of the Big Bang, when the BPs they are now "passing" left it. It follows from this that at every time between the Big Bang and now, and at every time in the future, the same BTTP is either "passing" or colliding with the same BP of matter (or one nearby). This seems like a paradox until one takes account of the fact that everything is happening "backward" for the BTTPs. It would seem that BPs are, in a way, "paired up" with BTTPs. They were originally created from EMR in pairs, as previously described in the section on how electrons absorb EMR. This process creates an equal number of BPs going forward in time at the speed of light, to add to the electron's mass, and BTTPs going backward in time at the speed of light in their domain. So after the big bang, when energy made the quantum shift to being matter, matter was created in BP-BTTP pairs that then stayed approximately together, perhaps wandering off slightly, perpetually passing each other until conditions were right for them to collide and jump to the energy quantum state again, where they become part of the Universal Energy Field, and manifest as EMR. So it seems like matter has a dual nature, consisting of perpetual pairs of "basic particles" and "backward through time particles." Note, though, that this pairing doesn't necessarily mean BTTPs are formed into structures like matter — the mechanisms of this theory suggest they are probably spread out evenly over their domain. This pairing could, though, provide the scope needed to explain the "entanglement" of particles in the domain of matter, noted in quantum mechanics, whereby once close particles seem to be causally connected even when separated by great distances. The BTTP pairs of the two particles of matter could remain in close contact, and continue to influence their BP "partners" though a mechanism proposed in a later section about the possible role of cosmic background radiation.

Trying to Imagine the Structure of our Space-Time Universe

It is very hard to imagine a four-dimensional sphere. The best we can do is imagine a three dimensional sphere, and try to extrapolate from there. The 3-D sphere, though, has its radius as well as its surface in the three space dimensions. The fact that the radii of our 4-D Universe are all in the time dimension, and passing through it gives rise to our sense of time, limits the usefulness of the 3-D sphere analogy.

Whichever direction we look in space we are looking back in time because of the finite speed of light which is also equal to our speed of travel through time. This is why, although EMR is “stationary,” fixed in the Universal Energy Field, as we race past it at the speed of light in the time dimension as our Universe expands, we see it coming at us from a direction in space, and it could be any direction in space. This is because every direction in space is backward in time. If we see a star that is eight light years away, we are looking back eight years in time. So, although we can’t imagine it, we are traveling though time toward every direction in space. EMR in every direction in space is stationary, but appears to be moving toward us with the speed of light, because we are moving toward it at the speed of light through time (or though space and time if we are moving relative to the grid of “stationary points” in space).

Looking at it in another way, there is a sort of perpendicularity to EMR, because while we are moving past it very largely in the time dimension, it appears to be coming at us in a direction perpendicular to the time dimension, from a particular direction in the three space dimensions. But then, perpendicularity is a quality of EMR — it has long been known to have three dimensions of perpendicularity. EMR consists of oscillating electric and magnetic fields, which are perpendicular to each other, and to its direction of propagation. It could well be that oscillating electric and magnetic fields are the result of the “imprinting” of the propagation of EMR on to the space dimensions which are all also perpendicular to the direction through time in which we are passing the “stationary” energy. That would just be adding a fourth dimension of perpendicularity to EMR, which is consistent with fact that EMR can be mathematically described as a “four-vector.”

Whichever of these two ways you try to conceive of it, though, don’t try to imagine what this four dimensional Universe actually looks like — that is something we just can't do.

The Universal Field Theory of Cosmology Explains where the Lost Energy goes to when there is a Gravitational Red Shift, and also Explains the Speed of the Fast Solar Wind

If you refer back to Figures 5 and 6, and the accompanying explanations about how this theory says gravity works, you will recall that a “backward through time particle” (BTTP), that would otherwise be on a straight-on collision course with a “basic particle” (BP) within an object, is slightly deflected by the presence of other matter nearby in a direction away from that other matter, which then creates a gravitational force by its repulsion of the BPs in the object it is near, pushing it toward the other matter.

It follows from this deflection of BTTPs that if the two particles *are* to collide in this situation the BTTP would need to be, after its deflection, arriving at the collision at a slight angle to the direction in which the piece of matter is moving forward through time. Since the deflection of the BTTP is proportional to the mass of the other nearby matter, and inversely proportional to its distance, the larger the gravitational field the piece of matter is in, the larger the angle of approach of the BTTP will be at the point of collision.

When this non-straight-on collision occurs, though, the *net* velocity of particles after colliding cannot be zero, as is required for them to become EMR in the Universal Energy Field. What could happen, though, and this theory predicts does happen, is that some of the particles remain as matter and carry away the net kinetic energy, and others effectively collide head on and become a part of the Universal Energy Field.

Let’s consider a case where a collision, when straight on, would involve 100 BPs directly colliding with 100 BTTPs, producing a photon of EMR with energy Es. If the collision were at a slight angle, such that one percent of the total energy needed to be carried off as kinetic energy, then one BP and one BTTP could carry off this energy as kinetic energy, leaving 99 BPs to collide head on with 99 BTTPs and make the quantum jump to the Energy Field. The quantum of EMR produced would then have 99/100 as much energy as Es. Its energy, Ea, would be: Ea = 0.99Es. Since the energy carried by EMR is proportional to its frequency, $f_a = 0.99f_s$. In other words, in this gravitational field, there would be a 1% red shift in radiation emitted, and this 1% of lost energy would be carried away by the particles as kinetic energy, half in our Universe by the piece of matter containing the BP and half by the BTTP in the backward through time domain it occupies. This can be illustrated as follows:

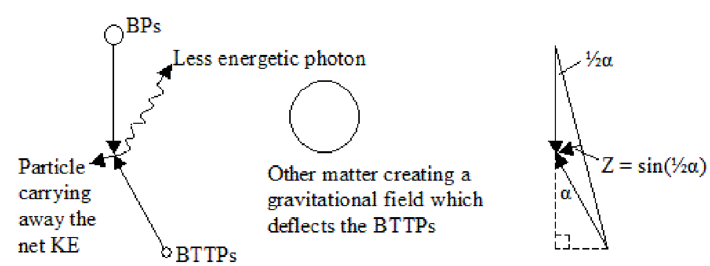

Figure 9: Gravitational red shift, showing why Z = sin(½α)

The reverse situation, with the same red shift result, occurs when photons are absorbed (creating absorption spectra lines) in a gravitational field. Since the BTTPs and the BPs matter that are created need to end up traveling in exactly opposite directions through time to satisfy the conservation of momentum, but the gravity of the sun will deflect the BTTP, the particles have to launch off at an angle to each other rather than in directly opposite directions. This is achieved with the help of an incoming particle (perhaps attracted by the gravitational field) which imparts the required KE and mass to the particles (say 1%), so a photon of only 99% the energy normally required need be absorbed. This creates a red-shifted absorption line in the spectrum.

Note from Figure 9 that the velocity of the piece of matter carrying away the KE, when a red-shifted photon is created, is always directly away from the center of mass causing the gravitational field. It is also clear that these pieces of matter could be carrying substantial amounts of kinetic energy (KE), as they could be traveling at very high speeds. If the piece of matter consisted of just the “basic particle” that carried away this energy, then it would be traveling at the speed of light, and have kinetic energy $E = ½m_bc^2$. If the mass of the piece of matter (a proton, for instance) were 160,000 times that of just the “basic particles” carrying the KE away, then the speed of the piece of matter can be calculated, since the KE is the same, but is spread out over a greater mass at a smaller speed. Equating the kinetic energies, we get:

$½(160,000m_b)v^2 = ½m_bc^2$

Dividing each side by ½, then by 160,000, then by m_b, we get:

$v^2 = c^2/160{,}000$

Taking the square root of each side, we get:

$v = c/400 = 300{,}000/400 = 750$ km/s . . (17)

The escape velocity of the sun is 618 km/sec, so pieces of matter, such as protons and electrons, traveling at 750 km/s would easily be able to escape the sun and become particles in the solar wind, even if they were slowed down somewhat on the way out. This is especially so considering, as we mentioned earlier, the direction of this velocity would be directly away from the sun's center of gravity, out from its surface into the solar system. And particles in the fast solar wind typically have a speed of about 750 km/s.

