The Evidence for a Contracting Universe and its Theoretical Explanation

Abstract

The Universe is contracting. The contraction of the Universe causes the radii of all massive objects in the Universe to decrease as a function of time and it causes the energy density at all points in the Universe to increase as a function of time. The increase in energy density at each point in space causes the rest mass of all massive objects to increase with time and it causes the g_{00} element of the General Relativity metric tensor to decrease with time for all points in the Universe. The reduction of the g_{00} element of the metric tensor causes the velocity away from the Earth of all massive objects in the Universe to increase as a function of time and to decrease as a function of distance from the Earth. The increasing velocity of massive objects with time causes an error in distances calculated using Hubble's law, where the error increases as the distance to the Earth decreases and such that nearby galaxies that are not gravitationally bound to the Milky Way are actually much closer to the Earth than believed, which implies that nearby galaxies have much smaller radii than is believed. If the appropriate galactic velocity and galactic radii are used in calculations of galactic distance, star orbital velocity, and galactic kinematics, then Dark Energy and Dark matter are no longer needed. The comparison of the change in redshift to the change in intensity of type 1A supernovae confirm that the supernovae velocity away from the Earth is increasing with time. Also, increasing differential redshift across a galaxy is proposed as further proof that the Universe if contracting.

Introduction

Astronomers have hypothesized that the Universe is expanding at an accelerating rate. However, the Universe is actually contracting at a constant rate. Our belief that the Universe is expanding is the result of subjective factors that affect our observations and measurements of the objects in the Universe. The situation is similar to how subjective factors cause us to observe and measure the Sun as revolving around the Earth. If we correct our observations and measurements for the change in our subjective measuring sticks with time, then our observations and measurements of the objects in the Universe demonstrate that the Universe and the object's in the Universe are all contracting as a function of time.

Recent pre-print articles have indicated that the Universe may be contracting. Christof Wetterich of University of Heidelberg in Germany posted an ArXiv manuscript arguing that the Universe is not contracting, but instead the mass of all massive particles is increasing. According to Wetterich, the increasing mass of atoms increases the energy of photons emitted by the atoms and thus provides the observed redshift.[1] The galactic redshift paradigm proposed by Wetterich allows galactic redshift and gravitational redshift to be treated by a single paradigm that is consistent with the gravitational redshift paradigm proposed by Nobel Prize winner Julian Schwinger, which has been expounded upon and clarified by Lev Okun.[6-12]

Sudesh Kumar Arora posted the article "CONTRACTING UNIVERSE AND THE COSMOLOGICAL REDSHIFT" to the Vixra server. Arora provides a modified General relativity metric that eliminates the assumption that the size of atoms and molecules does not change.[2] By applying this metric to a solution to the Dirac equation for a hydrogen atom in curved space-time, Arora concludes that the Universe must be contracting. He demonstrates that the contracting Universe model can recreate the observations of galaxies and supernovae at least as well as an expanding Universe and much better than a "tired light" model. [2]

Additionally, Recent supernovae observations discussed by Milne in "The Changing Fractions of Type Ia Supernova NUV-Optical Subclasses with Redshift" indicate that the change in magnitude of the red shift of distant supernovae relative to the redshift of nearby supernovae is greater than would be expected based upon the corresponding change in the supernovae intensity[3]. Although Milne describes the redshift as a blue shift for distant supernovae and he proposes that this additional blue shift is due to a change in the ratios of two distinct versions of Type of 1A supernovae over time, this additional redshift for nearby galaxies is actually caused by additional velocity that is added to all massive objects in the Universe as a function of time. Additionally, the variation in the spectrum of the emitted material can be seen to be caused by the relationship between the supernovae velocity and the emission direction. The increasing velocity of supernovae as a function of time provides a decreasing velocity as a function of distance from the earth. [3] Additionally, the increasing velocity with time and the decreasing velocity with distance from the Earth also applies to the galaxies in which the supernovae are located. Accordingly, galaxies will have the same increasing velocity with time and the decreasing velocity with distance from the Earth as the type 1A supernovae.

