The Relativity
of
Hubble Cosmology

Bob Ticer
February 13, 2016

Hubble Cosmology was initiated by Melvin Slipher in examining from 1912 to 1919 the spectrum of starlight from various galaxies. The data indicated a decrease in average light energy per distance towards the red end of the light spectrum. Carl Powell Hubble later observed a Cepheid classification of stars whereby the data indicated a more exact correlation of redshift per distance. He proposed his Hubble Constant in 1929 relating the proportionality of distance to redshift. An explanation of it had already been offered in 1924 by Carl Wilhelm Wirtz in pointing out a redshift occurs with the recessional speed of the light source, as to indicate a recession of galaxies from a common location. A counter proposal was offered by Fritz Zwicky in 1929 whereby light energy is assumed to be lost to the space medium through which it propagates.

An increase in wavelength, as towards the red end of the light spectrum, is referred to as a redshift equating to less energetic photons, as due to either recessional speed of the source or energy lost through the medium of space. A bullet fired from a gun speeding away from the target hits it with less speed and momentum than if the gun is relatively stationary with the target. Similarly, light from a receding source is received with less energy (even though it still moves at light speed) as its energy is decreased by extended distance during emission and/or between emissions because of relative recessional motion. If light is considered wave-like, longer waves are considered less frequent and less energetic. If light is considered particle-like, then relatively less energetic photons are emitted from the receding source. If the reduced energy is not from the recession of its source, but is instead lost to the space through which it moves, then the cause is referred to as tired light.

The condition of recession originally consisted of two competing theories, Steady State and Big Bang. By Steady state, a finite universe creates more stars and galaxies as old ones recede and burn out of existence. By Big Bang, a finite universe simply expands from a singularity as a common origin and beginning. Big Bang became the established theory in the 1960s along with a discovery of a Cosmic Microwave Background Radiation (CMBR) of light energy in the microwave range supposedly existing before the creation of matter by means of the universe cooling as it expanded. The present temperature of the CMBR coincides with this cooling, as predicted by theory. However, there are more nullification effects to consider with regard to relativity theory and a Cosmological Principle. A more complete theory is here proposed according to Tired Light in response to these nullification effects.

The Nullifications

One nullification pertains to a Tolman Brightness Test. In 1930, Richard C. Tolman offered this test to distinguish between recessional speed and tired light. According to recessional speed, intensity of light decreased according to distance decreases further by relative motion because of added distance between emissions. However, because light received from a farther away source is light emitted more from the past, there is an opposite effect to consider in that. the density of light from an expanding universe was greater in the past. It seems feasible the two effects simply nullify each other instead of combining for a more powerful effect. As the light source recedes at additional speed v in ratio to light speed c, there is additional space between emissions, but the light sources in the past were closer together, also according to additional speed v. The closer distance in the past simply nullifies the longer distance between emissions of recessional speed.

Another nullification pertains to a Cosmological Principle. By it, any location in the universe is perceived locally as though it is at the center of the universe. The universe thus appears relatively isotropic, as the same in all directions. How this is possible for an observer at the edge of the universe is because spacetime according to general relativity is curved due to the presence of mass. Light moving away from the universe thus curves back towards observers in the universe for them to perceive themselves as located at its center.

Another condition of the Cosmological Principle is that the universe appears relatively homogenous on a large scale as the effects of gravity from a wide distribution of mass counterbalance. Homogeneity is also a condition of a Schwartzschild Metric as a particular solution to Einstein's general field equations, and the Big Bang origin of the universe is also a singularity of the Schwartzschild Metric.

Homogeneity is also part of a particular application of the principle of equivalence by Einstein. He initially related effects of gravity with relative motion. A person inside an elevator falling freely towards Earth's center feels weightless with regard to feeling no internal effect of gravitational acceleration. Conversely, a person resisting Earth's gravity feels its weight the same as if the elevator is accelerating by a constant change in speed. However, Earth is in free fall with its moon, and ocean tides occur because parts of Earth are closer to the moon's gravitational presence than are other parts. Tidal effects are thus described according to spacetime curvature due to the presence of mass. The elevator explanation is only valid as a special condition of homogeneity, as occurring with regard to an incremental distance where the difference in gravitational force approaches zero.

