A Possible Anomaly in Galactic Recessional Speed Alleged to Increase with Universal Distance

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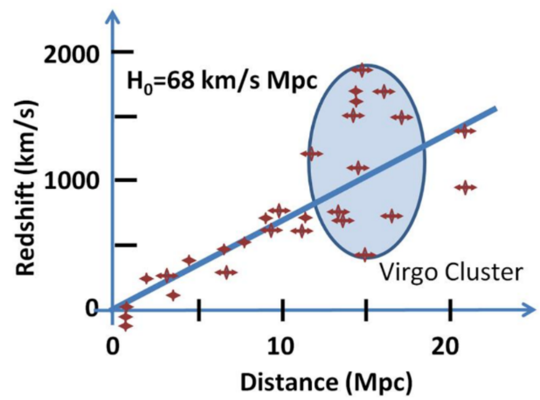
Hubble's law of cosmic expansion is typically based on fitting data for relatively low (on a 'universal' scale) redshifts and distances. Extrapolating Hubble's law to the entire observable universe, proponents of the Big Bang Standard Cosmological Model claim the universe is expanding (possibly faster than their sacred speed of light due to a repulsive acceleration being produced by 'dark energy') because galactic redshifts increase linearly with distance from the earth. To them, this 'proves' there was a Big Bang and the resulting universe will continue without bound to expand until all dies out in the absolute cold of space. However, a relatively simple analysis of galactic redshifts vs. distance spanning the full range of the observable universe, not just the 'nearby' galaxies, suggests that there is an anomaly in the reputed increasing recessional speed with distance. The nature of this anomaly is examined here, and speculation offered as to one possible explanation, albeit far from definitive.

1. Introduction

As described in Reference [1]:

> *Hubble's law is the name for the observation in physical cosmology that: (1) Objects observed in deep space (extragalactic space, ~10 megaparsecs* [Mpc] *or more) are found to have a Doppler shift interpretable as relative velocity away from the Earth; (2) This Doppler-shift-measured velocity, of various galaxies receding from the Earth, is approximately proportional to their distance from the Earth for galaxies up to a few hundred Mpc away. Hubble's law is considered the first observational basis for the expansion of the universe and today serves as one of the pieces of evidence most often cited in support of the Big Bang model … Georges Lemaître in a 1927 article … proposed the expansion of the universe and suggested an estimated value of the rate of expansion, now called the Hubble constant. Two years later Edwin Hubble confirmed the existence of that law and determined a more accurate value for the constant that now bears his name … The law is often expressed by the equation $v = H_0D$, with H_0 the constant of proportionality (Hubble constant) between the 'proper distance' D to a galaxy … and its velocity v …* [H_0] *is most frequently quoted in (km/s)/Mpc …*

Hubble's law is typically based on fitting data for relatively low (on a 'universal' scale) redshifts and distances, such as shown in Figure 1. [1] At larger redshifts and distances approaching the reputed size of the observable universe (1.4E+10 ly), "… using the theory of general relativity gives a more accurate relation for recession velocities, which can be greater than the speed of light. Note this doesn't break the ultimate speed limit of *c* in Special Relativity as nothing is actually moving at that speed, rather the entire distance between the receding object and us is increasing. This is a complex formula requiring knowledge of the overall expansion history of the universe to calculate correctly but a simple recession velocity is given by multiplying the co-moving distance (*D*) of the object by the Hubble parameter at that redshift (*H*) as z ≈ HD/v – 1," where v is the recession speed. [2]



<u>FIGURE 1</u>. Fit of redshift velocities to Hubble's law … for redshifts between 0.01 and 0.1 to find that $H_0 = 71 \pm 2$ (statistical) ± 6 (systematic) km $s^{-1}Mpc^{-1}$

2. Examining the Full Range of Galactic Redshifts and Distances

While Hubble's law is based on the 'lower' range of galactic redshifts and distances, and extrapolated to the 'higher' redshifts and distances to support the theory of universal expansion, it is instructive to revisit this over the full range of redshifts and distances, as tabulated by Gowan when developing "A Space-time Map of the Universe: Implications for Cosmology and Inflation." [3] Gowan extracted data on 27 redshifts as a function of distance from reported observations ranging from 0.04 (redshift) at 4E+8 ly from earth to 18.3 (redshift) at 1.34E+10 ly from earth (see Table 1). To facilitate subsequent calculations, I performed non-linear regressions on Gowan's data using Reference [4] to obtain the following best fits:

Polynomial: $z = D/(-0.1730D^2 + 2.269D + 1.409)$
Logarithmic: $z = 1/(-2.344\ln[D] + 6.139)$

Since both yielded essentially the same excellent fit (see Figure 2), I decided to work with the simpler logarithmic formula.

