TITLE: The Universe is Contracting

Authors:

Todd Sicklinger

Affiliations:

Todd Sicklinger

105 McCabe Ave, Bradley Beach, NJ 07920, USA

908 872 4100

Todd_sicklinger@hotmail.com

Abstract:

Is the Universe expanding? No, the Universe is contracting!! When we observe light from distant Galaxies, the light has longer wavelengths and its photons have less energy than the light emitted by identical objects located closer to us. Additionally, the observations of type 1A supernovas indicates that the amount of redshift is increasing with time. The concept of Dark Energy has been postulated to explain this apparent acceleration. However, the observations have been misinterpreted and the Universe is actually contracting. The action of a contracting Universe is applied to objects in the universe through a change in the metric tenser and this change causes all objects in the Universe to have increased velocity with respect to an observer when the energy density of the Universe increases. Additionally, the contraction of the Universe causes the physical size (volume) of every massive object in space to decrease and the

energy density of every object to increase, where this change in size is explained by an intimate unification relationship between General Relativity and Quantum Mechanics caused by the uncertainty factor. Essentially, we change size at the same relative rate as the universe, but we observe the Universe as Contracting because our rate of time has also increased.

One Sentence Summary:

The Universe is Contracting and so are the Objects in the Universe.

Main Text:

Through observation, Astronomers have determined that distant Galaxies have a red shift and that this red shift increases with the distance of the galaxy.[1] I demonstrate that these observations are exactly what we would expect if the Universe was contracting.

All physics is built upon the concepts of constancy and invariance. The most basic expression of constancy is that an object's inherent nature cannot change, unless the object undergoes an interaction with another object. In classical physics, constancy and invariance are embodied in the concepts that energy, mass, momentum, and angular momentum are all conserved quantities of an object and those quantities cannot change for that object unless the object is acted upon by an external force.

In Special Relativity, constancy is defined by the concept that the inner products of certain vectors describing an object are constant regardless of the reference frame that the object is viewed from. The constancy in special relativity is embodied in the Lorentz transforms, where we can use a Lorentz transform to change the view that an observer has of a vector, which changes the individual elements of the invariant vectors while leaving the inner products of those vectors constant. Equations 15 and 16 provide the energy momentum vector and the position vector for an object being observed in space time.

The energy momentum vector **P** and the position vector **X** of an object S can be combined together to represent the state of object S, where **S** = (**P; X**), where the inner product of S with itself is given as shown below:

$\mathbf{S} \cdot \mathbf{S} = \mathbf{P} \cdot \mathbf{P} + \mathbf{X} \cdot \mathbf{X} = E_0{}^2/C^2 + D^2 = K.$

$\mathbf{P} \cdot \mathbf{P} = E^2/C^2 - P_x{}^2 - P_y{}^2 - P_z{}^2 = E_0{}^2/C^2,$

$\mathbf{X} \cdot \mathbf{X} = (CT)^2 - x^2 - y^2 - z^2 = D^2$

where E is the total energy of the object, including its rest energy and its momentum energy. D is the distance of the object S from a reference point $\mathbf{X}_0$ = (0, 0, 0, 0). An energy momentum Vector $\mathbf{P_1}$ is inherently the same vector as the vector $\mathbf{P_2}$, if the inner product of $\mathbf{P_1}$ with itself is the same as the inner product of $\mathbf{P_2}$ with itself, $\mathbf{P_1} \cdot \mathbf{P_1} = \mathbf{P_2} \cdot \mathbf{P_2}$. Accordingly, the energy momentum Vector (3, 2, 1, 0) is inherently the same vector as (3, 0, 1, 2), since both vectors have the same inner product.

The expansion of the Universe is exemplified by the inner product of the vector **X** with itself decreasing over time because it shows an increase in the space dimensions. For an expanding universe, the quantity D in the inner product, $\mathbf{X} \cdot \mathbf{X} = (CT)^2 - x^2 - y^2 - z^2 = D$, will decrease with time for all distance vectors.

Lorentz transforms are a type of symmetry transformation, which means that a Lorentz operator **L** can act on a vector without changing the vector's inherent nature as defined by the vector's inner product with itself. Accordingly, the formula, **LS** = **S'** shows the Lorentz operator transforming the vector **S** into the vector **S'**. Since the vectors are invariant under a Lorentz transform, the inner product **S · S = S' · S'**. Lorentz transforms can rotate a vector, change its position, change its velocity or any combination thereof, without changing the inner product of the vector with itself. Accordingly, the Energy momentum vector and the distance vector can be transformed to any non-accelerating reference frame without changing the inherent nature of the vector.