The increase in velocity of all massive objects in the Universe with time is caused by the increase an energy density for all points in the Universe as a function of time, which is caused by the contraction of the Universe as a function of time. The increase in energy density in the Universe with time causes the value of the g_{00} element of the General Relativity metric tensor to decrease with time for all points in the Universe.[5, 6, 8] The decrease in the value of the g_{00} element of the metric tensor with time necessarily implies that the velocity in the direction away from the observer for all massive objects in the Universe increases as a function of time and decreases as a function of distance from the Earth, since an increasing value of has the same effect on an object as the object falling deeper into a gravity well.

When the additional redshift caused by velocity away from the observer on Earth is subtracted from the galactic redshift prior to applying Hubble's law, the linear regression of galactic radii versus galactic distance shows an increasing galactic radii for increasing galactic distance.[3, 4] Accordingly, galaxies are getting smaller in time, which implies that the Universe and the objects in the Universe are contracting as a function of time. Indeed, the radii of all massive objects in the Universe decreases as a function of time and increases as a function of distance from Earth.

However, we observe the Universe to be expanding because we contract along with the Universe and the other objects, and because our rate of time increases when we contract along with the Universe, and because the speed of light in a vacuum decreases with time in accordance with the decrease in the magnitude of the g_{00} element of the General Relativity metric tensor.[10-12] The contraction of the Universe also provides the increase in rest mass and rest energy as a function of time that is postulated by Wetterich, since the energy density for all objects increases for all space when the Universe contracts. Additionally, the modified General Relativity metric proposed by Arora is consistent with the observations of the type 1A supernovae, provided that the additional velocity acquired by massive objects is incorporated into Arora's analyses.

Decreasing differential galactic redshift as a function of distance from the Earth is proposed as a test to prove that the Universe is contracting, where differential galactic redshift is the difference between the maximum and the minimum redshift associated with a galaxy based upon whether stars in the galaxy are rotating towards or away from the Earth. The velocity of the stars increases because the rest energy of the stars have all increased and because the stars are closer together. It correlates to an increased rate of time for nearby galaxies and parallels the increased rate of time that observers on Earth experience as the Universe contacts as a function of time.

It is shown that the Universe is contracting because the size of the Universe and the size of the objects in the Universe decrease as a function of time.

In Figure 2 of "ANGULAR SIZES OF FAINT FIELD DISK GALAXIES: INTRINSIC LUMINOSITY EVOLUTION" Cayon et al. show that the linear regression of galactic radii to galactic redshift shows a slight decrease in galactic radii as a function of increasing galactic redshift.[4] However, when the velocity component of galactic redshift is removed from galactic redshift signal prior to applying Hubble's law, the linear regression of galactic radii to galactic distance shows that galactic radii increase as a function of galactic distance.

The increase in galactic velocity as a function of time is demonstrated by the data discussed in Milne in "The Changing Fractions of Type Ia Supernova NUV-Optical Subclasses with Redshift". Milne discloses that the difference in red shift from distant supernovae compared to the redshift of near supernovae is greater than the expected difference in the redshift based upon the change in the observed intensities of the same supernovae.[5] Although, Milne proposes that this discrepancy is due to a change in the ratio of two distinct types of 1A supernovae as a function of time, the discrepancy is actually caused by increasing velocity away from the earth of the Type 1A supernovae. Velocity redshift is a much simpler explanation for the extra redshift and velocity redshift is well known and accepted form of redshift. However, Milne's explanation is much more speculative and does not comport with traditional explanations of redshift.

Accordingly, the velocity redshift needs to be subtracted from the galactic redshift in order to provide a correct rendering of Hubble's law to determine the supernovae distance from the Earth. When the velocity redshift is subtracted from the red shift dimension of the galactic radii to galactic redshift linear regression, the galactic radii are seen to increase with increasing galactic distance. [4] After subtracting the velocity redshift, the curve in Fig 2 of Cayon rotates counter-clockwise about the pole at the far right of the curve, yielding a fairly constant increasing slope to the curve of galactic radii to galactic distance. Accordingly, the size of galaxies increases as a function of distance from the Earth. However, the rest energy of galaxies decreases as a function of distance from the earth, consistent with the prediction by Wetterich. [1]

In Addition to causing all massive objects in the Universe to have decreasing radii and increasing rest energy, the contraction of the Universe causes the rest mass of all massive objects to increase, the speed of light in a vacuum to decrease, and the rate of time all massive objects to increase. Since the speed of light decreases and our rate of time increases as we contract along with the Universe, we perceive the Universe to be expanding.

