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"Issues with the Expanding Universe Model "

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Abstract

According to the mainstream physics establishment, our universe is expanding. But is it really? In this paper, I make an attempt to answer this question according to observational data and equations without presuppositions that it is expanding. Subsequent questions also arise. If it is expanding, is it slowing down or accelerating? If not expanding, is it static or collapsing? Fair questions but not so easy to answer. I will start with key discoveries such as Hubble's relationship between interpreted galaxy receding speeds with observed distances. These discoveries will include Einstein's field equations, along with the Friedman equations that are derived from them. Also provided are the Newtonian expansion equations. After establishing the mainstream theory and interpretations, I will then discuss issues many have with this view, bringing out the possibility that the universe could currently be static or slowly expanding. Such dissention from the currently accepted model, known as the ΛCDM (Lambda Cold Dark Matter), is supported by observational data analysis. An explanation of the Tolman Test is provided, along with the results of its application to universe expansion. Drawing from redshift interpretations other than cosmological expansion, I show the possibility that the universe is not expanding but just appears to be as expressed in [1].

Hubble

Prior to, but most notably, the discovery by Edwin Hubble, in the 1920's on Mt. Wilson, of the distant stellar light wavelengths shifting toward the red end of the electromagnetic spectrum, observations of redshifts [1] were interpreted as receding motion at high speeds. Hubble found a strong correlation between the interpreted velocity of a galaxy away from us with the distance to it. This direction proportional relationship is known as "Hubble's Law", or the "Hubble Principle". In recent years these observed redshifts have been so high for some galaxies, they would need to be traveling much faster than the speed of light, a violation of Einstein's special theory of relativity (STR). Theoretical physicists, specifically cosmologists, have addressed this problem by assuming that it is the separations, or scale, of the nodes of the general theory of relativity (GTR) geometric space-time grid that are expanding at a high rate. Various physical mechanisms have been attributed to be the cause of this expansion over the age of the universe and these are discussed later in this article.

Hubble's Principle can be stated as follows:

$$H_0 = \frac{v}{D} \tag{1}$$

where H_0 is Hubble's parameter, v is the velocity of an object, and D is the distance to that object. Observational data for this parameter has been produced over many years and thousands of experiments. Figure 1 shows the results of some of Hubble's observations, with the typical units in km/sed per Mparsec A Mparsec is a million parsecs and a parsec is approximately 3.26 lightyears. Table 1 shows the results of some of these experiments [3].