In assuming the condition of homogeneity, omitting trigonometric coordinates in analogy to relativistic coordinates perpendicular to relative motion, and applying the Newtonian escape velocity as an approximation of spacetime curvature, the form of the Schwartzschild Metric with regard to incremental distances ds and dr and incremental time dt becomes

$$ds^2 = c^2\mathrm{dt}^2\left[1-\frac{\mathrm{2GM}}{\mathrm{Rc^2}}\right]-\mathrm{dr}^2\left[1-\frac{\mathrm{2GM}}{\mathrm{Rc^2}}\right]^{-1}$$

G is the gravitational constant for both general relativity and Newton's inverse square law of gravity, M is the gravitating mass, 2GM divided by distance R is the escape speed v squared required to escape the field at distance R from its center, and the factors in the two brackets are relativistic factors squared in analogy to that of relative motion of unity 1 minus the ratio v^2 to c^2. (The square roots of these factors are commonly considered relativistic factors.)

The increment ds is according to the principle of simultaneity, as a difference of distance or time of an event with regard to light speed and the relative motion of mass. If the event in question is of light, then ds is zero, such that the metric becomes

$$0 = c^2\mathrm{dt}^2\left[1-\frac{v^2}{c^2}\right]-dr^2\left[1-\frac{v^2}{c^2}\right]^{-1}$$

$$dr^2\left[1-\frac{v^2}{c^2}\right]^{-1} = c^2\mathrm{dt}^2\left[1-\frac{v^2}{c^2}\right]$$

$$\frac{dr^2}{dt^2} = c^2\left[1-\frac{v^2}{c^2}\right]^2$$

$$\frac{dr}{dt} = c\left[1-\frac{v^2}{c^2}\right] = c'$$

The speed of light thus decreases in a gravitational field by the relativistic factor squared.

In general, relative motion is also decreased in a gravitational field by the relativistic factor squared. Consider thus the moon's orbit about Earth as a natural clock. The clock is relatively slower within the gravitational field of the sun, as perceived by an observer apart from the sun's field. However, Earth observers having relatively slower clocks do not perceive the natural clock of the moon as slow. The orbital speed is slowed by the relativistic factor squared, but a stationary Earth observer's clock is also slowed by the relativistic factor squared. The relativistic factors are thus nullified for the orbital speed to be perceived the same locally whether in or outside the sun's gravitational field. The only relativistic effects to be observed are with regard to non homogeneity of the sun's gravitational field and with the gravitational fields of the Earth and moon and their motions relative to each other.

Note: If the radial distance dr is decreased by the relativistic factor, then both the natural moon clock and observer clock are also decreased only by the relativistic factor because of shorter orbital distances. The nullification still applies, but even more so on a homogeneous cosmic scale whereby nullification of expansion is possible by observers using expanding measuring devices as the universe expands. As to why the cosmic redshift is still evident, it is because of the inhomogeneous nature of the gravitational field.

The expanding nullification is also evident with regard to what might or might not be a cosmic coincidence:

$$\frac{H_1(2r_n)}{c} \approx \frac{Gm_pm_e}{e^2} \approx 4.4\times10^{-40}$$

H_1 denotes a particular value of the Hubble Constant, r_n the nuclear radius within the hydrogen atom, c light speed, G the gravitational constant, m_p the proton mass, m_e the electron mass, and e an electrostatic unit of charge. The latter squared has parameters as the product mv^2r = 23.07 X 10^{-20} grams times cubic centimeters per second squared.

Accordingly, the value of H_1 is approximately 70 kilometers per second at a distance of one million parsecs from the observer. Dividing 70 kilometers per second by one million parsecs renders a value of about 2.3 times per second. At a distance of one centimeter from the observer, the value of the H_1 is about 2.3 times 10^{-18} centimeters per second. At a distance of 5.76 times 10^{-12} centimeters, as equal to the nuclear diameter $2r_n$ of the hydrogen atom, the value of H_1 is only about 13.3 times 10^{-30} centimeters per second. Significantly, it per light speed c of 3 times 10^{10} centimeters per second renders a dimensionless value of approximately 4.4 times 10^{-40}, which is also the approximate value of the ratio of gravitational potential of say Gm_p per r_n to electrostatic potential of e^2 per m_er_n. Dividing the former by the latter renders Gm_pm_e per e^2.

Such an apparent coincidence as just presented was similarly noted by the physicist Paul Dirac for an explanation in view the Hubble Constant should be decreasing as the universe expands. (The Hubble Constant is only constant with present distances, not with time, if distances between galaxies of different recessional speeds are increasing). Dirac proposed the gravitational constant G decreases as the universe expands. However, in view of the relativistic nullification with regard to local observers within a gravitational field, the electrostatic force should relatively decrease as well. The nullification could be occurring if the increasing distance between light sources is counterbalanced by the emission of longer electromagnetic waves (as light) and such measuring devices as atoms slightly expanding while unknowingly decreasing the electrostatic unit of force e squared in proportion to expansion and the decrease in G. The universe should thus appear as relatively static instead of expanding.