Additionally, the velocity of stars within a galaxy will increase as a function of time. Accordingly, the difference in galactic redshift across a galaxy will increase as a function of time. Therefore, decreasing differential galactic redshift as a function of distance from the Earth can be used as a test to confirm that the Universe is contracting.

The work of Julian Schwinger and Lev Okun that explains gravitational redshift is extended to galactic redshift to show that "the phenomenon known as the red shift of a photon is really the blue shift of an atom" applies to Galactic redshift as well as gravitational redshift. [5,6] Accordingly, the following two postulates are assumed to be true:

(1) Photons do not change their energy from when they are emitted until they are absorbed; and (2) Massive objects are changed by the expansion or the contraction of the Universe.

The necessary consequences of the two postulates include the following ten statements:

(1) The energy density of the Universe increases when the Universe contracts into a smaller volume, which results in a decreased magnitude for the g_{00} element of the metric tensor for all points in space.

(2) All massive objects acquire velocity away from an observer on Earth as a function of time, such that galaxies closer to Earth will have greater velocity than galaxies farther from Earth, provided that the galaxies are not gravitationally bound to the Milky Way.

(3) The redshift of a photon emitted from a galaxy is dependent upon the g_{00} element of the metric tensor when and where the photon was emitted, such that a galaxy's redshift has a distance component and a velocity component and such that the distance to a galaxy using cannot be properly determined using Hubble's law unless the velocity red shift component is separated from the distance redshift component.

(4) The radii of all massive objects decreases as a function of time at the same relative rate as the radii of the Universe when the Universe contracts. Accordingly, galactic redshift and gravitational redshift are treated in a consistent manner according to the same paradigm.

(5) The rate of time of an object is determined by the g_{00} element of the metric tensor and by the special relativity gamma factor.

(6) An object's rest energy is proportional the g_{00} element of the metric tensor.

(7) The rest mass of all massive objects increases as the Universe contracts, where an object's rest mass is the rest energy that an object would have if it was in a Minkowski space, where a Minkowski space corresponds to a location infinitely far from any source of energy.

(8) There is no dark energy because the apparent effect of dark energy is caused by increasing galactic velocity with time, which is caused by the reduced magnitude of the g_{00} element of the metric tensor.

(9) There is no dark matter because nearby non-gravitationally bound galaxies have very large velocities away from the Earth that cause us to believe that those nearby galaxies are much farther away than they actually are and that they have much greater galactic radii than they actually have. When those galaxies are given their proper velocity and distance, dark matter is no longer necessary to hold them together or to explain their interactions with other galaxies. Additionally, most of our observations requiring dark matter come from nearby galaxies.[5]

(10) Entropy and Enthalpy are conserved in the Universe.

Discussion

According to Quantum Mechanics, all objects in the Universe have a probability density that extends over a volume of space and that gives the probability that an object will be detected at any particular point. [6] Additionally, in our normal day to day experience, we observe space-time to be comprised of three space dimensions and one time dimension. We also observe objects in space, where these objects comprise massless gauge bosons and massive particles. Additionally, every object in space is comprised of energy 'E', where massive objects have both rest energy (also known as internal energy) and momentum energy (also known as kinetic energy).[1, 2] Accordingly, each object in space has an energy density 'P_E' associated with that object for each point in space, where the energy density at each point X in space is approximately equal to the object's energy divided by the distance squared '$E/r(X)^2$' from the object to the point X. The total energy density at a point in space is equal to the sum of the energy densities for all objects at that point in space and the energy density changes as a function of time depending upon how the distribution of energy changes as a function of time, where the magnitudes of energy, distance, and time are also dependent upon the observer's reference frame.

$P_E(X, t) \approx E/r(X, t)^2$. (1).

$P_{E(tot)}(X, t) = \sum P_E(X, t)$ (2).

Accordingly, each point of space has a total energy density associated with that point, where the total energy density can change as a function of time. [6]

Instead of adding or destroying space, the expansion or contraction of the Universe causes each segment of the 3D surface of space to stretch or to shrink like a balloon stretches or shrinks when it is inflated or deflated. When the Universe contracts, the probability density and the mass density are concentrated into a smaller 3D surface. Accordingly, the objects in the Universe will contract along with the Universe, much like a picture of the objects drawn on a balloon would contract if you let the air out of the balloon.