One of the problems we have had up to now with our theories about solar wind is that it is not understood how the fast solar wind can accelerate up to the speeds it does. As we can see from the above calculations, though, the carrying away of excess energy from the gravitational red shift of the sun (even though the red shift itself is too small to be easily observed), could certainly account for the levels of kinetic energy of the fast solar wind. I believe it could also account for much of the slow solar wind. Stars with much higher gravitational fields than our sun (which are much more massive and/or denser), could also, in the same way, produce Cosmic Rays, which, like the solar wind, are mostly protons and electrons, but are much faster than the solar wind, nudging the speed of light.

Universal Field Cosmology predicts a value for the gravitational red shift of the sun at its photosphere, and from this a general formula for gravitational red shift can be derived

Many observations have confirmed Einstein's famous prediction that photons of starlight passing very close to the sun's surface will be deflected from their course by the sun's gravity by an angle of 1.7517" of arc. Universal Field Cosmology suggests that BTTP's heading toward photon-producing collisions with matter on the photosphere of the sun would be similarly deflected. This is because photons of EMR are attracted to matter that moves past it as the Universe expands at the speed of light. The EMR is in the "stationary" quantum state, meaning that it is not moving in the time dimension. It could, however, move within the space dimensions, as it is attracted by passing matter, and so be deflected as we pass it. Since photons would be "passing" this matter at the speed of light, half the speed BTTPs are passing matter, one would expect the photons to be deflected twice as much as BTTPs if they were subjected to the same field. They would seem, however, to be subject to just half the field, as they are equally subject to the influence of BTTPs, which exert no net attraction because they are spread out in an overall uniform density rather than being differentiated into objects like the material Universe is. The net result is that photons and BTTPs are deflected by the same amount as they pass objects of matter. Having said that, BTTPs at the point of collision with BPs on the sun's photosphere will only have been deflected by half the total amount that photons are because they are only traveling to a central point on the photosphere and not also away from it like the photons in starlight are.

So, knowing this angle of approach of BTTPs to the collision, the net kinetic energy (KE) left over after the collision, as a fraction of the total KE of particles before the collision, can be calculated, and, as we saw a little earlier, this causes the photon(s) emitted to have less energy, and hence a lower frequency, by the same amount. If both the BTTPs and the BPs they are colliding with were deflected by an angle "α", the fraction of energy lost as red shift would be $Z = \sin\alpha$, but since only the BTTPs are deflected by this angle, the fraction of energy lost is, as you will see if you refer back to Figure 9:

$Z = \sin(½\alpha)$ . . . (18)

Since BTTPs at the photosphere are deflected by half the angle that light is deflected by when passing the photosphere of the sun (as previously discussed), α = 1.7517/2" = 0.87585", and ½α = 0.437925" = $(0.437925/(60*60))\pi/180 = 2.1231 \times 10^{-6}$ radians, so:

$Z_s = \sin(2.1231 \times 10^{-6}) = 2.1231 \times 10^{-6}$ . . (19)

This value for the gravitational red shift of the sun of $Z_s = 2.1231 \times 10^{-6}$ is in agreement to at least five significant figures with the same value of $Z_s = 2.1231 \times 10^{-6}$ obtained from the equations of general relativity, which have been experimentally confirmed in various ways. This result is a confirmation that the line of reasoning presented here is correct, and BTTPs and photons are, in fact, deflected by the same amount in the presence of bodies of matter.

Is there enough energy lost from the sun's gravitational red shift to produce the solar wind?

The rate of conversion of solar matter to energy is about: 4.26×10^9 kg/s. This energy is produced in the core of the sun, but gradually percolates to the surface, where it is radiated at the photosphere. The question is whether the energy lost in the red shift of this radiation is sufficient to account for the mass and kinetic energy of the solar wind.

In determining this we will simplify the calculation by looking at just the BPs in matter, and only consider the half of the KE carried away by particles of matter, though an equal mass of BTTPs are involved, and an equal amount of KE is carried away by them.

With this rate of conversion of matter to energy, the amount of energy lost by the sun's gravitational red shift, measured by its mass, is:

Energy lost = $Z_s \times 4.26 \times 10^9$ kg/s = $2.1231 \times 10^{-6} \times 4.26 \times 10^9$ kg/s

= 9.04×10^3 kg/s

This 9.04×10^3 kg/s is the amount of matter that would carry away half the lost energy as KE if it were traveling at the speed of light, "c" (the other half is carried off by BTTPs). As we saw earlier (in Equation 17 and the calculations leading up to it), this amount of KE could also be carried away by 160,000 times as much matter if its speed were 750 km/s, a typical speed for the fast solar wind. This would give a total possible rate of emission of fast solar wind (SWf) of:

SWf = $9.04 \times 10^3 \times 160{,}000$ kg/s = $9.03 \times 10^3 \times 1.6 \times 10^5$ kg/s

= 1.45×10^9 kg/s

This rate of emission of 1.45×10^9 kg/s is right in the range of the estimated loss of matter from the sun due to the solar wind, which is about 1.3×10^9 kg/s to 1.9×10^9 kg/s. There are other mechanisms that can explain the speed of the slow solar wind, so some of it could be produced by these other mechanisms. It is clear, though, from the above calculations, that all of the fast solar wind, and at least a portion of the slow solar wind, can be produced by energy lost from the sun's gravitational red shift.

Knowing the amount of deflection of BTTPs at the sun's photosphere enables us to calculate the deflection caused by any object, at any distance, and this lets us calculate gravitational critical distances.

The deflection of BTTPs at the sun's photosphere is, as we found earlier, α = 0.87585", or $\alpha = (0.87585/(60 \times 60))\pi/180= 4.2462 \times 10^{-6}$ radians. Since the deflection is in proportion to the mass of the deflecting object, and, as discussed previously, inversely proportional to the distance from the object, we can say:

α = Mass in Solar Masses x 4.2462×10^{-6} radians/Distance in solar radii

This formula would be more useful if it were in terms of light years, and since there are 1.3603×10^7 solar radii in a light year, we can rewrite the formula as:

α = Mass in Solar Masses x $((4.2462 \times 10^{-6})/(1.3603 \times 10^7))$/Distance in ly, or:

$$\alpha = m_{suns} \times 3.1215 \times 10^{-13}/d_{ly} \text{ radians} \quad . \quad . \quad (22)$$

As we mentioned in the gravitation section, over considerable distances there is a splay in the direction of BPs moving forward in time due to the curvature of the Universe, and when this splay exceeds the deflection of BTTPs, then the gravitational force becomes repulsive. The angle of deflection, α, when two objects interact, is just the deflection at one side of the interaction, so the corresponding splay that needs to exceed the deflection to turn the gravitational intensity factor, I, negative, is just one half of the total splay angle between two objects. At one radian separation, 46 billion light years, there is one radian (57.29578°) of total splay, so the splay on each side is half this, or half a radian. Based on this we can calculate the splay (σ), as follows, from distance in light years (d_{ly}):

$$\sigma = 0.5 \times d_{ly}/4.6000 \times 10^{10} = d_{ly} \times 1.0870 \times 10^{-11} \text{ radians}$$

This splay formula is based on the assumption that the Universe is exactly spherical. If there are areas that are flattened out, and areas that have a greater curvature to make up for the flatter areas, then the splay will change in those areas. To account for these, I will introduce a "flatness factor", "f", which equals 1 at the exactly spherical curvature, and increases or decreases with the effective radius of curvature, so that, for instance, if the curvature is flattened out half way to being flat, where its radius of curvature is doubled, then f = 2. The splay will reduce in proportion to how much "f" increases, so the general formula becomes:

$$\sigma = d_{ly} \times 1.0870 \times 10^{-11}/f \text{ radians} \quad . \quad . \quad (23)$$

What is most useful to know about deflection and splay is the critical distance for any two objects, when gravitational attraction turns to repulsion. This is the distance where the deflection caused by the larger object equals the splay due to the distance — that is when σ = α. In terms of Equations 22 and 23, this is when:

$$d_{ly} \times 1.0870 \times 10^{-11}/f = m_{suns} \times 3.1215 \times 10^{-13}/d_{ly}$$

Multiplying both sides by f and d_{ly}, and dividing both sides by 1.0870 x 10^{-11}, we get:

$$d_{ly}^2 = (3.1215 \times 10^{-13}/1.0780 \times 10^{-11}) \times m_{suns} \times f, \text{ or}$$

$$d_{ly}^2 = 2.87177 \times 10^{-2} \times m_{suns} \times f$$

Taking the square root of each side we get:

$$d_{ly} = 0.16946 \times (m_{suns} \times f)^{1/2}$$

Since this is the critical distance in light years, let's call it "dc_{ly}", so then:

$$dc_{ly} = 0.16946 \times (m_{suns} \times f)^{1/2} \quad . \quad . \quad . \quad (24)$$