It is important to remember that in the four dimensional space, a vector is not just a single point in space or time, it is an entity that exists as a path through the four dimensional space, where the vector has distinct but variable characteristics at each point in the path. A vector is similar to a wire winding its way through space time. When you transform the vector, you move the entire vector/wire so that you can see what the vector/ wire would look like at another location in space. Likewise, you can use a Lorentz transform to move an observer from one location to another to see what vectors look like from other parts of space. However, Lorentz transforms don't actually apply any forces to the vector or to the object the vector represents. They are just a mathematical technique not a means of applying a force to an object.

Special Relativity enhanced the concept of constancy to include the concept that the speed of light is constant for all observers. If a Special Relativity space was expanding, then the value D in the inner product of the vector **X**, $\mathbf{X} \cdot \mathbf{X} = (CT)^2 - x^2 - y^2 - z^2 = D^2$, would not be a constant but would get smaller as a function of time, since the space dimension would get smaller with respect to the time dimension. This same concept of expansion carries over into General Relativity, except that the concept of a conserved inner product is more complicated in General Relativity.

General Relativity is an extension of Special Relativity and it differs from Special Relativity principally in the nature of metric tensor used to measure vectors in space-time. The metric tensor defines the inner product of a vector. In both General Relativity and Special Relativity, the metric tensor is a 4X4 matrix G, where the sixteen elements of the tensor are used to weight the components of the inner product, such that an inner product done using the matrix will provide the appropriate constant measurement of value for a vector that hasn't been acted on by a force and such that the vector can be measured in a consistent way through space-time.

In Special Relativity, only the diagonal terms of the metric tensor are non-zero, where the g00 term is -1 and the other diagonal terms are 1. The Special Relativity metric tensor yields the inner products for the energy momentum vector and the distance vector in the form shown above.[2,3]

However, in general relativity, all 16 elements of the metric tensor can be non-zero, unless limiting restrictions are placed on the mass distribution or on the intensity of the gravity field.

For certain symmetric non-rotating mass distributions, solutions to the Einstein field equations of General Relativity will provide a metric tensor that can be reduced to a metric tensor having non-zero elements only along the diagonal.[2, 3]

The value of the matrix elements of the metric tensor are determined by the distribution of mass density in the Universe and determining the matrix tensor elements based on the mass distribution in non-symmetric high field situations can be difficult. For analysis, simplified mass distributions are often used. In the well-known Schwarzschild solution, the metric tensor has non-zero magnitudes of elements only along the diagonal. Additionally, in weak gravity fields, the metric tenser can be approximated by applying a metric tensor having non-zero elements only along the diagonal.[2, 3] Further, by representing the diagonal elements as the infinite sum of linear basis functions, you can reduce the matrix to a matrix that has only non-zero elements on the diagonal.

Since we observe the redshift phenomenon from the Earth which has a weak field, we can use a weak field approximation to analyze the expansion or contraction of the Universe as viewed from earth.[2,3] Since a scalar times our weak field metric tensor is the same as the metric tensor, the real work of the weak field metric tensor comes in the ratios between the diagonal elements. The g00 element of the metric tensor operates on the time dimension and the energy dimension of the respective vectors. The g00 element can have a value of from -1 to zero. Where a value of minus one corresponds to a location infinitely far from our gravity field and a value of zero represents a location at the surface of a black hole. The g11 element of the metric tensor corresponds to the x dimension, the g22 term corresponds to the y dimension, and the g33 corresponds to the z dimension. If the field is also spherically symmetric, then the g11 term, the g22 term, and the g33 term can all be made equal to one and the whole tensor can be effectively described by the g00 element. If the mass distribution is asymmetrical, the values of the elements g11, g22, and g33 elements determine the way in which the inner product varies as a function of space. However, we will assume the symmetric case for the remainder of our analyses.

It is instructive to compare different metric tensors for different levels of mass density. In hypothetical case one, the gravitational field strength is zero and the g00 element = -1, the metric tensor becomes the special relativity metric tensor, which yields the inner product $\mathbf{P \cdot P} = E^2 - P_x^2 - P_y^2 - P_z^2 = E^2_{0.}$ In hypothetical the case two, the value of g00 = 0.5 and the other diagonal elements all equal 1, the inner product $\mathbf{P \cdot P = (1/2)}E^2/C^2 - P_x^2 - P_y^2 - P_z^2 = E^2_{0.}$ Accordingly, the value of E^2/C^2 must be reduced from its initial value for the inner product to remain constant. This is indicative of a decrease in the rest energy of the object as the object goes deeper into gravity well and it shows that the metric tensor changes the relationship between rest energy and momentum energy in the inner product to account for this change in rest energy. This relationship will be discussed in detail later in this paper.