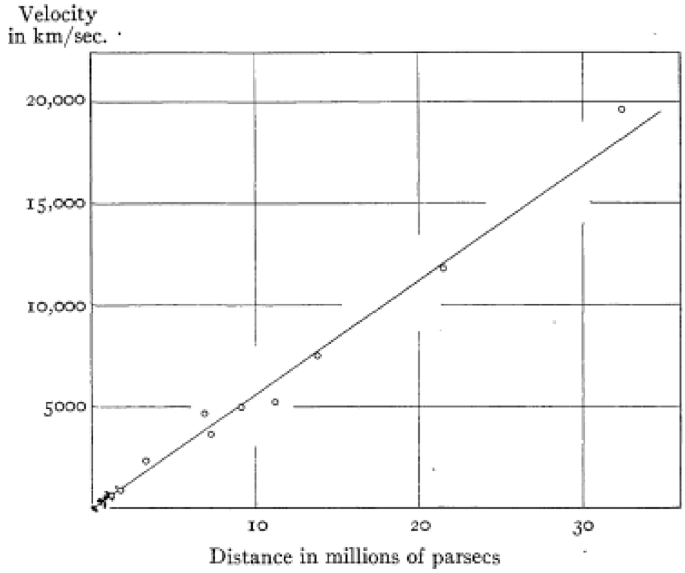


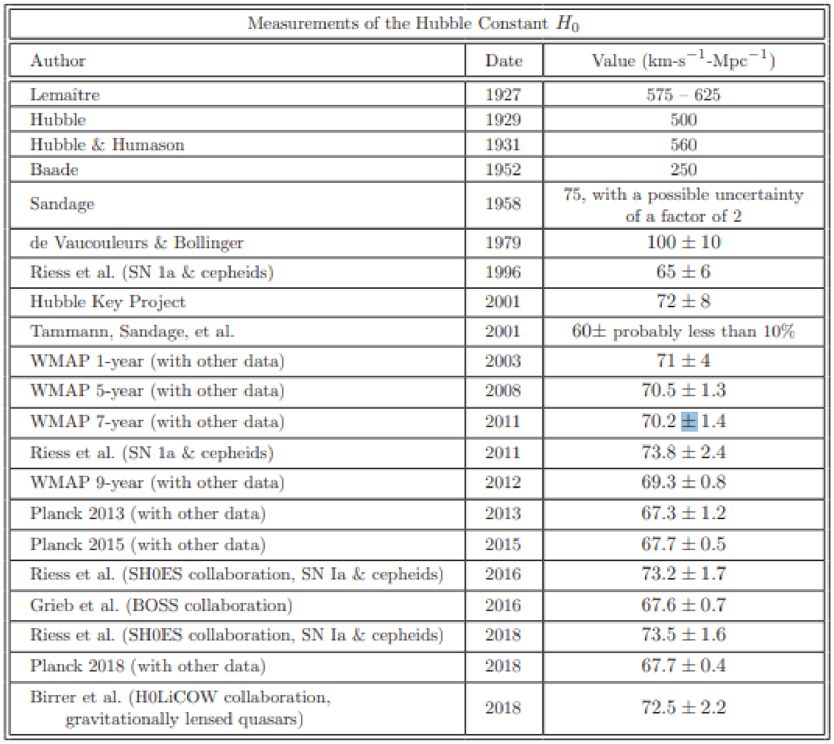
Figure 1. Plotted measurements by Hubble and Humason in [2], including the most distant objects they observed.

Cosmological Scale Factor, "a" and Redshift

From the influence of Hubble's work at Mt. Wilson (and others less known), the idea of an expanding universe became widely accepted, especially when combined with GTR. But how does the universe expand and in what form does it assume in the process? Figure 2 is provided to describe the model to which most cosmologists adhere. Imagine the universe consisting of billions of objects such as galaxies, residing on the surface of a sphere, a surface that can be partitioned with grid lines, as shown, with nodes where the lines intersect. Objects at rest on this grid become more separated as the sphere expands. This motion is described by the scale factor, "a", and is not a constant but a parameter that varies with time, expressed as a(t). Referring to Figure 2, "a" at time, t_0, is $a(t_0)$, or a_0, and similarly "a" at some time t_f is $a(t_f)$ or a_f. We can also express a time rate of change, "$\dot{a}$", and an acceleration of the scale factor change as "$\ddot{a}$". So now, applying equation (1), we can write the Hubble parameter as :

$$H_0 = \frac{\dot{a}}{a} \tag{2}$$

It is important to note that "a" is unitless and that the physical distance between any two points at any given time is then given by `p(t) = a(t)`c , where c is the desired unit of distance (e.g., km, parsec, light year).



Measurements of the Hubble Constant H_0		
Author	Date	Value (km-s^{-1}-Mpc^{-1})
Lemaître	1927	575 – 625
Hubble	1929	500
Hubble & Humason	1931	560
Baade	1952	250
Sandage	1958	75, with a possible uncertainty of a factor of 2
de Vaucouleurs & Bollinger	1979	100 ± 10
Riess et al. (SN 1a & cepheids)	1996	65 ± 6
Hubble Key Project	2001	72 ± 8
Tammann, Sandage, et al.	2001	60± probably less than 10%
WMAP 1-year (with other data)	2003	71 ± 4
WMAP 5-year (with other data)	2008	70.5 ± 1.3
WMAP 7-year (with other data)	2011	70.2 ± 1.4
Riess et al. (SN 1a & cepheids)	2011	73.8 ± 2.4
WMAP 9-year (with other data)	2012	69.3 ± 0.8
Planck 2013 (with other data)	2013	67.3 ± 1.2
Planck 2015 (with other data)	2015	67.7 ± 0.5
Riess et al. (SH0ES collaboration, SN Ia & cepheids)	2016	73.2 ± 1.7
Grieb et al. (BOSS collaboration)	2016	67.6 ± 0.7
Riess et al. (SH0ES collaboration, SN Ia & cepheids)	2018	73.5 ± 1.6
Planck 2018 (with other data)	2018	67.7 ± 0.4
Birrer et al. (H0LiCOW collaboration, gravitationally lensed quasars)	2018	72.5 ± 2.2

Table 1. Various historical measurements of the Hubble parameter.

Imagine light emitted from a galaxy represented by the yellow dot on the sphere at the left in Figure 2 and is directed towards the galaxy represented by the red dot. After some time t, during which the universe has expanded. When the light reaches the red galaxy, according to the cosmology, its wavelength has stretched an amount directly proportional to the change in the scale factor. Since the wavelength is longer, the light is shifted towards the red end of the visible spectrum (for wavelengths larger than the visible spectrum it is shifted towards the long wavelength end of the spectrum). This is known as the cosmological redshift.

$$Z = \frac{\Delta\lambda}{\lambda} \tag{3}$$

Where z = redshift, Δλ = change in wavelength, and λ = nominal wavelength. Cosmological redshift relates to the expansion scale factor as:

$$z = \frac{a_o}{a(t_{emission})} - 1 \tag{4}$$

where a_o= scale factor at time of observation and $a(t_{emission})$= scale factor at the time the light was emitted.