In standard SI units of meters and kilograms, the formula becomes:

$$dc = 1.1368 \times (mf)^{1/2} \quad . \quad . \quad . \quad (25)$$

Applying Equation 24 to our sun and another object weighing less than or equal to our sun, assuming the average curvature of space where f = 1, we get:

$$dc = 0.16946 \times (1 \times 1)^{1/2} = 0.16946 \text{ ly}$$

This would mean our sun would only attract objects less than or equal to its own mass if they were less than about one sixth of a light year away! While 1/6 ly is still about 28 times as far as comet Hale-Bopp reaches at aphelion, so such a critical distance might be able account for how the sun attracts everything in the solar system, it would mean the sun, rather than attract nearby stars, would actually repel them! If there were considerable flattening of space in our part of the Universe — our Local Supercluster of galaxies — such that f = 100, the critical distance of our sun would still only be 1.69 ly, and it would still slightly repel nearby stars. Of course, in this situation, our galaxy would still attract the stars in it. Our galaxy and the Andromeda Galaxy each have a mass of about 7.1×10^{11} times that of the sun, so with f=100 again, its power of attraction would extend to:

$$dc = 0.16946 \times (7.1 \times 10^{11} \times 100)^{1/2} = 0.16946 \times (71 \times 10^{12})^{1/2}$$

$$= 1.4280 \times 10^6 \text{ ly}$$

This critical distance for our galaxy of about 1.4 million light years would certainly be sufficient for it to attract all its stars and even its satellite galaxies, such as the Magellanic Clouds, but since the Andromeda Galaxy, M31, is about 2.36 million light years away (and about the same mass as our galaxy), it would mean the Milky Way and the Andromeda Galaxy would be slightly repelling each other. This is rather unlikely (though possible), considering these galaxies are moving toward each other with a speed of 120 km/s. What would be much more likely would be a minimum flattening of about f = 300, which would make the critical distance between the two galaxies 2.47 million light years, so they would be slightly attracting each other at their current distance apart. This would be an absolute minimum, though, and when a variety of factors are considered, especially the interactions of molecules, which we will look at later, it seems likely there would be a flattening of about f = 2,500 within our Local Supercluster.

For f = 2,500, the critical distance for our sun would be close to 8.5 light years. A star one fourth the mass of our sun would then have a critical distance of about 4.25 light years, and one four times the mass of our sun would have a critical distance of about 17 light years. Critical distances of this order would ensure that stars in globular clusters, in the central bulges of galaxies, and even in open clusters, would attract each other. Stars in the spiral arms of our galaxy and other spiral galaxies, on the other hand, would be far enough apart that their gravitational attraction would be significantly diminished or they would slightly repel each other, making it less likely they would have the kind of close interactions that are common in clusters, helping to give planetary systems around suitable single stars in the spiral arms the stability needed for life to evolve.

So, it seems like space in the neighborhood of galaxies has a "flat" (Euclidian) geometry to a fairly high degree of flattening, probably about f = 2,500. What, then, could be the cause of this flattening?

Universal Field Cosmology predicts local flattenings of the curvature of the spherical Universe which contain superclusters of galaxies

Within our own Local Supercluster of galaxies (LS), we know there is a general movement of all the galaxies of about 600 km/s with respect to the Cosmic Microwave Background Radiation (CMB) rest frame. I have already hinted that the CMB rest frame and the grid of "stationary points" of this theory are one and the same thing, and I will formally propose it in a following section. According to this theory, this movement means that there would be a certain small amount of reduction in the rate of passing of time within our LS as compared with other parts of the Universe that are at rest with respect to their "stationary points." Since the Universe is expanding in the time dimension, if the rate of passing of time is reduced in one area of the Universe due to the preponderance of matter in that area having a significant speed with respect to the grid of "stationary points," then one would expect that that area would have *expanded less* than the areas around it, and that its outward curve would be flattened somewhat, at least, and perhaps be largely or completely flattened or even be reduced to a concavity.

Let's assume for the moment that we are at the center of a local area where the Universe has been totally flattened out so that it has no curvature. We can then calculate how big this area of flattening is, based on the current estimate that our galaxy is moving at a speed of 627 km/s with respect to the rest frame. At this speed, our rate of passage through time compared with the rate of passage though time of a place at rest, "T_0", is given by Equation 6:

$T = T_0(1 - v^2/c^2)^{½}$

Plugging in the values of v = 627 km/s, and c = 299,800 km/s, we get:

$T = T_0(1 – 627^2/299,800^2)^{½} = T_0(1 – 393,129/89,880,040,000)^{½}$

$= T_0(1 – 4.37392996 \times 10^{-6})^{½} = T_0(0.999995626)^{½}$

$= T_0 \times 0.999997813$, so:

$T = 0.999997813T_0$

If this local slightly smaller rate of the expansion of the Universe has been the same since the Big Bang, then the current radius of the Universe at this point will be smaller than the general radius by the same amount, so:

$R = 0.999997813R_0$ . . . . (26)

Let's see what this looks like on a diagram:

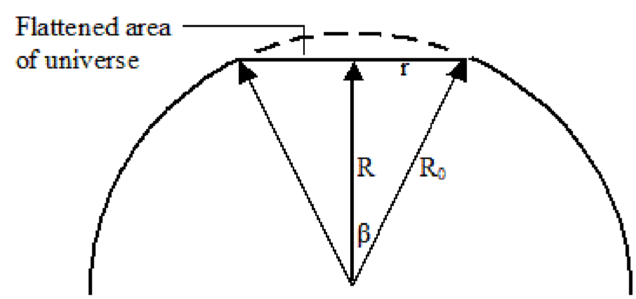

Figure 10: Local flattening of universe

From (26) above and Figure 10:

$R/R_0 = 0.999997813$ and $R/R_0 = \cos β$, so:

β = acos 0.999997813 = 0.002091411388 radians (about 0.12°).

Also, $r/R_0 = \sin β$, so:

$r = R_0 \times \sin β$ . . . . (27)

Now "r" is the radius of the flat spot around our galaxy that we are looking for, R_0 = 46 billion light years — the radius of the Universe, and we just found the value of β, so:

$r = 4.6 \times 10^{10}$ ly x sin(0.002091411388) = 4.6×10^{10} ly x $2.09140986 \times 10^{-3} = 9.62 \times 10^7$ light years.

This gives a diameter (twice the radius found above) for our local "flat spot" of about 192 million light years, just a little larger than our Local Supercluster, the diameter of which is variously estimated to be from 110 to 150 million light years.

To the extent that the local slightly lower rate of passage through time started after the Big Bang, the diameter of our "flat spot" would be reduced. If, for instance, it started when the Universe was one billion years old, when the diameter of the Universe, according to Figure 8, was already about 7 billion light years, then the diameter of the "flat spot" would be (46 – 7)/46 x 192 mly = 0.848 x 192 mly = 163 million light years. But to the extent that we are not at the center of the "flat spot" and the speed is higher than 627 km/s at the center, or the flattening is not complete, the diameter of the "flat spot" would be larger, so the figure of about 200 million light years is a useful "ball park" figure.

The splay between adjacent "flat spots" on the four dimensional sphere of our Universe will be the same as the splay between the points on a sphere at the centers of the "flat spots", since the centers of the flat spots are parallel to a tangent to the sphere. This splay will then be the splay between any point on one flat spot and any point on the other flat spot. Since flat spots seem to have a radius of about 100 million light years, their centers must be at least 200 million light years apart, and probably quite a bit more, perhaps 400 million light years, to take account of the voids between them where the Universe is curved. So let's work out what the critical distance of two superclusters would be, with f = 1. The mass of the Virgo Supercluster (the LS) is estimated to be: 1×10^{15} times the sun. The critical distance is, from Equation 24, then:

$dc = 0.16946 \times (10 \times 10^{14} \times 1)^{½} = 5.359 \times 10^{6}$ ly

This critical distance of "flat spots" containing superclusters of about 5.4 million light years is way below their distance apart of at least 200 million light years, so these "superclusters" (on separate "flat spots") are certainly going to be repelling each other, and it is this repulsion, according to this theory, that is keeping the Universe expanding, and driving the current acceleration of its expansion.