The concepts of constancy and invariance are at the core of physics. In classical physics, constancy and invariance are embodied in the conservation of energy, mass, momentum, and angular momentum. Those quantities cannot change for an object unless the object is acted upon by an external force. The most basic expression of constancy is that an object cannot change, unless the object undergoes an interaction with another object. Macroscopically, interactions usually take the form of an applied force. Microscopically, forces are typically applied to objects through the emission and absorption of gauge bosons. In radioactive decay, an object interacts with its decay products.

In Special Relativity, constancy is expressed by the concept that the inner products of certain state vectors with themselves are constant regardless of the reference frame from which that the object is viewed. Lorentz transforms are mathematical operators that act on a vector or an observer to allow the observer to see what a vector would look like if it was moved to a different location or that allow the observer to see what vectors would look like if the observer was moved to a different location.[6] Since Lorentz transforms do not apply forces to objects, when a Lorentz transform is applied to a state vector, the inner products of the state vector with itself does not change.

In Special Relativity, an object S can be described by two state vectors, the energy momentum vector **P** and the position vector **X,** where **S** = (**P; X**), where the Special Relativity inner products of **P** and **X** with themselves is shown below:

$$\mathbf{P \cdot P = -}E_{rest}{}^2/C^2 + P_x{}^2 + P_y{}^2 + P_z{}^2 = E_{total}{}^2/c^2 \qquad (3);$$

$$\mathbf{X \cdot X} = - (CT)^2 + x^2 + y^2 + z^2 = D^2 \qquad (4).$$

'E_{rest}' is the rest energy of the object, 'c' is the speed of light, 'P_x' is the momentum energy in the x direction, 'E_{total}' is the total energy including its rest energy and its momentum energy, 'T' is the rate of time in the reference frame. 'D' is the distance of the object S located at (T, x, y, z) from a reference point $\mathbf{X}_0$ = (0, 0, 0, 0).[2] The inner products of the state vectors will not change for an object provided that the g_{00} element of the metric tensor is constant.[2, 3, 4, 6, 7] However, if g_{00} element changes along an objects path, then the Special Relativity inner products of the state vectors with themselves will change.[6]

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. Accordingly, $\mathbf{P_1}$ is inherently the same vector as the vector $\mathbf{P_2}$, if $\mathbf{P_1 \cdot P_1 = P_2 \cdot P_2}$. For example, the energy momentum vector (3, 2, 1, 0) is inherently the same vector as the vector (3, 0, 1, 2), since both vectors have the same inner product with themselves.

Lorentz transforms can rotate a vector, change its position, and change its velocity or any combination thereof without changing the inner product of the vector with itself.[6] Accordingly, the Energy momentum vector **P** and the distance vector **X** can be transformed to any non-accelerating reference frame without changing the inherent nature of the vector.

If a Special Relativity universe was expanding, then the distance provided by the inner product of the vector **X** with itself would not be a constant but would get larger as a function of time, since the space dimension would get larger with respect to the time dimension. This same concept of expansion carries over into General Relativity. However, the concept of a conserved inner product is more complicated in General Relativity than it is in special relativity.

In both General Relativity and Special Relativity, the inner product is defined by the metric tensor, where the metric tensor is a 4X4 matrix G.[6] In special relativity, only the diagonal elements of the metric tensor are non-zero, where the diagonal elements are 1, 1, 1, 1, where the g_{00} element is contravariant and provides a negative one in the inner product. 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.[6] The value of the matrix elements of the metric tensor are determined by the distribution of energy in the Universe in accordance with the appropriate solution to the equations of General Relativity, where the energy of a massive object is given by the object's mass times the speed of light squared.[6]

Determining the metric tensor elements based on energy distribution in non-symmetric high field intensity situations is mathematically difficult. For analysis purposes, simplified mass distributions are often used. 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, the General Relativity metric tensor can be diagonalized by representing each of the diagonal elements of the tensor as the infinite sum of analytic basis functions, you can reduce the matrix to a matrix that has only non-zero elements on the diagonal.[6]