A significance of this static condition is that it allows for a more complete explanation of gravity itself. General relativity explains gravity according to spacetime curvature due to the presence of mass, whereby the equations assume conservation conditions for energy and momentum. However, how such a contiguous action of gravity occurs is still not completely explained according to spacetime curvature itself. A more complete explanation is here given with regard to probability and invisibility conditions of quantum physics, and it includes explanation of attraction and repulsion of protons and electrons as well.

Explaining Gravity and Electromagnetism

Gravitational radiation is essentially invisible except for its gravitational effect. The reason it is invisible is because it is able to occupy the same space, as also does light, whereas matter cannot. Such invisibility is typical of wave action. Waves can superimpose to produce visible effect only if the medium of wave action changes in a way it becomes observable. If the total action within a space large enough to be measured is counterbalanced, then no change of the medium need be seen. The only observable effects are with regard to such attributes of mass interacting with other mass and radiation, and also with regard to both relativistic effects and quantum probability effects of the spacetime medium.

Although light is invisible to other light, as massless effect, it still has momentum with regard to the presence of mass, and sometimes it even converts to mass by interacting with it.

According to special relativity, mass in relative motion is relatively greater than mass relatively at rest. If the relative motion is caused by the reflection of light, then light loses energy in increasing the mass it reflects. There is also the Higgs Mechanism to consider whereby massless particles similar to light become mass by moving slower through the Higgs Field. Light also moves slower through a gravitational field, but an increased mass effect is locally nullified by local matter moving slower in the field and itself increasing in mass-energy.

More in general it is assumed vacuum space is not empty; it contains instead a virtual energy field whereby invisible massless particles moving at light speed are somehow slowed for them to convert into new form, as mass.

As for non detection of radiation by matter, in quantum physics there is a virtual field of energy that is detectable according to quantum probability of the virtual field. According to a Born rule, a quantum wave function is interpreted as a probability amplitude (measure of change) for detecting a particle within a given time and/or a particular location. The probability of detection can be extremely slight. Billions of neutrinos, for instance, move through our bodies every second, but Earth only detects a few of them. Neutrinos are thus virtually invisible for the most part.

A particle-wave paradox is evident of quantum physics. A quantum refers to a discrete unit of energy, as absorbed and emitted by matter. Waves are consistent with relative motion in that they vary to any degree. Waves can also carry momentum, as an inelastic striking of one end of a row of touching iron balls by a single iron ball. The striking produces an impulse action through the row of balls that carries through as a wave action to allow the iron ball at the other end to continue forward with the same momentum of the original single ball, providing the original ball and the row are maintained in place. Light waves are consistent with both quantum and wave effects in that the value of the Plank constant h of product parameters $mv(2\pi r)$ is maintained by constant light speed whereby greater light momentum mc is nullified by shorter wavelength r.

As for the probability of quantum effects, Louis de Broglie noted the duality of light and matter having both particle and wavelike effects. Erwin Schrodinger provided a wave equation for his Wave Mechanics. However, Max Born, Werner Karl Heisenberg, Niels Bohr and Dirac interpreted the wave equations of Schrodinger's Wave Mechanics as probability equations with regard to discrete quantum actions occurring in a particular places and/or particular times. However, these discrete quantum effects are also subject to conditions of relative motion and gravity. The discreteness of quantum effects are thus a particular part of a more complete theory including non-quantum effects.

As for the difference between light and mass, suppose mass is an equilibrium state of light waves moving at light speed and crossing paths from every direction. It is contained by not allowing other waves to pass through it. It allows some of the waves to pass through while it reflects others in maintaining its form. The form itself is also capable of moving through space at different speeds, as does mass. How this free motion is possible is according to its particular state of equilibrium. If in motion, then it reflects less energetic virtual waves counter to the direction of relative motion in allowing the more energetic ones to pass through, and it reflects more energetic virtual waves arriving in the direction of relative motion in allowing the less energetic ones to pass through. In effect, mass itself is wavelike motion moving through quasivacuum space as its medium of propagation, which is opposite to the effect of reflection of observable radiation encountering mass.