If you and an object sitting next to you were both in hypothetical case 1 with g00 = 1.0 and then you altered the gravity field at your location such that metric element g00 became 0.5 instead of 1.0, you would cause large amounts of energy to transfer from the rest energy of the object into the momentum energy of the object increasing the object's distance from you and its velocity from you. This is required since the object must satisfy the energy momentum relationship of the inner product for its location in space as defined by the metric tensor for that point in space. However, a contracting universe increases mass density, which is what would cause the magnitude g00 element of the metric tensor to get closer to zero. It is like a figure skater bringing her arms in or a container of gas being compressed. The velocities increase. Additionally, the contraction causes the energy density of every object in the universe to increase and the physical size of every object in space to decrease and the rate of time of every object to increase.

This change in physical size will now be explained to provide a beautiful symmetric relationship that applies from quarks to galaxies and to show that the Universe is contracting.

When a clock is moved from being stationary at location R_0 in a valley to a location $R_0 + h$ on a mountain top, a force is applied to the clock over a distance, which performs work on the clock and increases its energy. Accordingly, the force applied to the clock while moving it from a stationary location in a valley to a second stationary location on a mountain top must increase the Energy of the clock by an amount $\int F_{(clock)}(R)$ dot dR as measured by an observer in the valley.[2,3] The energy applied to the clock by the person carrying it is equivalent to the increase in the energy of the clock, which equals $(E_0(R_0)gh/c^2)$ for the weak gravity field of the earth. Since the clock was originally stationary in the valley and since it is also stationary on the mountain, all of the increased in energy (E_0gh/c^2) goes into the rest energy of the clock (see equation 5).[2,3,7] In general, any force applied in line with the gravity field only increases the object's rest energy and any force applied perpendicular to the gravity field only increases the object's momentum energy.

The rest mass of an object is the rest energy that the object would have if it was located in a hypothetical location outside the gravity field. Rest mass is invariant when the object is measured from different observation frames. The rest mass is the value of rest energy at a hypothetical co-moving location where g00 = -1.[2,3] Rest mass is given by the following equation

$m_o = E_0(loc) = E^R{}_0(R)/\sqrt{(g00(R))}$

When a photon is emitted from an object (object 1) at a location R_0 of a gravity well and the released photon is detected/absorbed at a location R + h higher in the gravity well by a second object (object 2), the photon will be measured to have had a wavelength $\lambda_{(R + h)}$ that is greater than the wavelength $\lambda_{(R)}$, by the observer at location R + h. The photon did not increase the energy of object 2, as measured at location R + h, by as much energy as the photon decreased the energy of object 1 as measured by the change in energy of object 1 at location R_o. Accordingly, the observer at location R_o + h observes the photon as having a red shift of $-gh/c^2$ (see equations 9-16).[2,3,4]

However, photons never change their inherent nature or their actual size regardless of where they are in the gravity well because no force can act on them. You can't apply a force to a photon. Since you can't change an object without applying a force to it, the inherent nature of the photon cannot be changed without absorbing the photon.[2,3] Accordingly, "the phenomenon called the red shift of a photon is actually the blue shift of an atom".[2] The apparent red shift of the photon is caused by the observer at location 2 being physically smaller than the observer at location 1, which is caused by the observer at location 2 having greater energy than the observer at location 1.[2,3,4]

Imagine identical clocks (Clock 1 and Clock 2) and two identical observers (observer 1 and observer 2) in a valley. Observer 1 wearing Clock 1 takes an elevator to the top of the mountain and then gets off and then sits there. Clock 1's rest energy becomes greater than Clock 2's rest energy by an amount W_{ec1} equal to $\int F_{(clock\ 1)}(R)$ dot dR when it is moved up the mountain by the distance h to location $R_o + h$, in the Earth's gravity field. We know that all of the energy applied to Clock 1 went into its rest energy, even though it was applied kinetically, because clock 1 is at rest with respect to both observers before and after being carried to the top of the mountain. This increase in rest Energy applies to all elements of the clock including its electrons and nucleons.[2,3,4]

The Bohr radius describes the radius of an atom such that the radius is inversely proportional to the mass (energy) of the electron.[4] Since the applied force was in line with the electron's rest energy, all of the energy went into increasing the electron's rest energy and none went into increasing the electron's velocity. Accordingly, the radius of the atom decreased by an amount proportional to the increase in rest energy.