However, the diagonalized version of the General Relativity metric tensor provides a General relativity inner product for the state vectors that remains constant for changes in energy density, where the infinite sums analytic basis functions of the g_{00} element is contravariant and the infinite sums of analytic basis functions for the g_{11}, g_{22}, and g_{33} elements are covariant. Accordingly, the diagonalized version of the General Relativity metric tensor provides a constant inner product for the state vectors in General Relativity provided that no force has been applied to the objects. This allows Lorentz transforms to be used in General Relativity without changing the General Relativity inner products of the state vectors. The diagonalized General Relativity metric tensor provides the following inner products:

$$\mathbf{P} \cdot \mathbf{P} = - g_{00}E_{rest}^2/C^2 + g_{11}P_x^2 + g_{22}P_y^2 + g_{33}P_z^2 = E_{total}^2/C^2 \qquad (5);$$

$$\mathbf{X} \cdot \mathbf{X} = - g_{00}(CT)^2 + g_{11}x^2 + g_{22}y^2 + g_{33}z^2 = D^2 \qquad (6).$$

'E_{rest}' is the rest energy of the object in the observer's reference frame, 'c' is the speed of light in the observer's reference frame that is the well known constant, 'E_{total}' is the total energy including its rest energy and its momentum energy. 'D' is the distance of the object S located at (T, x, y, z) from a reference point $\mathbf{X}_0 = (0, 0, 0, 0)$.[2, 3, 4] By looking at equations 5 and 6, it can be seen that momentum energy must increase to counter the decrease in rest energy as an object moves lower in a gravity well and that space distance must increase to counter the decrease in time distance as the object moves deeper in a gravity well. Hence, equations 5 and 6 describe the curved space of General relativity and they describe how energy, momentum, time, and distance vary for objects moving the four dimensional shell that describes space in time. However, the expansion or contraction of the Universe in time will change E_{total}^2/C^2 and D^2., which needs to be considered when observing distant objects like other galaxies.

The weak field approximation for the g_{00} element of the metric tensor is just the first two elements of the infinite sum that defines the g_{00} element for all cases, where the weak field approximation for a symmetric mass distribution is given by the following equation.

$g_{00}(r) = 1 + - 2GM/rc^2$. [5,6,7] (7)

'G' is the gravitational constant; 'M' is the mass; 'r' is the distance from X_r to X_0; and 'c' is the speed of light. The error of the approximation can be made as small as desired by adding additional terms. The g_{00} element of the metric tensor can have a value of from 1 to zero. Where a value of minus one corresponds to a location infinitely far from the source of energy density and a value of zero represents a location at the surface of a black hole.

The other three diagonal elements of the metric tensor describe the asymmetry of the inner products, where the inner product asymmetry is caused by the asymmetry of the mass distribution. Accordingly, the g_{11}, g_{22}, and g_{33} elements of the metric tensor correspond to the gradient of the energy density, where the g_{11} element corresponds to the x dimension, the g_{22} term corresponds to the y dimension, and the g_{33}term corresponds to the z dimension.

If the field is also spherically symmetric, then the g_{11} term, the g_{22} term, and the g_{33} term can all be made equal to one and the whole tensor can be effectively described by the g_{00} element. If the mass distribution is asymmetrical, the values of the elements g_{11}, g_{22}, and g_{33} will each be different from 1. However, the sum of g_{11}, g_{22}, and g_{33} will always be 3.

Additionally, constant values of the g_{00} element of the metric tensor provide 3D contours of the g_{00} element on the 3D surface of space in the same way that constant values of atmospheric pressure or constant values of elevation can provide contours of constant atmospheric pressure or of constant elevation, which be drawn on a globe or a map to provide 2D circle like structures that have tangent directions and perpendicular directions. The direction along the 3D surface of space that is perpendicular (normal) to a contour of the g_{00} element of the metric tensor at a point on the surface of space is the direction ($\sqrt{g_{11}}$, $\sqrt{g_{22}}$, $\sqrt{g_{33}}$) for that point on the surface.

If the Universe was expanding, the mass density would decrease and the value of the g_{00} element of the metric tensor would get closer to 1, while the value of the g_{00} element would get closer to zero if the universe was contracting. Accordingly, we can determine the effect of the contraction of the universe on the objects in the Universe by showing how a reduction in the magnitude of g_{00} element towards zero affects the objects in the Universe as observed by us on Earth. Accordingly, we will compare to hypothetical symmetric energy distributions.