Within the Local Supercluster, if the flatness is f = 2,500 (which we earlier estimated to be a reasonable flatness based on the apparent slight attraction between our galaxy and the Andromeda Galaxy and other factors) then the critical distance of the LS would be $2{,}500^{½}$ = 50 times greater, or 270 million ly, well over the estimated radius of the LS of 55 to 75 million ly, and of the calculated ball-park radius of our "flat spot" of 100 million ly, so more than enough to account for its cohesion. This seems to confirm that f = 2,500 is a pretty good estimate of the flatness of the "flat spot" that contains our Local Supercluster.

I would expect that a detailed analysis of the dynamics between our galaxy and the Andromeda Galaxy, and a careful analysis of where our galaxy is in the Local Supercluster and where the LS is placed with respect to other receding superclusters (along with work on how molecules interact in certain circumstances), should lead to better estimate of the flatness of our "flat spot", its radius, and the position of the LS within the local "flat spot." I believe that having better estimates of these would then enable many different lines of investigation into how the structure of the Universe evolved, from the creation of superclusteres of galaxies all the way down to the formation of planets.

I would like to suggest that the "flat spots" in the Universe may not just be four dimensional analogs of "disks," but may be 4-D analogs of shallow cones. This would enable the movement to go around in large circles, or "swirls," rather than actually going somewhere in the wider Universe. Since on every level of the Universe we see matter orbiting around in circles or ellipses, it would hardly be surprising if this were also to happen on the level of the movement of galaxies with respect to the CMB rest frame. These "flat spot swirls" could, as Figure 11, below, shows, be about 400 million light years in diameter. They could also be considerably larger, perhaps 800 million light years to 1 billion light years in diameter.

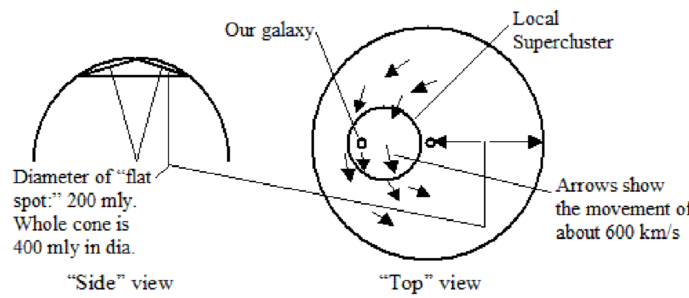

Figure 11: Shallow cone "flat spot" with circular swirls of movement

As can be seen from the above discussion and calculations, Universal Field Cosmology predicts that the local geometry of the Universe, within superclusters and perhaps groups of superclusters, is "flat" to within about one part in 2,500 (the value of the "flatness factor", "f"), but that the global geometry is "spherical" with little flat patches all over it — kind of like a golf ball if you filled its dimples in until they were flat. This agrees with the recent astronomical observations that suggest the local geometry of the Universe is flat to within ±0.5% (one part in 200). The Poincaré dodecahedral space, a model that apparently fits the data, is the closest prior model. Universal Field Cosmology, however, predicts that the global geometry is that of a polyhedron with many millions of "flat spots," each probably about a quarter of a degree across, or half a degree if they are "swirls."

If it doesn't seem like millions of ½° "flat spots swirls" could fit on a sphere, bear in mind that we are talking about a 4-D sphere here. The "bounding volume" of a 4-D sphere is given by $S_3 = 2\pi^2R^3$. Using this formula it turns out that this bounding volume equals about 29.7 million ½°-width cubes, each of which could contain a "flat-spot swirl" ½° in diameter. Interestingly, this formula reveals that the total volume of the Universe (not just the visible part of it) is about 1.9×10^{33} cubic light years. Also, assuming each of the 30 million "flat spot swirls" contains an average of two Local Supercluster's worth of mass, the mass of the Universe would be about 1.2×10^{53} kg. Interesting, considering we calculated earlier that the mass of a "basic particle" is probably about 10^{-53} kg. It seems like the macro and the micro in the Universe might be fairly evenly balanced.

Critical Distances of Small Particles

Using Equation 25, and again assuming a "flatness factor" of 2,500, we can calculate the critical distance of various small particles, and look at some of the implications of these values. Hydrogen molecules would have a critical distance of only about 3×10^{-12} of a meter, which means that in all usual situations they would repel each other. Just after the Big Bang, though, while matter was still very compressed and the actual separation of hydrogen atoms was less than this, they may have begun to accumulate into clumps that would have had a large enough critical distance to attract more hydrogen atoms even as the Universe expanded. For instance, an accumulation of matter weighing just 1 mg would have a critical distance of about 5.7 cm, and since the molecular clouds that stars are formed from contain about 100 particles of matter per cm^3 (mainly hydrogen molecules and helium atoms), even a 1 mg "seed" would easily enable larger accumulations of matter to form. As particles move into this 5.7 cm radius, they would be attracted to the "seed" matter and make way for more particles to move into this area because of repulsion from particles around them and from the "gas pressure" of their kinetic energy. The bigger the mass accumulation becomes, the greater its critical distance, and the more surrounding molecules it would be able to attract. It could well be that a part of what is considered to be "gas pressure" in the molecular clouds from which stars form could be gravitational repulsion of individual atoms and molecules, rather than from their kinetic energy. (For a discussion of how the critical distance between water molecules affects the properties of water and cloud condensation, and supports a flatness value of f = 2,500, see Appendix C.)

Derivation of a General Formula for Gravitation According to the Universal Field Cosmology

We have seen earlier that, according to this theory, gravitational force varies with the deflection of BTTPs (α), but the "splay" of BPs (σ) due to the curvature of the Universe subtracts from the gravitational force to the extent that it is present. This means gravitational force varies with the deflection minus the splay. The deflection, itself, increases with the mass of the larger object, and decreases with distance between the objects but, as already discussed, not the square of the distance between them. We can put all this information into this equation:

$$F_g = K(\alpha - \sigma)m_2/d \qquad (28)$$

K is a constant, m_2 is the lesser mass, and "d" is the distance between the objects. The effect of the larger mass, m_1, and a decrease with distance, is already built into the deflection. At small distances, when the splay, σ, is negligible, this equation will limit to Newton's equation for gravity, so:

$$K\alpha m_2/d = Gm_1m_2/d^2 \qquad (29)$$

We earlier derived a formula for deflection in terms of the number of solar masses in m_1 and the distance apart of the objects in light years. It is Equation 22. Converting this to a formula where m_1 is in kg and distance, d, is in meters, and α is in radians, we get:

$$\alpha = m_1 \times 1.484856 \times 10^{-27}/d \qquad (30)$$

Substituting this in Equation 29 we get:

$$Km_1m_2 \times 1.484856 \times 10^{-27}/d^2 = Gm_1m_2/d^2$$

Canceling out the common terms from each side, we get:

$$K = G/1.484856 \times 10^{-27} \qquad (31)$$

Substituting the value for G into this equation, we get $K = 6.673 \times 10^{-11}/1.484856 \times 10^{-27}$, or $K = 4.4940 \times 10^{16}$.

Since $c^2 = 8.9880 \times 10^{16}$, we can see that $K = ½c^2$.

Inserting this value into Equation 28, this theory's primary formula for gravitational force, in terms of deflection and splay in radians, becomes:

$$F_g = ½m_2c^2(\alpha - \sigma)/d \qquad (32)$$

This equation is interesting in at least two respects. Firstly, it has no need for a constant of gravitation, or any constant, for that matter (except for c, which would appear to vary over large periods of time), thus it is very revealing of the nature of gravity. The lack of the need for a constant of gravitation is because *the force of gravity on an object is a result of that object's kinetic energy as it moves forward through time at the speed of light* ($½m_2c^2$), divided by its distance from the mass attracting it (d), and multiplied by the angle of deflection of particles caused by the attracting mass (α – σ), as we have already discussed. Since energy = force x distance, it is clear that force = energy/distance, and there is no reason why gravitational force should be any different. The actual gravitational force, though, is only the result of the *deflected* kinetic energy divided by the distance from the attracting mass, which is why it is then multiplied by the net angle of deflection (α – σ).

Secondly, this equation shows that the force of gravity is proportional to the square of the speed of light. So if the speed of light were just over seven times its current value when the Universe was about a billion years old, as Figure 8 suggests, then the force of gravity would have been about 50 times higher then than it is now. That would certainly have got that primeval matter condensed into galaxies in a hurry! It would also have acted to quickly slow the speed of expansion of the Universe, and, as a result, the speed of light, until the force of gravity became a lot lower, and couldn't slow it any more. The speed of expansion of the Universe would then have begun to settle around an equilibrium value, as has been previously suggested.