The postulates of relativity requires that an observer cannot tell that he is free falling in a gravity well by observing himself. If the characteristics of your atoms changed in a way observable to you, then you would violate a postulate of General Relativity. Accordingly, all measurable nuclear properties of Clock 1, as measured by observer 1, must vary in lock step with the variance of clock 1's rest energy, rate of time, change in size and with the atom radius, as the clock 1 moves from location R_0 to location $R_0 + h$. If the observable nuclear properties, such as nuclear radii or reaction rates, did not vary in lock step with the photon wavelength and the rate of time, then observer 1 could tell he was moving in a gravity well simply by observing the properties of her atoms.

Gluons are the gauge bosons that transmit the strong nuclear force.[6,7] They decay with time and thus provide a range limit for the nuclear force that determines the radius of the nucleus.[6,7] The decay rate of gluons arises from the uncertainty relation, where there is uncertainty in the ability to confine momentum and position simultaneously. Accordingly, the decay rate of Gluons is inversely proportional to the Gluon rest energy, which means that the nuclear radii are inversely proportional to rest energy and that the nuclear radii will follow the same equations for change in radius as the electron radius of the atom. Thus the nuclear radii will vary in exactly the same manner as the atomic radii when Clock 1 is moved to the top of the mountain, as observed by observer 2 in the valley. This inverse size/radius relation holds for all particles in the nucleus.

Since the force was applied in line with the gravity field, all of the energy went into the rest energy and the particle velocities for the clock components have not changed for either observer. Since the velocities of light and the velocities of the sub-atomic particles have not changed and since the radius of the atom and of the nucleus and of the particles all decreased , the amount of time for an interaction to occur has decreased by the same factor as the radius which is the same factor by which the energy increased which is the change in √g00.

All interactions will occur faster for Clock 1 than for Clock 2 as observed by observer 2 and as observed by observer 1. The change in this rate of interactions (rate of time) for Clock 1 will be exactly the change in the √g00 factor that determines the change in rest energy, since the lengths associated with clock 1 all changed inversely to the change in Clock 1's rest energy. Observer 1 will observe that Clock 2 has increased in volume, gotten lighter, and gotten slower. Likewise, Observer 2 will observe that Clock 1 has decreased in volume, gotten heavier, and gotten faster.

If we were able to change the metric tenser element g00(mountain top) to the magnitude g00(valley), all of the internal/rest energy that we added to Clock 1 when we moved it up the mountain would translate into momentum/kinetic energy and cause the clock to acquire a relative velocity away from us and to have a greater space difference from us. This effect is exactly what happens to all massive objects in the Universe when the universe contracts and increases the overall mass density of the Universe. Accordingly, the contracting universe causes all massive particles to acquire real relative velocity away from each other and to become farther apart, which explains our observations of the Universe without the need for Dark energy. We normalize our measurements of the universe based upon our own contraction so that we perceive the universe to be expanding.

However, the Universe started out at a diffuse slow moving state and its contraction increases the kinetic energy and the distance of the objects in the Universe. This makes all objects in the universe get smaller and faster with time because the contracting Universe increases the rest mass for each object and thereby lowers the g00 metric tensor element for each object in the universe. The increased g00 element causes all objects in the universe to acquire distance and velocity away from the observer just as expected for a contracting Universe.

Equations:

$\mathrm{Delta}(\text{Ø}(h)) = \text{Ø}(R_0 + h) - \text{Ø}(R_0)$. (1)[2,3]

Ø is the gravitational potential, R_0 is a location is space in a gravity well, and $R_0 + h$ is a second location in the gravity well.

$\mathrm{Delta}(\text{Ø}_{weak}(h)) = \text{Ø}_{weak}(R_0 + h) - \text{Ø}_{weak}(R_0) = gh$. (2)[2,3]

$\text{Ø}_{weak}(R) = - GM/r$, $g = - GM/r^2$

G is the gravitational constant, M is a centrally located mass, r is the radius from the mass to the location R, and g is the filed strength in the weak field.

$g00(R) = 1 + 2\text{Ø}(R)/c^2$. (3)[2,3]

This equation provides a valid approximation for the g(0,0) element of the metric tensor in a weak gravitation field like we have on Earth. This could be expanded by additional terms for a more precise approximation.

$\sqrt{}(g00(R))\ E_0(loc) = E^R{}_0(R)$. (4)[2,3]

$E_0(loc)$ is rest energy of an object or particle at a hypothetical co-moving location where there is no gravitational potential (Ø = 0, and g00 = 1) and $E_0(R)$ is the rest energy at the location R.

$m_o = E_0(loc)$.   (5) [2,3]

This defines the concept of rest mass.