In hypothetical case one, the gravitational field strength is zero and the g_{00} element = 1, the metric tensor is the special relativity metric tensor, which yields the inner product $\mathbf{P \cdot P} = -E_{rest}^{2} + P_x^2 + P_y^2 + P_z^2 = E_{total}^{2}$. In hypothetical the case two, the value of $g_{00} = 0.5$ and the other diagonal elements g_{11} , g_{22}, and g_{33},of the metric tensor all equal 1. Accordingly, the inner product is $\mathbf{P \cdot P} = -(1/2)E_{rest}^{2}/C^2 + P_x^2 + P_y^2 + P_z^2 = E_{total}^{2}$. Accordingly, the portion of the inner product that corresponds to rest energy must be reduced from its special relativity value in order for the inner product to provide constancy of measure with the inner product of the special relativity inner product. This change in the inner product corresponds a decrease in the rest energy of the object as the object goes deeper into gravity well and it shows that the momentum energy (kinetic energy) increases to account for this change in rest energy.[5,6,7] Since the rest energy of massive objects decreases when the massive objects go deeper into a gravity well, the kinetic energy of the objects must increase by an equivalent amount and the velocity of the object must increase due to the conservation of energy as observed from any specific reference frame.

The effect caused by a contracting Universe is reminiscent of the effect caused by a container of gas being compressed, where the reduction in volume of the container causes the molecules in the container to increase their kinetic energy.   Accordingly, the contracting Universe conserves enthalpy, as well as entropy. Whereas, the expanding Universe model changes enthalpy and entropy through the insertion of Dark Energy.

If we want to determine how the Universe has objectively changed based upon our observations of the objects in the Universe, we need to consider how our subjective measuring sticks change when the Universe expands or contracts. Accordingly, the remainder of the paper provides an explanation for the reduction of an object's physical size (radii) and its increase in rate of time as a consequence of the Contraction of the Universe using the same method Lev Okun used to show that "the phenomenon known as the red shift of a photon is really the blue shift of an atom" in gravitational red shift.[5,6] Okun's method derives from the teachings of Julian Schwinger and it uses a thought experiment to identify the relationship between rest energy and an object's physical size. [5,6,8]

Imagine two identical clocks (Clock 1 and Clock 2) and two identical observers (observer 1 and observer 2) in a valley adjacent a mountain. Observer 1 wearing Clock 1 takes an elevator to the top of the mountain and then gets off and then sits down.   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. [5,6]   The work applied to clock 1 is equivalent to the increase in the energy of clock 1, which equals $(E_0(R_0)gh/c^2)$ for the weak gravity field of the earth. Since Clock 1 was originally stationary in the valley and since it is also stationary on the mountain, all of the increase in energy (E_0gh/c^2) went into the rest energy of the clock. [5,6,9]   Accordingly, any force applied in line with the gradient of energy density only increases the object's rest energy and any force applied perpendicular to the gradient of energy density only increases the object's momentum energy (its energy due to velocity), although we need to consider the gamma factor for relativistic speeds.[6,8,9] All elements of the clock, including its electrons and nucleons, will have a corresponding increase in rest energy.[5,6,10,11]

The rest mass is the value of rest energy at a hypothetical co-moving location where $g_{00} = 1$.[5,6] Rest mass is given by the following equation $m_o = E_0(loc) = E^R{}_0(R)/\sqrt{(g_{00}(R))}$, where $E^R{}_0(R)$ is the rest energy at a location R.[5,6] Accordingly, rest energy of an object varies from a value of its rest mass at $g_{00} = 1$ and a value of zero at the surface of a black hole.

When a photon having a wavelength $\lambda_{(R)}$ is emitted from Clock 2 in the valley and the photon is absorbed by Clock 1 on the mountain top, the photon will be measured to have had a wavelength $\lambda_{(R+h)}$ that is greater than the wavelength $\lambda_{(R)}$ when measured by Observer 1. The photon did not increase the energy of Clock 1, as measured at location R + h, by as much energy as the photon decreased the energy of Clock 2 as measured by the change in energy of Clock 2 by observer 2. Accordingly, Observer 1 observes the photon as having a red shift of $-gh/c^2$.[5,6]

However, photons never change their energy regardless of where they are in the gravity well because no force can act on them (a photon can't absorb a gauge boson).[5,6] Accordingly, "the phenomenon called the red shift of a photon is actually the blue shift of an atom".[5] The apparent red shift of the photon is caused by Observer 1 and Clock 1 being heavier and physically smaller than Observer 2 and Clock 2, which is caused by Observer 1 and Clock 1 having greater rest energy than Observer 2 and Clock 2.[5,6,9]

The Bohr radius describes the radius of an atom such that the radius is inversely proportional to the mass (rest energy) of the electron.[9] Since the applied force was in line with gravity field, all of the energy went into increasing the electron's rest energy and none went into increasing the electron's velocity.[5,6,9] Accordingly, the radius of the atoms of the clock decreased by an amount proportional to the increase in rest energy, which is proportional to the square root of the g_{00} element of the metric tensor.