There are other sources for redshift besides recessive motion. I recently did some work in this area where I looked at possible mechanisms that could be the cause for redshifts without the need for recessionary motion [1]. As was the focus of that paper, there are several

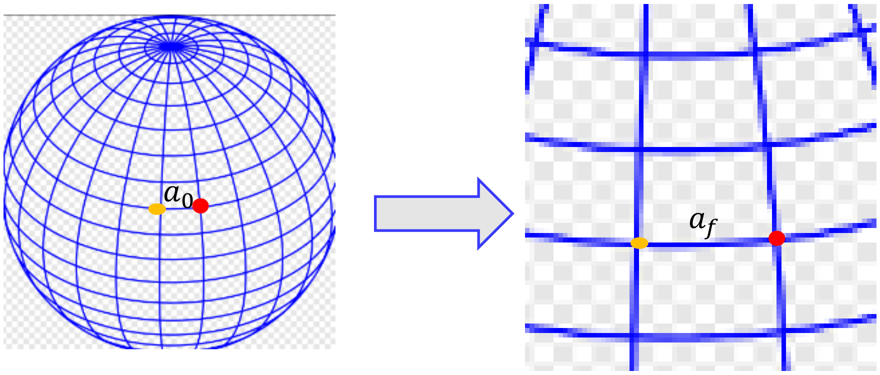


Figure 2. Illustration of a spherical universe expansion showing increase in grid scale factor but unchanging size of objects.

interpretations of redshift of cosmic light besides that of motion away from the observer. A review of these types of redshift are addressed later in this article.

Einstein's Dilemma

Prior to Hubble's discovery on Mt. Wilson, the majority of physicists at that time considered the universe to be static: neither contracting nor expanding. Einstein had been working for some time in the first two decades of the twentieth century on the development of equations that could be used for better understanding of gravity as it would affect the universe. Applying Newtonian gravity models to his general relativity mathematical paradigm, along with a fluid model, and assuming that matter distribution in the universe is both isotropic and homogeneous, Einstein, along with Friedmann, derived the well-known acceleration equation:

$$\frac{\ddot{a}}{a} = -\frac{4\pi G}{3c^2}(\varepsilon + 3P) \tag{5}$$

where:

G = Newtons gravitational constant
c = speed of light
$\mathcal{E}$ = energy density
P = pressure

Herein lies the dilemma. Notice that since all the quantities listed must be positive, the left side of the equation must be negative which forces the scale factor acceleration to be negative. In other words, the universe is either slowing down or contracting. Einstein, and all other believers in a static universe, would either have to accept this or "adjust" the equation to give them the answer they wanted to see. So, Einstein added a constant to the right side of the equation, a constant that would later be directly associated with what has been dubbed the "cosmological constant". There is also a closely related Friedmann equation as follows:

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G\varepsilon(t)}{3c^2} - \frac{\kappa c^2}{R_0^2 a(t)^2} + \frac{\Lambda}{3} \tag{6}$$

where:

κ = curvature parameter (open = -1, flat = 0, closed = 1)
R_0 = radius of curvature
Λ = cosmological constant

Determining Curvature

Notice that the term in parentheses on the left side of equation (6) is simply the square of the Hubble parameter (see equation (2)). Excluding the cosmological constant for now, we can write equation (6) as:

$$H^2 - \frac{8\pi G\varepsilon(t)}{3c^2} = -\frac{\kappa c^2}{R_0^2 a(t)^2} \tag{7}$$

We now use H rather than H_0 since the former can vary over time while the latter is only for a given epoch. Each of the three terms can be considered in terms of what they qualitatively represent as follows:

$$\text{(expansion)} - \text{(energy density)} = \text{(curvature)} \qquad (8)$$

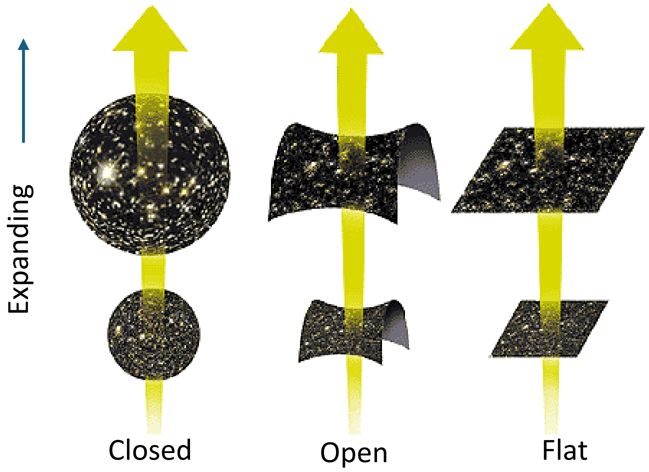


Figure 3. Types of expanding curvature topologies

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The qualitative nature of curvature is open, flat, or closed. Quantitatively, the "amount" of curvature is defined by the term R_0. Figure 3 illustrates the three forms of universe space-time continuum curvature considered by most cosmologists. Standard cosmologists believe the topology for the universe space-time continuum is very slightly closed (i.e., close to flat) but such conclusions rely on the observable distance we can measure. It might be that the topology is spherical, but our observable universe circumscribes an area that is exceedingly small when compared to the overall surface area of the sphere.

Utilizing equation (8), we see that the amount of curvature (excluding flat topology) depends on the difference between how much the universe is expanding and how energy density there is throughout the universe. Energy density, ρ (or $\mathcal{E}(t)$), is a combination of various forms of energy as follows:

$$\rho = \rho_{baryon} + \rho_{radiation} + \rho_{CDM} + \rho_{DE} \qquad (9)$$

where

ρ_{baryon} = density of baryonic matter (i.e., not dark matter)
$\rho_{radiation}$ = density of electromagnetic radiation
ρ_{CDM} = density of cold dark matter
ρ_{DE} = density of dark energy

The energy density term in the Friedmann equation includes all forms of observed (baryonic and electromagnetic radiation) and hypothesized unobserved types (cold dark matter and dark energy). Furthermore, the Friedmann acceleration equation (7) includes pressure as a form of energy density since it is equivalent to kinetic energy density. Dark energy density is also directly related to pressure.

It is interesting to note that when we set the value of k in equation (7) to zero (representing a flat, or no curvature) we can solve for what is called the "critical energy density". Recalling that ρ = ε(t), we get:

$$\rho_{crit} = \frac{3H^2}{8\pi G} \tag{10}$$

Substituting the current values for H and G, we get ρ_{crit} = 3.07×10−27 kg/m^3, or ~10^{-9} J/ m^3.

A well-used parameter in cosmology is that of the density parameter, Ω, where:

$$\Omega = \frac{\rho}{\rho_{crit}} \tag{11}$$

This parameter changes with time and is simply the normalized version of the critical density. However, Ω is also called the critical density. Using equation (6), we derive it into the form :

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G}{3}\rho - \frac{\kappa}{a^2} \tag{12}$$

By ignoring the cosmological constant term for now and setting the curvature, R_0, and the speed of light, c, to unity and recalling that ε(t) is equivalent to ρ and that $H = \frac{\dot{a}}{a}$, we get:

$$\Omega - 1 = \frac{\kappa}{H^2 a^2} \tag{13}$$

Notice that the sign of k is governed by how Ω relates to 1. If Ω = 1, k must be zero and the universe has no curvature. The following relationships emerge from this:

If $\rho < \rho_{crit}$, then $\Omega < 1$ and $k < 0$ so the topology has open curvature,

If $\rho = \rho_{crit}$, then $\Omega = 1$ and $k = 0$ so the topology has no curvature (i.e., flat),

If $\rho > \rho_{crit}$, then $\Omega > 1$ and $k > 0$ so the topology has closed curvature.

Predicting Time Histories of Scale Factor, a(t)

If we know how the energy density components are distributed, how each density relates to its associated pressure, and type of curvature, k, we can solve equation (6) for the time history of the expansion scale factor, a(t). All that is necessary is to execute a first order integration of both sides of the equation. A first order differential equation results. It is helpful to solve this equation for each type of energy density separately. Let "*i*" represent the type under evaluation. We can substitute the following trial solution:

$$\rho_i = \rho_{i_0} a^{-n_i} \tag{14}$$

Fluids assumed in cosmology behave with the following relationship:

$$p = w\rho \tag{15}$$

where *w* is a constant representing the state for the given fluid and the relationship is called the "equation of state". In equation (14) the parameter "n" is determined by solving the differential equation resulting from integrating equation (6). Table 2 shows the values for *w* and *n* for the various fluid (energy density) types. When we apply conservation of energy to the trace of the diagonal vector in Einstein's momentum-energy tensor, we get:

	w	***n***
matter	0	3
radiation	⅓	4
dark energy	-1	0

Table 2. Cosmology parameters related to scale factor expansion.

$$\frac{\dot{\rho}}{\rho} = -3(1+w)\frac{\dot{a}}{a} \qquad (16)$$

Leonard Susskind

credit link

Solving this differential equation, exploiting the fact that *w* constant, yields the following relation:

$$\rho \propto a^{-3(1+w)} \qquad (17)$$

Applying (17) to the three considered fluids (energy density types) yields:

$\rho_M \propto a^{-3}$ for matter,

$\rho_R \propto a^{-4}$ for radiation, and

$\rho_{DE} \propto a^{0}$ for dark energy.