Let's continue on, though, to get a formula for gravity in terms of masses, distances and G, the recognized gravitational constant. Just as we converted Equation 22 to get Equation 30, we can also convert Equation 23 to get a formula for splay in terms of meters, with the result in radians. It is:

$$\sigma = d \times 1.14888 \times 10^{-27}/f \qquad (33)$$

Substituting Equations 30, 31 and 33 into Equation 28 we get:

$$F_g = G((m_1 \times 1.484856 \times 10^{-27}/d) - (d \times 1.14888 \times 10^{-27}/f))m_2/(d \times 1.484856 \times 10^{-27})$$

Multiplying top and bottom of the subtracted term by d to get a common denominator:

$$F_g = G(m_1 \times 1.484856 \times 10^{-27} - d^2 \times 1.14888 \times 10^{-27}/f)m_2/(d^2 \times 1.484856 \times 10^{-27})$$

Dividing both top and bottom of the right hand side by 1.484856×10^{-27}, we get:

$$F_g = Gm_2(m_1 - (0.77373d^2/f))/d^2 \qquad (34)$$

This is a very useful formula for gravitational force as it stands, which limits to Newton's formula when the subtracted term is relatively tiny, such as within our solar system. We could, however, take it one step further and multiply top and bottom of the subtracted term by m_1, so we can take out m_1 as common factor to get:

$$F_g = Gm_1m_2(1 - (0.77373d^2/m_1f))/d^2 \qquad (35)$$

This then enables us to write the formula as in Equation 15:

$F_g = IGm_1m_2/d^2$ . . . . (36)

where $I = 1 – (0.77373d^2/m_1f)$ . . . (37)

"I" is the Gravitational Intensity Factor we have previously mentioned, which we now have quantified. "f" is, of course, the "flatness factor" that we have previously talked about, which is likely to have a value of about 2,500 within our Local Supercluster of galaxies. Note that the factor of 0.77373 in the subtracted term is dependent on the radius of the Universe. This value is based on the current radius being presumed to be 46 billion light years. This factor varies inversely with the radius of the Universe, and will decrease over time.

The way in which "I" decreases slowly at first with distance ensures that "I" will always be very close to one at small fractions of the critical distance. Our sun has a critical distance of about 8.5 light years. At 0.085 light years distance, 128 times the distance of the orbit of Neptune, and 1/100 of the sun's critical distance, "I" will only be reduced by one part in 10,000, to be I = 0.9999. At the orbit of Neptune, I = 0.9999999968. At the orbit of the Earth I = 0.999999999997. These figures show the Universal Field Cosmology is in agreement with what we know from experience — that Newton's formula for gravitational is a very good description of gravity within our solar system.

Although "I" only differs minutely from one within the solar system, it would be interesting to see whether these minute differences could account for the tiny anomalies of planetary motion that Newton's formula by itself can't account for. In particular, could it account for the tiny fraction of the precession of the perihelion of Mercury's orbit that Newton's formula can't account for, but general relativity can? Newton's formula already accounts for 99.23% of the precession of Mercury's perihelion, so it is quite conceivable that the tiny differences within the solar system, predicted by the Universal Field Cosmology, could explain the remaining 0.77%. (For a discussion of how the repulsion of nearby stars by our sun could affect the environment we live in, see Appendix D.)

Universal Field Cosmology's equation for gravity gives a rate of acceleration for the expansion of the Universe that is close to the observed value

The most interesting "road test" of Equation 34 would be to see whether it gives a value for the acceleration of the expansion of the Universe close to the value astronomers have observed. To try to get a rough estimate of what this theory predicts the acceleration of the expansion of the Universe is, we will first use Equation 34 to calculate how much gravitational repulsion there is between two adjacent "flat spot swirls."

The Pisces-Cetus Supercluster Complex, that our Local Supercluster is a part of, measures about a billion light years long by about 150 million light years wide, and has a mass of 10^{18} suns. According to this theory this supercluster complex must exist within one flat spot swirl, since there are no voids between any parts of it. Assuming it is a little larger than average for the Universe, we could say an average figure for the size of flat spot swirls might be about 800 million light years, separated by approximately equal sized voids, placing them at about 1.6 billion light year centers. We will also assume a somewhat smaller average mass of 5×10^{17} suns, the equivalent of about 500 superclusters the size of our local supercluster in each "flat spot swirl." We will assume these dimensions for each of our flat spot swirls to calculate how much they would accelerate away from each other. We'll then use a rough model to sum the accelerations across one radian of the Universe to get a "ballpark" figure for the acceleration of the expansion of the Universe. I'm sure a more rigorous analysis would be possible, but it is, unfortunately, beyond the scope of this initial presentation of this theory. Still, it would be useful to know if the theory, using this rough and ready model, can give a value that is within an order of magnitude of the observed value. If it can, then future efforts to refine the model and get a more precise value could be warranted. So let's see what we get.

Equation 34, one of the forms of this theory's formula for gravity, is:

$F_g = Gm_2(m_1 – (0.77373d^2/f))/d^2$

As previously discussed, the flatness is f = 1 because the masses are on separate flat spot swirls. Also, since $m_2 = m_1$ and F = ma, a = F/m and so: $a = F/m_2$. So:

$a = Gm_2(m_2 – (0.77373d^2))/m_2d^2$ or:

$a = G(m_2 – (0.77373d^2))/d^2$

Converting m_2 from suns to kilograms we get: $m_2 = 5 \times 10^{17} \times 1.9889 \times 10^{30} = 9.9445 \times 10^{47}$ kg

Converting d from light years to meters we get: $d = 1.6 \times 10^9 \times 9.461 \times 10^{15} = 1.5138 \times 10^{25}$ m

So:

$a = 6.673 \times 10^{-11}(9.9445 \times 10^{47} - ((0.77373 \times (1.5138 \times 10^{25})^2))/2(1.5138 \times 10^{25})^2$

$= -5.13 \times 10^{-11}$ m/s/s

The minus sign means this is a repulsive acceleration rather than an attractive one. This is however, just the acceleration between two repelling flat spot swirls (without any other flat spot swirls around them pressing back on them) about two degrees apart in the 4-D sphere of the Universe. To get the acceleration of the Universe, we need the accumulated acceleration across a whole radian of the Universe, which will be 57.3/2 = 28.65 times higher. But we also need to account for the fact that each of the flat spot swirls will be "pushing back" on each other as well, and will not be free to just accelerate into nothing. This should (according to an initial analysis, though I must say I'm not 100% sure of it yet) cut the total acceleration in half. But going with this figure, the acceleration of the Universe would be:

$a = (28.65/2) \times 5.13 \times 10^{-11}$ m/s/s, so:

$a_{calculated} = 7.35 \times 10^{-10}$ m/s/s.

How does this compare with what astronomers have observed? The figure for the observed acceleration I have seen quoted is: 73.8 ± 2.4 km/s/Mpc (Mpc = million parsecs)

$= 73.8$ km/s/3.26×10^6 ly. Since looking out a light year in space is the equivalent of looking back in time one year, this gives an actual acceleration of:

73.8 km/s/3.26 x 10^6 years = (73.8 ± 2.4 x 1,000)/(3.26 x 1,000,000 x 365.25 x 24 x 3,600) m/s/s

$a_{observed}$ = 7.17 ± 0.23 x 10^{-10} m/s/s.

As you can see, the calculated value is within the error limits of the observed value! Of course, considering all the assumptions and approximations made in calculating what the acceleration should be according to this theory, it can only be, as we started by saying, a ballpark value. Considering this, it is rather a coincidence that it agrees so closely with the observed value. For instance, the exact distance apart of flat spot swirls is not known, and this has a big effect on the result due to the number of them fitting into one radian. However, we did calculate earlier that flat spot swirls must be about 400 to 800 million ly in diameter, and if the expansion of the Universe has separated them by that much again, then the 1.6 billion ly separation seems quite reasonable. As for the mass of the superclusters in each flat spot, and the effect of separation distance on the repulsive acceleration between two flat spots, there is only a minimal variation between any reasonable values. For instance, if you halve the distance down to 800 million light years, and double the mass up to 1 x 10^{18} suns, the acceleration between two isolated flat spot swirls only changes from 5.13 x 10^{-11} m/s/s to 4.93 x 10^{-11} m/s/s, and other combinations of changes of this order, up or down, yield similar small changes in acceleration.

Since, as we've mentioned, the factor of 0.77373 in the subtracted term of Equation 34 gets smaller as the Universe gets larger with age, and this factor reducing will reduce the force the repulsive gravity, this theory suggests that the acceleration of the speed of the expansion of the Universe is very gradually reducing over time.