The postulates of General Relativity require that an observer cannot tell that he is free falling in a gravity well by observing herself or her atoms.[8,12] 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 atomic 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 $\sqrt{g_{00}}$, the photon wavelength, and the rate of time, then Observer 1 would be able to tell that she was moving in a gravity well simply by observing the properties of her atoms.[8,9,12] Accordingly, the magnitude of the nuclear radii must be inversely proportional to rest energy and the $\sqrt{g_{00}}$, such that the nuclear radii will follow the same equations for change in radius as the atomic radius. Otherwise, an observer could tell that she was free falling in a gravity well by comparing the atomic radii to nuclear radii of her own atoms. This inverse size/radius relation must hold for all particles in the nucleus. The proportional decrease in radii for increasing rest energy automatically conserves angular momentum as observed from any specific reference frame. If objects did not shrink as they rose in a gravity well, then angular momentum would not be conserved.

However, Savickas and Hilo have shown through two independent means that the speed of light in a vacuum varies proportionally to $\sqrt{g_{00}}$.[9,10,11,12] Savickas and Hilo have separately demonstrated that the speed of light in a vacuum is proportional to the square root of the g_{00} element of the metric tensor.[6, 7, 8] Hilo generalizes the Special Relativity gamma factor such that it can be applied in the presence of gravity in accordance with General Relativity, where the generalized gamma factor is given by the following equation.

$Y_{SpecialGeneral} = 1/ \sqrt{(g_{00} - (v^2/c^2))}.$[10-12]

Since the generalized gamma factor approaches infinity as v approaches $\sqrt{(g_{00})}c$, the speed of light in a vacuum must be proportional to $\sqrt{(g_{00})}$.

Accordingly non-massive particles (gauge bosons) will have a slightly greater velocity higher in the gravity well.[10, 11, 12] Accordingly, the velocities of the massive particle in Clock 1's atomic nuclei will have slightly increased due to the change in the gamma factor. However, the increase in momentum as measured by Observer 2 will still be proportional to $\sqrt{g_{00}}$ as measured by Observer 2, since the combined increase in momentum due to increased rest energy and due to increase velocity equals the change in $\sqrt{g_{00}}$. Since applying a force in line with the gradient of energy density increases the rest energy Clock 1's massive particles by $\sqrt{g_{00}}$ as measured by Observer 2, the radius of the atoms and of the nuclei and of the particles have all decreased by $\sqrt{g_{00}}$ as measured by Observer 2. Further since the velocity of Clock 1's particles have slightly increased due to the gamma factor, the amount of time for an interaction to occur has also decreased by slightly more than $\sqrt{g_{00}}$ and the reaction rate has increased by slightly more than $\sqrt{g_{00}}$ for Clock 1 as measured by Observer 2.

All interactions will occur faster for Clock 1 than for Clock 2 as observed by observer 2 and as observed by observer 1. 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 g_{00}(mountain top) to the magnitude g_{00}(valley), all of the rest energy that we added to Clock 1 when we moved it up the mountain would transform into momentum energy (kinetic energy) and cause Clock 1 to acquire a relative velocity away from us and to have a greater distance from us. This increase in kinetic energy is exactly what happens to all massive objects in the Universe when the universe contracts and causes the g_{00} value at all points in the Universe to get closer to zero.

Additionally, the contraction of the Universe increases the rest mass and rest energy of all objects in the Universe. Accordingly, the contraction of the Universe causes all objects to shrink and it causes the relative velocities of bound objects to increase with time. Accordingly, the contraction of the Universe causes the rate of time of all massive objects to increase as a function of time and to decrease as a function of distance away from the observer.