In other words, energy density for matter drops off as the inverse of scale factor cubed while it drops off as the inverse fourth power of the scale factor yet is not affected by the change in scale factor for dark energy density. Standard cosmologists assume dark energy remains constant even with the additional volume in the expanding universe. This would mean the addition of new dark energy with the same density as the dimension of the universe increases.

Before we move on, we must also consider that GTR curvature of space is also considered to be a contributor to universe expansion with w = -1/3 and n = 2. This means that $\rho_{curature} \propto a^{-2}$. So, the curvature effective energy density drops off as the inverse square of the scale factor even with containing matter or radiation.

As was done previously in solving the Friedmann equation for energy density as a function of scale factor, we can do the same for the scale factor as a function of time. When we do this, we arrive at this relationship:

$$a \propto t^{2/n} \qquad (18)$$

Therefore, by substituting in the proper "n" values yields the following relationships:

$a_M \propto t^{2/3}$, $a_R \propto t^{1/2}$, a_{DE} divergent over time, and $a_{Curvature} \propto t$. The resulting relationship for dark energy is $a_{DE} \propto e^{Ht}$. Notional time histories are sketched in Figure 4. Standard cosmologists believe that, initially after the "big bang" the universe was dominated by electromagnetic radiation (i.e., photons). Later, after a cooling down period, the expansion began to be more dominated by matter. Eventually, dark energy, by its exponential expansion behavior

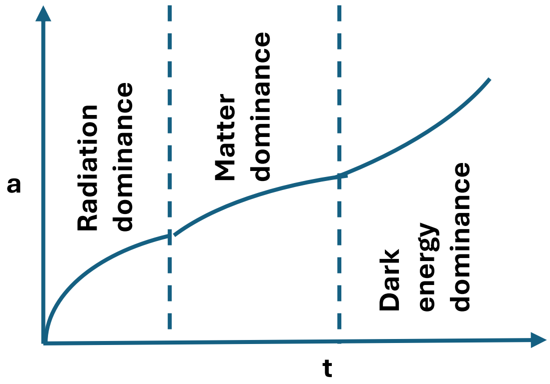

Figure 4. Rough sketch of scale factor time history.

due to constant energy density, is now beginning to dominate. According to most cosmologists the current epoch of observation is not long after the start of dark energy dominance. No one really knows what this dark energy is or from what is its cause. Initially it was assumed to be quantum vacuum energy, but such energy density is tens of orders of magnitudes higher than what is observed in the cosmos. Much research has been done through the observation of high Z galaxy distances of Type 1a supernovae that has resulted in the claim that the universe has reached the dark energy dominant phase of expansion. The most noted physicist, winning the Nobel prize in physics for his work in this area is Dr. Adam Riess [4]. However, a large and critical part of this effort was the interpretation of redshift as recessive motion of the supernovae.

Issues with Expansion

There have been many scientifically legitimate claims that the universe is not actually expanding. The remainder of this article addresses those. Various data analysis tests have been applied to determine whether or not the universe is expanding, some of which are described in [5]. Two of these tests are included in this section, along with highlights of their results.

Tolman Test

Although there are several, one reliable tool for testing the expansion hypothesis is the surface brightness (SB), or the Tolman test, proposed by Richard Tolman in 1930. SB is basically the ratio of the apparent luminosity of an object (galaxy, nebula, star, etc.) with respect to its surface area. The main premise behind the SB (or Tolman) test is that the redshift, z, of an observed celestial object relates to its surface brightness with the following relationship, depending on whether or not the universe is expanding:

$$SB \propto \frac{1}{(z+1)^n} \tag{19}$$

where n = 1 for nonexpanding and n = 4 for an expanding universe. This means, for example, that, for redshifted galaxies consisting of the same size and luminosity of a non-redshifted counterpart, the SB would be much more decreased. Such is also the case when comparing galaxies of the same observed redshift between the non-expanding and expanding universe. Proponents of the expanding universe model, such as Allan Sandage [6] claim that observational data analysis they have performed, using Tolman test supports their hypothesis that the universe is expanding.