How Universal Field Cosmology explains Black Holes

Very massive large objects that are also spinning very fast could well have average rotational speeds well in excess of what would be needed to "flatten" the Universe in their vicinity. They could have sufficient speed to slow down the expansion of the Universe around them so much that the flat spot immediately around them would turn into a concavity (crater), and even into a deep "hole." The BPs of this matter would have their forward paths through time so splayed inward by this that it would increase the force of gravity in the area so it would be far beyond what would be expected from its mass alone (the Gravitational Intensity Factor, I, > 1 in Equation 15, maybe I = 100?). This tremendous gravitational field would suck even light into it, and be a "black hole."

The supermassive black hole at the center of our galaxy, and the presumed similar ones in other galaxies, would be good candidates for gaining gravitational field strength through rotation. Since our galaxy rotates, it would not be unreasonable for the mass inside a black hole at the center of it to be rotating. Also, its relatively large size means that its rotational speed (in rpm) could translate into a relatively high actual speed capable of creating a deep concavity where matter would have the inward splay necessary for "I" to be much greater than one.

In establishing the existence of the supermassive black hole at the center of our galaxy, astronomer Andrea Ghez discovered a number of very young stars orbiting around the center of the galaxy, very close to the center, at very great speeds of about 4% of the speed of light. This would only be possible if there were a huge gravitational attractor, a black hole, at the center of their orbits. It could be, in accord with this theory's suggestion that black holes are rapidly rotating, that the center of our galaxy *transitions* into being a black hole, with progressively higher rotational speeds as the black hole is approached. The 12,000 km/s speed of Ghez's very young stars could be, thus, just somewhat less than the speeds of objects inside the black hole. It could also be that the reason why only very young stars are found this close to the supermassive black hole is that matter this close to such a black hole is quickly accelerated by it and sucked into it, and that stars formed near it at earlier times have already been absorbed into it.

By plugging the SI formula for "α" (Equation 30) into the formula for gravitational red shift (Equation 18), we can get a formula for Z in terms of the mass of a body in kg, and its radius in meters (r):

$$Z = \sin(7.4243 \times 10^{-28} m/r) \qquad (39)$$

According to this equation, Z reaches a value of one, where no light could escape an object, when that object has a m/r ratio of 739,860 times that of the sun. This compares with m/r ratios of 474,006 and 176,628 times that of the sun for the two formulas general relativity provides. As was just pointed out, though, if a massive object is spinning very fast, its Gravitational Intensity Factor, "I" could be much greater than one, as the negative splay would add to "α" rather than subtract from it. This would allow a body to reach Z = 1, and become a black hole, at a much lower m/r ratio. This theory's general formula for gravitational red shift, would then be:

$$Z = \sin(7.4243 \times 10^{-28} Im/r) \qquad (40)$$

For I = 4.19 this formula would give the same m/r ratio for Z = 1 as general relativity's "long" formula.

The factor of 7.4243 x 10^{-28} present in Equations 39 and 40 just happens to equal to G/c^2. This means we can re-write Equation 40 as:

$$Z = \sin(IGm/c^2r) \qquad (41)$$

At the small angles seen when this formula is applied to the sun, and even much larger stars, the sine of the angle in radians limits, to a high degree of accuracy, to the angle itself, and unless the body is rotating at very high speed, "I", at the short distances involved, will limit to one. So in these usual situations, the formula becomes the recognizable "short" formula of general relativity (which, apparently, Newton's theory of gravity can also derive) of:

$$Z = Gm/c^2r \qquad (42)$$

Since Z = sin(½α), in these usual situations, Z = ½α, and ½α = Gm/c^2r, so:

$$\alpha = 2Gm/c^2r \qquad (43)$$

Since the deflection of light when it passes a body is, as we determined earlier, 2α, then the formula for gravitational lensing limits, in these usual situations, to the well-known:

$$\theta = 4Gm/c^2r \qquad (44)$$

Interestingly, all these equations have the factor G/c^2 in them. Since we determined earlier that the force of gravity, and hence G, vary with c^2, and c varies with the rate of the expansion of the Universe, which appears to have been varying over time, neither G nor c are actually universal constants that have been constant at all times since the Big Bang. Since G varies with c^2, though, G/c^2 would be a truly universal constant, that would have always kept the same value since the Big Bang, and will always keep it in the future. It would make sense to use this as a universal constant. It would be (to a higher precision than we have up to now been using): $U = G/c^2 = 7.42471382 \times 10^{-28}$. Then we could say that $\alpha = 2Um/r$, $\theta = 4Um/r$ and $Z = Um/r$. This would make it clear that these quantities do not vary over time, even as c varies. Uc^2 could be used to replace G in equations for gravitational force, making it clear that the force of gravitation varies with the square of the speed of light. Equation 34, the formula for gravitational force in this theory, would become:

$$F_g = Um_2c^2(m_1 - (0.77373d^2/f))/d^2 \quad . \quad . \quad (45)$$

Since, as previously mentioned, the factor of 0.77373 in the formula varies inversely with the radius of the Universe, it might make sense to introduce a radius of the Universe quotient "q", where q = radius of Universe/35.59158 billion light years. This would mean q = 1.2924405 at the moment (1/0.77373), when the radius of the Universe is 46 billion light years. Using this, the general formula for gravitational force would become:

$$F_g = Um_2c^2(m_1 - d^2/qf)/d^2 \quad . \quad . \quad . \quad (46)$$

This shows quite clearly just what factors gravitational force depends on, with the use of just one truly universal constant, U.

Universal Field Cosmology Explains much of the "mysteriousness" of space

General Relativity proposes that objects of matter bend "space" and that this bent space is then the "gravitational" field that dictates the movement of other matter. The fact that General Relativity doesn't say what it is in space that gets bent, or how matter bends it, nor how this bent space influences the movement of other matter, doesn't, however, undermine its usefulness as a theory — it still very accurately predicts how gravity works in many situations. It leaves the structure behind these workings a mystery, though.

Universal Field Cosmology likewise says matter causes a bending of something in space, but it also says what is being bent: the flight path of backward-through-time particles (BTTPs). This theory proposed, back in the section on gravitational red shift, that the BTTPs passing a body of matter (like the sun) are deflected by the same angle as a ray of starlight passing the same body of matter, and this was used as a "Rosetta Stone," so to speak, to develop the specific formulas for gravitational red shift and the force of gravity this theory provides — formulas that accurately describe the Universe, and limit to previously known formulas such as Newton's formula for gravity in most usual situations, but are initially, such as in Formula 32, formulated in terms of these angles of deflection. Since General Relativity says starlight follows the contours of bent space, it is clear that the flight paths of BTTPs around a massive object are exactly the same as General Relativity's "contours of bent space" around the object. Universal Field Cosmology then, like General Relativity, says these deflected BTTPs (bent space) are the gravitational field that dictates the motion of other matter, however, it also creates a model of how this works.

The power of having this model, quite apart from explaining much of the previous "mysteriousness" of space, is that it then predicts that gravity will turn into a repulsive force at great distances, which explains why the rate of expansion of the Universe is accelerating, and seems to fairly accurately predict the amount of this acceleration. This, of course, avoids the need to resort to propose the existence of what would be the most mysterious and weird thing of all about the Universe: "dark energy." That what is being bent in space is the flight path of basic particles of matter that repel matter as they travel backward in time, also gives scope for future attempts to develop a unified description of the forces between fundamental particles (currently described by quantum mechanics) and the force of gravity. My apologies to all those who rather liked the previous mysteriousness of space! I hope they'll find the mysteriousness of having "backward through time particles" a good substitute.

Universal Field Theory of Cosmology Explains the Existence of Cosmic Microwave Background Radiation and the CMB Rest Frame

The very basis of the Universal Field Cosmology is that the electromagnetic radiation of the Universe is at rest in a "stationary" Universal Energy Field, and that our material Universe is expanding through it at the speed of light. EMR originates from sources like light bulbs and stars, when "basic particles" moving forward in time at the speed of light collide with BTTPs moving backward through time at the speed of light. Their speed after the collision becomes zero, and they drop back into the EMR quantum state, and become a part of the stationary, Universal Energy Field (which appears to us to be moving at the speed of light, though it is in fact us that is moving). Since the Big Bang, a substantial amount of matter has dropped back like this into the Universal Energy Field, and this has made much energy available to the Universe. Let's call this "New Energy."