In order to determine distances using Hubble's law, we will need to remove the velocity component of galactic redshift. A photon emitted by a distant galaxy does not change its energy from when it is emitted by the distant galaxy until it is absorbed by us on Earth.   Additionally, the amount by which we contracted after the photon was emitted is determined by the amount of time it took the photon to reach us, which is determined by the distance to the distant galaxy. Accordingly, after removing the velocity signal from galactic redshift, we still see a larger redshift for galaxies that are farther away from us because we shrink and get heavier as a function of time.   Since the Universe is contracting at a constant rate, the distance to galaxies is a linear function of the galactic redshift minus the velocity component of galactic redshift. The traditional explanation for galactic red shift is false because it assumes that photons lose energy after being emitted by a galaxy and since Universal expansion would not provide any real velocity.

The component of red shift that accounts for the perceived acceleration of the expansion of the Universe is caused by the increasing velocity of massive objects with time in the contracting Universe. Accordingly, a contracting Universe is a better fit for our observations because the observations in an expanding Universe would show a blue shift corresponding to the galactic distance and the decrease in galactic velocity.

Our observations of galactic radii confirm that the Universe is contracting because we observe greater galactic radii for galaxies that are farther away from us, which implies that galaxies had greater radii in the past. Our observations of increasing velocity for type 1A supernovae also imply that the Universe in contracting. Further, differential galactic red shift will decrease with distance from the earth, since the contraction of the Universe increases the kinetic energy of the stars in the galaxies.

EQUATIONS

Delta(Ø(h)) = Ø(R_0 + h) – Ø(R_0).   (8)[5,6]

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.

Delta($Ø_{weak}$(h)) = $Ø_{weak}$(R_0 + h) - $Ø_{weak}$(R_0) = gh.   (9) [5,6]

$Ø_{weak}$(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.

g_{00}(R) = 1 + 2Ø(R)/c^2 = 1 - 2GM/rc^2. [5,6,7]   (10)

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.

√(g_{00}(R)) E_0(loc) = $E^R{}_0$(R).   (11) [5,6]

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 g_{00} = 1) and E_0(R) is the rest energy at the location R.

$m_o = E_0(loc)$. (12)[5,6]

This defines the concept of rest mass.

$\sqrt{}(g_{00}(R)E_\gamma^R(R) = (E_\gamma^{loc}(_{loc}))$. (13)[5,6]

$E_\gamma^R(R)$ 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 at a co=moving reference frame infinitely far from mass ($g_{00} = 1$) would measure the photon.

$\sqrt{}(g_{00}(R)\ \epsilon_\gamma^{loc}(loc) = \epsilon_\gamma^R(R)$. (14)[5,6]

$\epsilon_\gamma^R(R)$ 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). (11)[5,6]

$(E_0(R_0 + h) - E_0(R_0))/ E_0(R_0) = - gh/c^2$. (15)[5,6]

$(E_\gamma (R_0 + h) - E_\gamma(R_0))/ E_\gamma (R_0) = gh/c^2$. (16)[5,6]

$(\epsilon^{(R + h)}(R_0 + h) – \epsilon^R(R_0))/ \epsilon^R(R_0) = - gh/c^2$. (17)[5,6]

Equations 11-14 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 decreased. A longer photon wavelength provides lower energy. Equations 15-17 are applicable in a weak field.

$E^{(R0)}(R) = (E_0(loc))\ (g_{00}(R_0))/ \sqrt{}(g_{00}(R_0)) – (v^{(R0)}(R_0 + h))^2/c^2))$. (18)[7]

$Y_{SpecialGeneral} = 1/\sqrt{(g_{00} - (v^2/c^2))}$. (19)[7]

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 19 is the combined special relativity/general relativity gamma factor that allows for calculating many relativistic effects of gravity and special relativity simultaneously.

$r_{(atom)}^{(R0)}(R) = a/E_e^{(R0)}(R)$. (20)[7]

$r_{(atom)}^{(R0)}(R)$ 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.

$$\mathbf{P \cdot P} = - g_{00}E_{rest}^2/C^2 + g_{11}P_x^2 + g_{22}P_y^2 + g_{33}P_z^2 = E_{total}^2/C^2 \qquad (21)$$

$$\mathbf{X \cdot X} = - g_{00}(CT)^2 + g_{11}x^2 + g_{22}y^2 + g_{33}z^2 = D^2 \qquad (22)$$

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