There are some legitimate concerns with Sandage's approach and results. First, only galaxies of redshifts less than z = 1 were included. A better approach to make the case would have been to include the much higher redshifted galaxies we have now been able to observe through the James Webb Space Telescope (JWST). Dr. Eric Lerner, renowned plasma physicist and author of "The

Big Bang Never Happened" [7], perhaps the current most leading critic of expanding universe model, performed, along with his colleagues, an in-depth analysis of astronomical data from both the Hubble Space Telescope (HST) and JWST [8]. In this work, they determined the SB for hundreds of galaxies of the same size and luminosity with various redshifts up to z = 5. Their findings strongly support the non-expanding universe model, with SB ratios in line with $SB \propto \frac{1}{z+1}$ rather than $\frac{1}{(z+1)^4}$. .Lerner's objection to Sandage's techniques included their added hypothesis of evolution of galaxies to explain the difference between Tolman test results and their preferred model. Additionally, he observed that Sandage used a highly involved adjustment by what are called k-corrections and many other free parameters and assumptions to fit the observed surface brightness.

Angle Test

Another well-known and widely respected test for expansion of the universe is the "angle test". According to this test, the angular size of an object in space is inversely proportional to its redshift. Through the work of physicists such as Kapahi [9], LaViolette [10], and López-Corredoira [11], including detailed analysis of observational data, it has been shown that a non-expanding universe is dramatically more in line with the angle test than does the expanding universe.

Alternative Theories

With the expanding universe model failures of the above test s and others, the obvious question is raised, "Then what is the source or cause of the observed redshifts?". Several candidates have been proposed but not accepted by the mainstream physics community. Not all of these are address in this articsle, such as Doppler, Compton, and gravitational. However, they are covered in some detail in [1, 12]. Their exclusion from this article should not be interpreted in any way as a lack of merit in that they, or a combination of them could actually be the cause. Alternative candidate redshifts that I do include here have been selected due to there connection with the content of the previous paragraphs.

Quasars

Quasi-stellar objects, or quasars, were discovered in the 1960's. They exhibit enormous amounts of energy and luminosity in the radio wave portion of the electromagnetic spectrum. Observing the emitted light at such intensities in this part of the spectrum translates to significant redshifts.

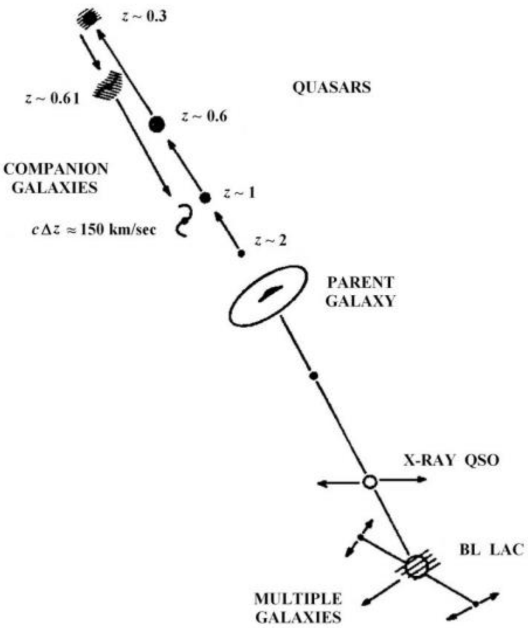

Figure 5. Halton Arp's diagram of how quasars are formed from galaxies and are intrinsically redshifted [14].

Two key proponents for intrinsic redshifts have been the Halton Arp, a prodigy of Edwin Hubble, and his colleague, Jayant Narlikar. In their co-authored 1993 paper [13], they laid out their claims and rationale, heavily supported by observational data, that quasars are created and ejected by parent galaxies called active galactic nuclei (AGN's). Halton Arp included an illustration of this in [14] as provided in Figure 5. Their model includes the assumption that, when a quasar is in its early stage of development, electron mass is less than what it becomes as the quasar matures. The initial redshift is therefore significantly higher in the beginning due to the lesser energy transition of electrons in the emission of a photon. At ejection, the quasar, in the form of a plasmoid, undergoes extremely high acceleration away from the parent AGN. As the velocity increases, the mass is assumed to increase as well, resulting in significant increases in energy. This results in redshift reduction. Once the ejection force diminishes, the application of momentum conservation requires that the electron speed must decrease but yet still maintain the high energy that was gained by increased mass. The theory is that the quasar eventually forms into a galaxy and then spawns more galaxies. Such an explanation by Arp, Narlikar, Hoyle, and others provides an interesting theory for galaxy formation that seems to be more based on observational data than does the standard model.