At the time of the Big Bang, though, this energy field already existed, and it was within it that the Big Bang took place and expansion of the Universe has taken place, and will continue to take place for countless eons into the future. It seems reasonable to suppose that such a huge energy field would not just have been empty at the time of the Big Bang, but would already have been populated with a matrix of energy. Let's call this "Old Energy." As the four dimensional spherical Universe of matter expands past the "particles" of energy in this matrix of Old Energy, one would expect the energy to be detectable to us as EMR. It would not come from any discernable source, though. It would just originate from countless "stationary points" in space and spread out in all directions. This would make it appear highly diffuse and scattered. And since it would be originating from "stationary points" no part of it should show a Doppler shift different from any other, as none of it would be coming from a moving source. Any Doppler shift we saw in this radiation would have to be solely due to the Earth's motion with respect to the "stationary points" the Old Energy radiates from.

The Universal Field Theory of Cosmology predicts that this "Old Energy" could exist and, if so, should be able to be detected as EMR. Indeed, I believe it has already been detected, because Cosmic Microwave Background Radiation (CMB) has exactly the qualities, just outlined, that this Old Energy should have. It seems to come from everywhere in space, and has a "blackbody spectrum" typical of radiation that has been highly scattered. It has no discernable source, except that the source of all of it is traveling at the same speed with respect to the Earth, enabling astronomers to specify a CMB "rest frame" within which the source of all of this radiation is at rest, as determined by Doppler shifts.

The existence of this "rest frame" is also evidence that all speeds are not just relative to each other, but that there actually are absolutely "stationary points" as the Universal Field Cosmology predicts. I propose that the CMB rest frame is one and the same as the grid of "stationary points" of this theory. The Solar System's motion with respect to the CMB rest frame has been determined by Doppler shifts to be about 400 km/s in the approximate direction of the constellation of Leo.

Our galaxy is moving at about 630 km/s with respect to this rest frame, and over the billions of years this has been our solar system's average speed, too. At the moment, though, we are at a part of our orbit around the center of our galaxy that moves us in the opposite direction at about 220 km/s, causing our current speed with respect to CMB rest frame to be about 400 km/s.

Prediction of Increased Time Dilation in Accelerated Particles

It is fairly easy to calculate that the solar system's motion of about 400 km/s with respect to the "stationary points" it is passing through, which is proposed by this theory, should affect the amount of time dilation experienced by satellites rotating around the Earth, and particles moving close to the speed of light in particle accelerators. The difference from what Special Relativity predicts for Earth orbiting satellites is extremely tiny, amounting to less than one second of difference in time dilation in five million years, an amount that we may never be able to measure. The difference for a particle moving around a particle accelerator at 0.999983 of the speed of light (299795 km/s) is much more measurable, though. The time dilation predicted by Special Relativity, the Lorentz factor, is 173.15 — in other words a particle which would decay in one second at rest would last for 173.15 seconds. According to this theory, because of the Earth's 400 km/s motion toward a point in the constellation of Leo near the constellations of Crater and Virgo, a particle traveling at this speed around an orbit in a particle accelerator whose plane is perpendicular to the direction of the Earth's line of travel towards this point in Leo, should last 178.0 seconds, about 2.8% longer than Special Relativity would suggest. The Universal Field Theory of Cosmology thus makes the prediction that differences in time dilation of this order should be able to be observed in accelerated particles.

Prediction that Speeds up to about 400 km/s greater than the speed of light will be able to be measured in accelerated particles

It follows from Universal Field Cosmology that no particle can travel through the three space dimensions at more than the speed of light relative to the "stationary points" it is passing through. Since the grid of these stationary points is, according to this theory, one and the same as the CMB Rest Frame, it follows that accelerated particles could have speeds of up to the speed of light relative to the CMB Rest Frame. This means that if a particle were traveling from the direction of the point in Leo our Earth is traveling toward, at close to the speed of light relative to the CMB Rest Frame, that its speed, added to the speed of the Earth moving toward that point in Leo at 400 km/s, could add up to greater than the speed of light, as measured from the Earth. This theory thus predicts that accelerated particles moving from the general direction of this point in Leo could be measured to have speeds exceeding the speed of light. Particles coming from close to that point in Leo could have speeds, as measured on Earth, of up to 400 km/s higher than the speed of light. But even particles coming from up to 60° away from this point in Leo could have speeds up to 200 km/s higher than the speed of light, particles coming from 80° away from this point could have speeds up to 69 km/s higher than the speed of light, and particles coming from 88° away from this point could have speeds up to 14 km/s higher than the speed of light. Particles traveling from the hemisphere opposite this point in Leo, however, could not exceed the speed of light, and particles coming from near the center of this opposite hemisphere would be restricted to a maximum speed of about 400 km/s below the speed of light.

Old Energy and Hindu Cosmology

Since the publication of *The Tao of Physics* by Fritjof Capra, we have become increasingly aware of the parallels between modern physics and some of the ancient wisdom from the East.

Hindu cosmology says there are three planes of existence, the "Causal," a realm of pure ideas (like the world in which theoretical physicists work), the "Astral," a realm of forms made only of energy, and the "Physical," where the energy blueprint created in the Astral is transformed into physical reality. The physical Universe is considered by Hindus to be a small clump of matter attached to the vastly larger Astral universe of "light" (or energy) that dictates its form.

It has not escaped my attention that there is an uncanny similarity between this Hindu cosmology and the Universal Field Cosmology model of the Universe I have presented here. The Universal Energy Field, within which the Big Bang happened, and into which the physical Universe continues to expand, is like the Astral plane, a domain of pure energy, with the physical Universe being substantially smaller than the Universal Energy Field, as it is continually expanding into it, and will, presumably, continue to do so for billions of years to come.

The Astral is filled with creative energy, and the Universal Energy Field is filled with "Old Energy" (as well as New Energy). The energy forms in the Astral are a blueprint for what emerges in the physical, so, to continue this parallel, could it be that the "Old Energy" (CMB) plays a similar role, and is a kind of "blueprint" that is progressively "scanned" as we travel past it at the speed of light through time, and that it determines the forms that matter takes as it moves through time?

In terms of the Universal Field Cosmology, one of the things this "scanned information" could code for would be which particular basic particles in matter would collide with oncoming BTTPs, and which wouldn't. This would play a big part in determining, among other things, the energy levels of electrons around atoms, and in turn the whole chemistry of substances, and the biochemistry of life.

One of the problems with the idea that CMB is radiation left over from the intense energy of the Big Bang is how very uniform this energy is — it gives very little scope for the differentiation into galaxies and clusters of galaxies that has subsequently occurred. But if this radiation is "coding" for how physical reality expresses itself, then in terms of a "picture," you would expect it to be very uniform, with the variations occurring only on a very fine level. Look at this page — it is just blocks of text. You can't see a picture in it. When I look at a large paragraph without my glasses, its appearance is that of a mottled uniformity, rather like the pictures of CMB we see, which also show a kind of mottled appearance. It is only if you look at the page of text with a resolution sufficient to see the fine detail, and the knowledge needed to decipher it, that you can see it is rich in information. Such could be the case with the "Old Energy" (CMB) that we see. So far we just see a mottled uniformity in it.

If the "Old Energy" does turn out to be "code," though, (like the genetic code DNA stores) and we can one day learn to "read" and "write" this code, in what wonderful ways might we be able to bend reality to our bidding? For instance, we may, one day be able to draw energy out of the Universe for human use, in a cheap, plentiful, safe and environmentally friendly way.

Now we are like end users of a computer program, who can only learn the rules of the program, and figure out how to use it to our advantage. Then we will be like computer programmers, and be able to change the way the program works whenever we wish to.

John Barrow, in his book *Theories of Everything*, says, "The great unanswered question is whether there exists some undiscovered organizing principle which complements the known laws of Nature and dictates the overall evolution of the Universe." This scanning of the Old Energy blueprint could just turn out to be such an "organizing principle," specifying the pattern for development of organized complexity in the Universe in the face of the otherwise continually increasing disorder of entropy. Barrow goes on to say that the discovery of an organizing principle that specifies how the Universe evolves, "…would be profoundly interesting because the Universe appears to be far more orderly than we have any right to expect." The existence of a continuously scanned blueprint would certainly explain this puzzling excess of order in the Universe.