Suppose this new wave form of mass-energy has additional properties, such as further converting energy of the spacetime medium to gravitational energy, as constantly in proportion to the amount of mass according to the principle of equivalence. Also consider the probability of detecting this massless gravitational energy is extremely slim in providing a vacuum effect in the wake of its emission. It converts into a new form of energy that is only detectable as gravitational effect. Since it does not directly change the motion of other matter, it does not violate conservation of momentum. Moreover, the extremely slim probability of its detection renders it as a long range effect consistent with the force of gravity being relatively weak compared to the electrostatic force of such atomic masses as the electron and proton.

If our observable universe is a finite anomaly of an infinite source of virtual energy, then the supply of energy converted to gravitational radiation could be indefinite, such that there could be no observable effect of its recycling back into its original form after escaping the anomalous field of mass and gravity. However, there could be observable momentum effect for it recycling back into it original form before leaving the confines of our observable universe. Perhaps it recycles back as dark energy to cause the universe to expand at a greater rate, as consistent with Einstein's cosmological constant as a repulsive force. This effect could occur if the recycling is between galaxies where gravitational fields neutralize in becoming a homogeneous state. On the other hand, if our universe is infinite in extent, then the radiant energy recycling back into its original form is merely an equilibrium state of existence. It would be consistent with a tired light theory of a multiverse of an infinite amount of finite universes with each observationally separated by the life span of tiring light, which could vary with a variation of its original energy for a more complex observation of the universe.

A more complex analysis involves the thermodynamics of how radiation is absorbed and emitted by matter. It is generally assumed that matter emits the exact radiation it absorbs. However, there are also messenger particles to describe the effects of atomic events. Such events include repulsions between electrons or between protons, and attractions between electrons and protons. Somehow these messenger particles are created and annihilated by the presence of electrons and protons. The action of the electron, or of some adjacent part of it, thus converts virtual electron radiation as a repulsive field associated with the electrons. There is likewise a repulsive field created for protons. In order not to violate conservation of energy, the proton and electron fields interchange. They also neutralize each other for the attraction between protons and electron to occur. Neutrons, as neither electrically attractive nor repulsive, would then be created in particular combinations of the fields neutralizing each other.

Tired Light

A new tired light theory has been proposed by Lyndon Ashmore that is totally consistent with quantum physics except for a constant of proportionality k that is exactly one cubic meter:

$$H_2 = \frac{hr_e}{m_e k} \approx 64 \frac{km}{(sec)(Mpc)}$$

That k is exactly one cubic meter is a remarkable coincidence, but it is empirically consistent with astronomical observation and with general relativity. The average density ρ_U of the universe in relation to H_2, as according to an Einstein formula, is

$$\rho_U = \frac{3H_2^2}{8\pi G} = \frac{3c^2}{8\pi R_u^2 G} \approx \frac{3(2GM_u)}{8\pi R_u^3 G} = \frac{3M_u}{4\pi R_u^3}$$

Since the dimensional value of the Hubble Constant refers to a velocity per distance, H_2 in the relation converts to light speed c for a critical radius R_u of the universe in relation to the gravitational escape speed c squared for the mass M_u of the universe, whereby $c^2 = 2GM_u/R_u$.

The density of the universe in ratio to the density ρ_n of an atomic nucleus of the hydrogen atom further approximates to the ratio of the gravitational and electrostatic forces between the proton and electron in the manner

$$\frac{3H_2^2}{8\pi G} \div \frac{3m_p}{4\pi r_n^3} = \frac{H_2^2 r_n^3}{2Gm_p} \approx \frac{Gm_p m_e}{e^2} = \frac{Gm_p m_e}{m_e c^2 r_e} = \frac{Gm_p}{r_e c^2} = 4.4 \times 10^{-40}$$

$$H_2^2 \approx \frac{2G^2 m_p^2}{r_n^3 r_e c^2}$$

The ratio of this Hubble Constant value squared to the previous Hubble Constant H_1 squared is

$$\frac{H_2^2}{H_1^2} = \frac{2G^2 m_p^2}{r_n^3 r_e c^2} \div \frac{G^2 m_p^2}{4r_n^2 r_e^2 c^2} = \frac{8r_e}{r_n}$$

The respective radii r_e and r_n, of the nucleus and electron (and the Bohr radius r_a of the hydrogen atom) relate to internal and potential energies in the manner

$$\frac{e^2}{m_e r_e} = c^2 \qquad \frac{e^2}{m_p r_n} = \frac{e^2}{m_e r_a} = v^2$$

The velocity v in ratio to c represents here the fine structure constant, as e^2 per h per 2π. The ratio v^2 to c^2 is also indicative of a relativistic effect according to the approximation

$$1 + \frac{v^2}{c^2} \approx \frac{1}{1-\frac{v^2}{c^2}}$$

It is significant with regard to the equivalence principle of free fall in a relatively homogeneous field of gravity. (The numerical value of v in this case is also the fine structure constant equal to the electrostatic unit e squared in ratio to ħc = hc divided by 2π. The 2πr of h pertains to a perimeter distance whereas the r of ħ is a radial distance.)