Over many years, Arp documented a host of observations where the quasar redshift and that of its nearby parent galaxy had sizable differences [13]. Critics, supporting the expanding universe model, claim the quasar is in a far more distant location. However, these critics cannot account for the observed quantization of redshifts where Arp's model does. Much more can be written here on this topic but that is not the purpose of this article. Before moving on, however, it should be mentioned that, in Arp's catalogue [15], the highest quasar redshift recorded was 4.39 and the highest quasar redshift since then [16] is 7.64.

Anomalous Galactic Atomic Energy Levels

In recent years, I have done some research on my own [1] related to the idea that there could be distant galaxies composed of atoms with slightly lower energy levels than nearer galaxies. Light emitted from these galaxies would therefore manifest redshifted wavelengths. The mechanism behind this, in the case of quasars, is suggested by Arp and Narlikar [13] to be smaller than electron mass associated with mature galaxies. This lesser electron mass hypothesis could also be true for the development of a few special galaxies at creation. However, smaller electron mass is balanced by other parameters, as shown in [17] to sustain consistent atomic energy levels. For a few galaxies, such as the ones studied in [17], there could have been exceptions to this balance. For my intrinsic redshift analysis, I explored this phenomenon, through application of the redshift equation:

$$z = \frac{\Delta\lambda}{\lambda} = \frac{hc}{\lambda(E+\Delta E)} - 1 \qquad (20)$$

where h is Planck's constant, λ is the wavelength, $\Delta\lambda$ is shift in wavelength, and the expected energy level, E, is decreased by ΔE. The analysis also included parameterization across a range of atomic energy level deviations from the norm for various elements: oxygen, nitrogen, hydrogen, argon, neon, and helium. Results are shown here in Figure 6. Note that the observed redshifts for each of the selected galaxies could have been the result of these slightly lower initial atomic energy levels. Once again, no galaxy motion is required.

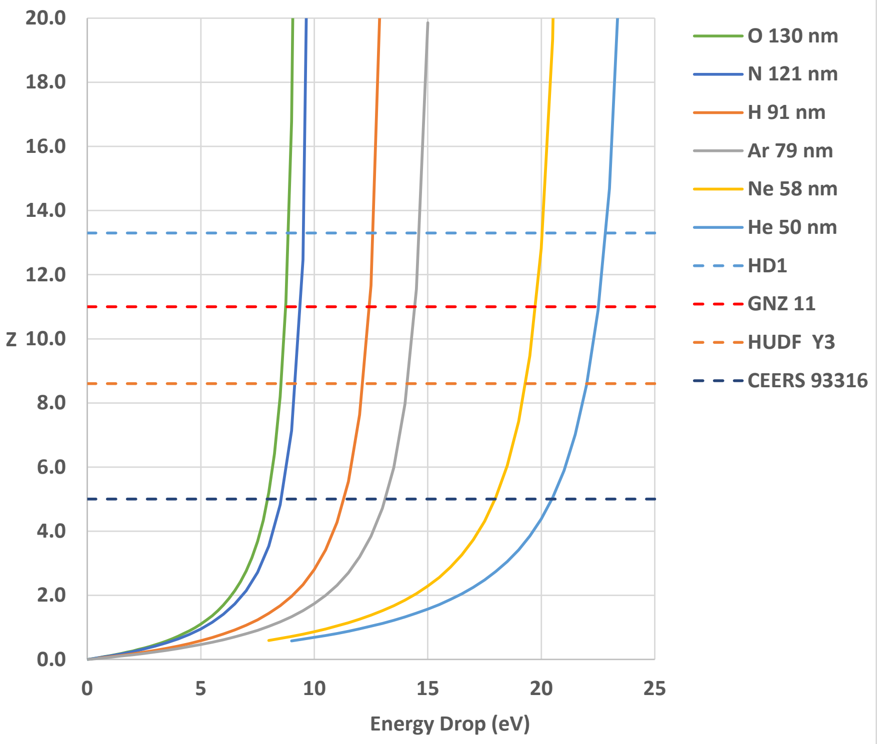

Figure 6. Computed sensitivity of redshift to off-nominal drops in atomic energy levels for various elements. Dashed lines represent the observed redshift values for the galaxies: HD1, GNZ-11, HUDF Y3, and CEERS 93316 [1].