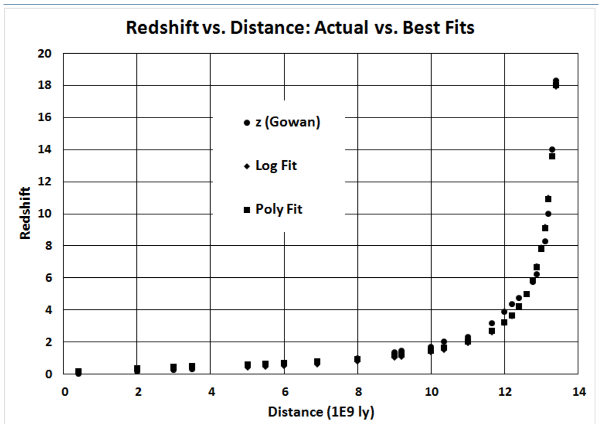


FIGURE 2. **Redshift vs. Distance**

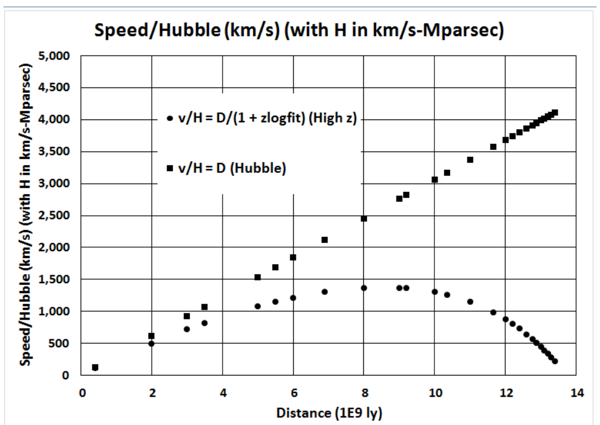


FIGURE 3. **Recession Speed (Scaled to Hubble Constant) vs. Distance**

Using the logarithmic formula for redshift vs. distance, I projected the recession speeds (scaled to the Hubble constant H) as a function of distance for both the linear Hubble law, v/H = D, and the non-linear approximation, v = HD/(1 + z[D]), cited above. Figure 3 and Table 1 show the results of these calculations.

If one applies a value of ~ 70 km/s-Mpc for the Hubble Constant, the recession speeds approach that of light based on the Hubble law (4,108 x 70 = 288,000 km/s = 0.96c) but peak at roughly one-third this value for the non-linear approximation (1,372 x 70 = 96,000 km/s = 0.32c). Furthermore, the peak for the non-linear approximation occurs around a distance of 9E+9 ly from earth, where the redshift is ~ 1. There is a distinct deviation from linear behavior for the latter as low as ~ 3E+9 ly from earth (redshift ≈ 0.25), with a decrease in recession speed beyond 9E+9 ly (redshift ≥ 1). What might this indicate?

3. Speculation

I must confess to being at a loss to begin to explain the anomalous behavior of recession speed (scaled to H) resulting from the non-linear approximation based on the Gowan data. In order to try to make some progress, I first tried some regression fits to this curve up to a distance of ~9E+9 ly (the increasing part of the curve). The three best and simplest results were as follows (via Reference [4]):

Sinusoidal: v/H Ratio = sin(-0.1787D + 9.410)
Inverse: v/H Ratio = 1.749 - 10.25/(D + 5.518)
Logarithmic: v/H Ratio = 0.4605 ln(D + 0.4120)

based on the data shown in Table 2. A reference point is assumed to be located at a distance 9E+9 ly from earth corresponding to a maximum v/H as shown in Figure 3 and Table 1. As one proceeds away from this reference point, the v/H ratio decreases. For convenience, these ratios as scaled to a maximum value at D = 9E+9 ly and plotted against the distance from earth in Figure 4. Evident is that all three fits are quite close to the actual ratios.