$\sqrt{}(g00(R)E_\gamma^R(R) = (E_\gamma^{loc}(_{loc}))$. (6) [2,3]

$E_\gamma^R(R)$ is the energy of a photon γ emitted at R and measured at R and $E_\gamma^{loc}(loc)$ is the energy that an observer would measure the photon.

$\sqrt{}(g00(R)\ \epsilon_\gamma^{loc}(loc) = \epsilon_\gamma^R(R)$.   (7) [2,3]

$\epsilon_\gamma^R(R)$ is the amount of energy detected at R for a photon γ emitted by an atom or an atomic nucleus at location R as measured at R. $\epsilon_\gamma^{loc}(loc)$ is the amount of energy as measured from R that the same atom would emit if the atom was at loc.

Red shift = λshift = (λ(observe) - λ(emit)) / λ(emit) = (ω(emit) - ω(observe)) / ω(observe). (8) [2,3]

$(E_0(R_0 + h) - E_0(R_0))/ E_0(R_0) = - gh/c^2$. (9) [2,3]

$(E_\gamma (R_0 + h) - E_\gamma(R_0))/ E_\gamma (R_0) = gh/c^2$. (10) [2,3]

$(\epsilon^{(R + h)}(R_0 + h) – \epsilon^R(R_0))/ \epsilon^R(R_0) = - gh/c^2$ (11) [2,3]

Equations 8-10 describe a red shift, which is the relative amount by which a photon's wavelength has increased, while a blue shift is the relative amount by which a photon's wavelength has increased decreased. A longer photon wavelength provides lower energy. Equations 10-12 are applicable in a weak field.

$E^{(R0)}(R) = (E_0(loc))\ (g00(R_0))/ \surd(g00(R_0)) – (v^{(R0)}(R_0 + h))^2/c^2))$. (12)[5]

$Y_{SpecialGeneral} = (g00(R_0))/ \surd(g00(R_0)) – (v^{(R0)}(R_0 + h))^2/c^2))$ (13)[5]

E(R) is the energy of an object, v is the velocity of the object, where the object is traversing a gravity well with a velocity v relative to an observer at R_0 and where the object mass, energy, and velocity are all measured from $R_{0.}$ Equation 18 is the combined special relativity/general relativity gamma factor that allows for calculating many relativistic effects of gravity and special relativity simultaneously.

$r_{(atom)}{}^{(R0)}(R) = a/E_e{}^{(R0)}(R)$ (14)[4]

$r_{(atom)}{}^{(R0)}(R)$ is the radius of an atom at the location R as measured at the location R_0, where the atomic radius is inversely proportional to the electron energy according to the Bohr model.

$\mathbf{P \cdot P} = E^2/C^2 – P_x{}^2 – P_y{}^2 - P_z{}^2 = = E_0{}^2/C^2$ (15)

$\mathbf{X \cdot X} = (CT)^2 – x^2 – y^2 - z^2 = D$ (16)

Equations 14 and 15 provide the energy momentum vector and the Time Space vector for an object in the Universe.

[1] W. Michael et al., Quark-Novae Ia in the Hubble diagram: implications for dark energy. *RAA* 2014 **Vol. 14** No. 5, 497–519 doi: 10.1088/1674–4527/14/5/001.

[2] L. B. Okun, K. G. Selivanov, V L. Telegdi, Gravitation, photons, clocks. Physics- *Uspekhi* **42** (10) 1045 - 1050 (1999).

[3] L. B. Okun, K. G. Selivanov, V L. Telegdi, On the interpretation of the redshift in a static gravitational field. *Am. J. Phys*. **68** (2), February 2000. Pp. 115-119.

[4] O. E. Rossler, “SCHWINGER-THEOREM”: ASCENDING PHOTONS IN EQUIVALENCE PRINCIPLE IMPLY GLOBALLY CONSTANT c IN GENERAL RELATIVITY. *European Scientific Journal* January 2014 edition **vol.10**, No.3 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431. Pp. 26-30.

[5] M. H. M. Hilo, Using of the Generalized Special Relativity in Deriving the Equation of the Gravitational Red-Shift *Journal of Modern Physics*. (2011), 2, 370-373 doi:10.4236/jmp.2011.25045 Published Online May 2011, Pgs 370-373.

[6] J. S. Wang *et al.*, RMF calculation and phenomenological formulas for the rms radii of light nuclei Nuclear Physics. *Nuclear Physics A* **691** (2001) pp. 618–630.

[7] J. L. Bassdevant, J. Rich, M. Spiro, *Fundamentals in Nuclear Physics*, (Springer, ISBN 0-387-01672-4, New York. 2005) pp 14-15.