Plasma Redshifts

Another physical cause for redshifts includes interactions of photons with electrons. such as Compton or Thompson scattering. Unfortunately, those reactions would result in a blurred image to the point that may not even be observed. However, plasma redshifts are caused by loss of energy to electrons without colliding with them [1] so their direction does not change. Another difference between plasma scattering and Compton scattering is that a photon can interact with multiple electrons simultaneously, hence amplifying photon energy loss and, subsequently, increased redshift. Brynjolfsson [18], through laboratory experiments, derived the following equation for the plasma redshift:

$$ln(1+z) = 3.326x10^{-25} \int_0^R n_e F_1 \frac{\gamma}{\gamma_0} dx + \frac{\delta\lambda_i - \delta\lambda_0}{\xi\lambda} \qquad (21)$$

where R is the length of the trajectory through the plasma. F_1, the frequency cutoff factor, is typically 0.5 and the ratio of the classical damping coefficients , $\frac{\gamma}{\gamma_0}$, for the incident photon, is typically between 0.1 and 10. The numerical constant (3.326×10^{-25}) is a function of Planck's constant and the election orbital radius. The added term on the right in equation (19) can be discarded for high z analysis because it is negligible in such cases. Solving for z and collapsing the product, $F_1 \frac{\gamma}{\gamma_0}$, to unity, we get the following approximate expression.

$$z \approx e^{3.326x10^{-25} \int_0^R n_e dx} - 1 \,. \tag{22}$$

So, it appears, as it should, that the plasma redshift is very dependent on the electron density and the pathlength through the plasma. Very high levels for R and/or n_e would be required to produce a significant redshift. The sensitivities to these parameters were explored through parameter sweeps and the results are shown in Figure 7.

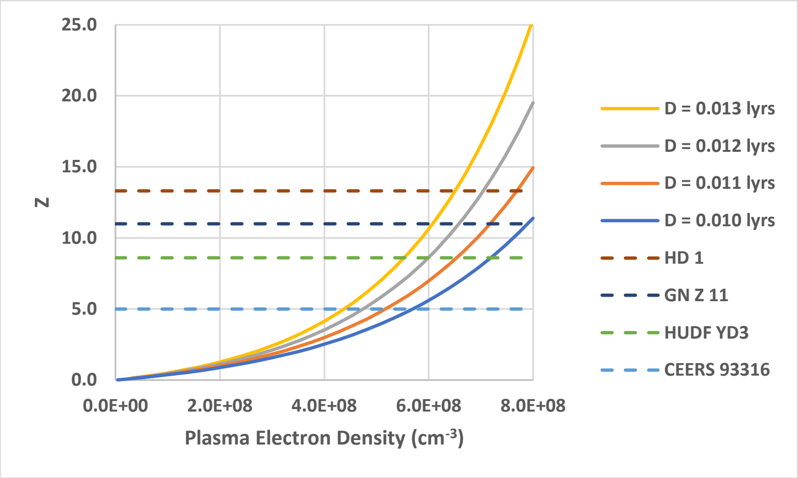

Figure 7. Sensitivity of redshift to plasma density and distance through the plasma. Dashed lines represent the observed redshift values for the galaxies: HD1, GNZ-11, HUDF Y3, and CEERS 93316 [1].

Conclusion

In this article I have laid out a brief tutorial, presenting key equations that are used to model how the universe could possibly have expanded and perhaps continues. However, whether or not one believes in expansion depends on how one interprets the astronomically observed data. This interpretation depends on presuppositions and assumptions driving the mathematics. For example, Einstein was not content with the way his equations were resulting in the conclusion that the universe was not static, a presupposition he had due to his steady state beliefs. In fact, they revealed that the universe is slowly collapsing. So, he added a "fudge factor", we now call the "cosmological constant", to save us from this disaster. When Hubble made his famous observations on Mt. Wilson and showed them to Einstein, he, along with the physics community, strongly affected by expansion assumption and the exhilarating coverage in the press (mainstream media at that time), impulsively assumed the discovery as evidence for expansion. It has been established as a major element in the standard LCDM cosmology. I have also described some legitimate criticisms and concerns for expansion (Hubble was one of first to doubt expansion). In order to explain a physical mechanism, to give credence to accelerated expansion, a physical mechanism labeled "dark" energy has been invented but never observed. At first, the thought was that it is the laboratory-measured quantum vacuum energy density. This idea was dismissed when it was realized that the universe would double in size in a very minute fraction of a second. Such has been a big part of the motivation to develop string theory and other purely mathematical approaches that could never be falsified through empirical testing. But it is not enough to point out these major flaws in the expansion theory. We ask the question, "Then what is causing these redshifts?" There are legitimate alternatives to the interpretation of redshifts, and I have provided some description for the two that I prefer in this article. There could be a combination of redshift contributions to create what we observe in our telescopes. It is my belief that these two (intrinsic and plasma redshifts) should be more explored.

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