To explain the factor 8, as according to the Schwartzschild Metric, consider the maximum escape speed calculates as the square root of one half c as the value of c' in the manner

$$c\left[1 - \frac{2GM_u}{R_u c^2}\right] = c\left[1 - \frac{1}{2}\right] = \frac{1}{2}c'$$

In ratio to the escape speed is the orbital speed c'', such that

$$c = \frac{1}{2}c' = \frac{1}{2\sqrt{2}}c''$$

$$c^2 = \frac{1}{4}c'^2 = \frac{1}{8}c''^2$$

The factor 8 is thus explained as relativistic effect of the gravitational potential of a mass approaching one-eighth light speed whereby light speed in the field becomes one-half of c as an upper limit.

The application of the orbital speed is here explained as emerging with the escape speed as the gravitational field becomes homogeneous on the cosmic large scale. Because of spacetime curvature, the path of light along with orbital speed is curved for them to eventually become one and the same effect according to the Cosmological Principle. It is estimated from astronomical observations that the scale for cosmic homogeneity is 250 million light years, which is about 55.2 times smaller than our universe now appears to be according to Big Bang theory.

Further Implications

Another interpretation of the Hubble Constant is that it is a change in frequency per distance. A frequency itself is light moving a particular distance per time, as c per $2r_n$, whereby the change in frequency H_1 divided by the frequency c per $2r_n$ approximates to the ratio of gravitational to electrostatic forces as 4.4 X 10^{-40}, which also approximates to the ratio of mass densities of the universe to the mass density of the nucleus of the hydrogen atom. By another interpretation, the product of the average density of the universe and the electrostatic unit of charge squared per distance r_n approximate to the density of the nucleus of the hydrogen atom and its gravitational potential between the proton and electron.

The gravitational potential at r_n is extremely minute compared to its electrostatic potential. It could further relate, in a relativistic manner, to a drift velocity (as a slight change in speed):

$$\frac{mu^2}{mc^2\left[1-\frac{u^2}{c^2}\right]} - \frac{mu^2}{mc^2} \approx \frac{u^4}{c^4} \approx 4.4 \times 10^{-40}$$

$$u^4 \approx (4.4 \times 10^{-40})c^4$$

u ≈ 4.345 centimeters per second

The gravitational relativistic increase in potential energy mu^2 per its internal energy mc^2 thus renders and increase equivalent to a change in speed u. Significantly, 4.345 centimeters is in the range of wavelengths of low energy microwaves.

The significance of the drift velocity is with regard to The Drude Model and Ohm's Law. Paul Drude proposed in 1900 that colliding electrons move in zigzag paths while drifting in the opposite direction of an electric field. The drift velocity, as change in speed, results as the average initial velocities of the electrons according to the current density and the electric field.

By Ohm's Law, the current is the product of the change in the electric field and the conductivity of electricity. Ohm's Law is also sometimes expressed as a frictional resistance to current of a particular voltage.

The significance of the microwave relation is with regard to its Big Bang prediction. Microwaves are also absorbed and emitted by hydrogen and water as low energy light. A high humidity atmosphere aided by carbon dioxide heats up. Lyndon Ashmore also proposed that tired light consists of quantum loses of energy in the microwave range.

There still remains a probability that the universe could be part of an expanding singularity. Greater energy effects, such as larger meteors striking Earth, occur less often. There is thus a minute probability, as predicted by theory, that our universe expanded about 13.8 billion years ago. However, this probability could includes such other effects of a more complex universe. All in all, there emerges the possibility of a more complete theory of reality. Before the discovery of the CMBR, it was proposed that Big Bang would provide a frame of reference for relating such various effects as the creation of atomic particles with regard to such conditions as pressure and temperature. What is here proposed is a more complete frame of reference with the inclusion of Tired Light, Steady State and Big Bang effects.