I know I've gone off on a tangent of speculation in this final section, largely for the fun of it, but also to suggest one possible direction for future research. One redeeming virtue of this speculation is that it is, at least, all consistent with the Universal Field Cosmology, and with what we know about CMB and the entropy levels of the Universe — which is, of course, not to say it is necessarily true. Many different lines of speculation are possible from the basics of this theory, and only the patient, thorough progress of science will, in time, through the dedication of many very special men and women, reveal how the Universe actually works.

Mark Mason,
30160 Fox Hollow Rd.,
Eugene, OR 97405
USA

July 6, 2011

Latest revision: April 22, 2012

Feedback is welcome!

Contact information:
www.markmason.net
mark@markmason.net
Ph: 541 359-0724

Appendices:

Appendix A:

As mentioned in the text, this theory thus predicts that electrons in higher (more energetic) orbitals would weigh slightly more than those in lower orbitals, in proportion to the energy of the photon emitted when the electron moves between the orbitals. It is possible that being of higher mass might propel an electron into a higher orbital, and being in a higher orbital might "expose" the electron to a collision of the right number of BPs to return it to its lower orbital. Then when the collision takes place, and the photon is emitted, the lower mass of the electron would allow it to return to a lower, less energetic orbital. When in the lower orbital, BPs in the electron would be "protected" from a collision involving this many BPs, although they may be vulnerable to a collision involving fewer BPs, until the electron is in its lowest possible orbital, where it would be "protected" from all collisions with BTTPs.

When an atom absorbs a photon, the reverse process must occur. If an electron is exposed to a photon that has the right energy to allow it to jump to a higher orbital within the atom, it will absorb the photon, and accelerate it from its stationary (energy field state) up to the speed of light (matter state). An equal and opposite action and reaction would occur, whereby a cluster of BPs are propelled forward in time at the speed of light to become extra mass in the electron, and the same number of them are propelled backward in time at the speed of light to become BTTPs in their domain. In this way momentum would be conserved.

In most ordinary situations, "basic particles" (BPs) within the nuclei of atoms are "protected" from collisions with BTTPs. In certain circumstances, though, such as the rare one where ^{235}U nuclei are bombarded with neutrons leading to a fission of the nuclei, or the much more common one occurring in stars where high temperatures and pressures lead to the fusing of nuclei to create nuclei of heavier elements, BPs are exposed to collision, and some of the mass of protons and neutrons is carried away as EMR.

Again, the mass removed from protons and neutrons is small compared with their total mass, and should not interfere with their function. However, protons and neutrons weigh over 1,800 times as much as electrons, so there is much more scope with them for releasing large amounts of energy. In atomic bombs, only about 0.1% of the mass of split ^{235}U nuclei is converted to energy (and only about 40% of the ^{235}U nuclei are split). Though this is likely to be due to degrees of "protection" of BPs within the nucleus, another reason suggests itself as well. Matter, and hence BPs, are very highly concentrated within the nucleus of atoms. The clumps of BTTPs which are available to collide with BPs in nuclear reactions would be more spread out, so that the number of BTTPs passing though a nucleus at one time would be a lot fewer than the number of BPs there. As a result, only a small percentage of BPs in nuclei could be involved in collisions (presumably only about 0.1% to 0.7%, as that's what's seen in nuclear reactions).

Appendix B:

The simple argument for the inverse square relationship is that because the ever so tiny repulsion between p1 and m2 and p2 and m1, causing the initial slight deflection of p1 and p2, is inversely proportional to the square of the distance between m1 and m2, this causes a multiplier effect, as discussed earlier, where p1 repels m1 toward m2 and p2 repels m2 toward m1 with a greater force, which should have a multiplied-up inverse square relationship. Bear in mind, in terms of trying to analyze Figure 6, that it is only the repulsion in the space dimensions, perpendicular to the line of travel through time, that has any effect on this attraction between objects in space. It should also be noted that the angle of deflection of backward-through-time particles (BTTPs) will vary with the simple inverse of the distance from the center of the object that is repelling it, not the inverse square. Although the repelling force varies with the inverse square of the distance, the amount of time it is being repelled to gain its deflection increases directly with the distance, canceling out the squared inverse for the deflection, and bringing it back to a simple inverse. A final factor to consider is that the further apart m1 and m2 are, the more BTTPs will be passing between them, adding a slight repulsive force to attenuate the attractive force — and the number of these certainly depends on the square of the distance between m1 and m2.

Appendix C:

In our atmosphere, at standard temperature and pressure (STP), gas molecules are an average of about three nanometers (nm) apart. In liquid water the molecules are about 0.3 nm apart. Both of these distances are much greater than the critical distance of a water molecule which is about 0.01 nm, at f = 2,500, the flatness figure we have been working with. This would mean that water molecules would, according to this theory, gravitationally repel each other rather than attract each other! In liquid water, of course, the surface tension is far greater than the tiny gravitational repulsion, and ensures water stays together in drops. In the atmosphere, though, water vapor molecules would certainly repel each other at the average 3 nm distance they are apart. An accumulation of water approaching 100 nm in radius would be needed to actually attract further water molecules. A 100 nm radius water droplet would have a critical distance of 117 nm, so water molecules approaching it would be attracted rather than repelled.

For cloud droplets to begin to form, according to this theory, somehow a decent sized nucleus would have to form, or already be present, with a critical distance large enough to attract more water molecules. One possibility is that when there is a sufficient concentration of water molecules present collisions could occasionally bring enough water molecules into simultaneous contact so that surface tension between the molecules could hold them together. As further collisions added to the size of this droplet it would reach the 100 nm radius needed to gravitationally attract more water molecules to the droplet, then would grow faster.

It is known that cloud droplets actually form around tiny particles of matter, such as dust, called cloud condensation nuclei or CCNs, and can form with their aid at only about one fourth the concentration of water molecules in the air that would be needed without them. Typically these particles are about 200 nm in diameter, but can be as small as 100 nm in diameter or 50 nm in radius. It turns out that a 50 nm radius dust particle with a density twice that of water would have a mass of 1.047×10^{-18} kg, and a critical distance of about 58 nm, slightly larger than its own radius, so it would be able to gravitationally attract water molecules to its surface to begin forming a cloud droplet without the need for high concentrations of water vapor to be present so a nucleus could be formed through the simultaneous collision of multiple molecules. A 100 nm radius CCN twice as dense as water, a more typical size for CCNs, would have a critical distance of 167 nm, considerably larger than its radius, so would easily be able to attract water molecules. This theory suggests that particles much smaller than 1×10^{-18} kg, which have critical distances less than their radii, would, as they get smaller, become increasingly ineffective as CCNs.

The fact that the critical distance of water molecules dovetails in so well with the properties of water at a flatness of f = 2,500 seems to confirm that this is a good estimate of the flatness of the “flat spot swirl” our supercluster of galaxies resides in. It is interesting to speculate that, according to this theory, water could have significantly different properties in another ‘flat spot swirl” that had a significantly different flatness. At a lower flatness, water would condense less easily into clouds and rain drops, and be more likely to stay in the vapor state.

I don’t know enough about cloud formation physics to know whether the gravitational critical distances of Universal Field Cosmology could help explain the process of cloud formation, but it does seem from the above discussion that there is the possibility that they could.

Appendix D:

One possible “road test” of Equation 34 is to look at the gravitational interactions of some local stars. The sun has a critical distance of about 8.47 ly, and there are just four star systems within this radius. This means that, according to this theory our sun will only have any gravitational attraction for these four star systems; all others it will repel slightly, except for Sirius as we are within *its* critical distance. All these other stars are being slightly repelled by our sun, and over billions of years, this could have a significant effect in keeping stars’ trajectories safely away from our sun and helping to preserve the stability of our orbit around the sun necessary for the evolution and maintenance of life. As stars approach our sun, this repulsion would slightly slow down their radial velocity toward us, and slightly increase their proper motion, steering them slightly away. Consider the star Ross 248, which is 10.4 light years from us, and traveling toward us at 81 km/s. Its proper motion is such that it will pass our sun at a distance of about 3 light years in around 36,000 years. If we assume Ross 248 got to where it is now very gradually decelerating as it went due to the repulsion calculated by Equation 34, then without this repulsion happening over the last 100 million years, Ross 248 would have traveled about 10.5 light years further, and be passing us right now, possibly significantly closer than three light years, since there would have been no repulsion to increase its proper motion so it would pass safely clear of us. This repulsion by our sun, for objects significantly further away than the critical distance, accelerates them by an amount of -6.5×10^{-10} km/s/year — a tiny amount, for sure, but one which adds up to something noticeable over the billions of years, especially where larger stars are concerned.