TABLE 1. **Redshift vs. Distance: Gowan Data, Regression Fits and Recession Speed Predictions**

TABLE 2. **Redshift vs. Distance: Gowan Data, Regression Fits and Recession Speed Predictions**

3.1 Electromagnetism?

Reviewing the regression fits for some possible clue as to what phenomena might generate the anomalous behavior in the recession speed, only the inverse fit seems to offer some semblance of explanation. If the effect was gravitational based on some sort of 'Great Attractor' or 'Great Wall' located about 9E+9 ly from earth (perhaps analogous to these reputed to be located ~ 1.5-2.5E+8 and 3.0-5.5E+8 ly, respectively, from earth), an inverse distance-squared behavior might be expected. [5] This is not evident from any of the fits. Perhaps something electromagnetic, possibly aligning with some of the Electric/Plasma Universe hypotheses might be appropriate? [6]

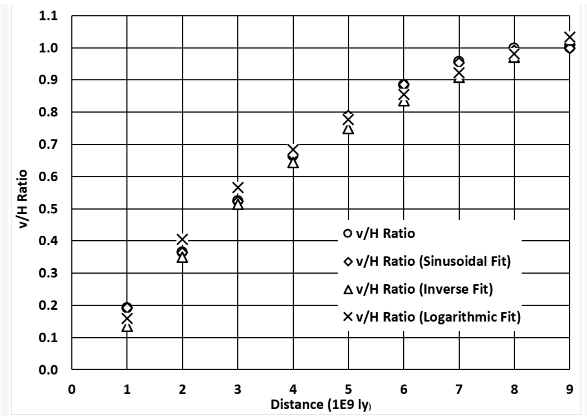


FIGURE 4. v/H Ratio vs. Distance

Ampere's Law applied to a long conductor carrying a current 'i' indicates an inverse distance (radius) behavior for the generated magnetic field: $B = \mu_0 i/2\pi r$. If at a distance 9E+9 ly from earth there were another 'Great Attractor' or 'Great Wall' in the form of a long electromagnetic (plasma) filament consisting perhaps of many galaxies, such a magnetic field decreasing inversely with the distance from the filament might be generated. As such, it would pull on nearby galaxies, resulting in attractive speeds that decrease with distance. Combine this with a relative motion away from this filament by the earth (either or both could be moving), perhaps analogous to the constant term in the inverse fit (positive to indicate relative movement away from each other?), and the type of behavior shown in Figures 3 and 4 might result. Of course, the inverse regression fit is not strictly an inverse distance behavior, as there is a constant in the denominator with the distance, significantly 'dampening' the postulated effect. Clearly, even if I was somehow on a logical path toward an explanation, there would be other phenomena involved.

3.2 "Big Wave?"

An interesting theory regarding the formation of the universe postulated by Rydin, the "Big Wave," offers a possible suggestion for the sinusoidal fit: [7]

> *We postulate that all of the mass and gravitons in the central black hole dissociate simultaneously ... [and] proceed together outward from the origin at the speed of light as a correlated symmetric spherical wave ... We assume that new matter is created along the radial direction ... as the wave recedes from the origin ... A series of deep redshift galaxy count measurements ... perpendicular to the plane of the Milky Way and taken at an angle of 45 degrees from the plane exhibit the same periodic behavior, but with some distortion in the 45 degree traverse, indicating that the data are sampling a spherical distribution centered near the Milky Way ... A postulated spherical J_0 Bessel function-squared solution with a small initial phase shift, times an exponential that accounts for matter deposition losses ..., matches the measured deep red shift N-S galactic pencil surveys when the experimental data are scaled by the inverse of the square of the radial distance to correct for the conical shape of the pencil ... Note that the basic data illustrate a damped sinusoid,* [~~if~~]*regardless of any theoretical model ... The new Big Wave model predicts that* [periodic correlated] *Great Walls and Voids will form in the universe! The measured distortion at a 45 degree angle off of the N-S poles places the origin somewhat to the side of the Milky Way.*

While Rydin assumes there was a Big Bang, likely in the relatively near vicinity of the Milky Way (~7E+7 ly), one might relax this assumption to be merely that a 'Big-Bang-like' explosion, not necessarily from a black hole or constituting the 'birth' of the universe, but only an event that may repeatedly occur at different locations within the universe, happened approximately 9E+9 years ago, traveling spherically outward at approximately light speed such that the density of matter varies sinusoidally (i.e., in a J_0 Bessel function-like manner) with distance away from the peak density, now located ~9E+9 ly from earth. The effect of this sinusoidally-increasing density (as one proceeds away from earth) can be gravitational and/or electromagnetic such that galactic recessional speeds reflected by the sinusoidal model might be observed from earth.

Figure 5 plots the sinusoidal v/H ratio from Table 2 at distances of 9.0, 7.2, 5.4, 3.6 and 1.8E+9 ly from earth against the J_0 Bessel function at ω = 0, 0.5, 1.0, 1.5 and 2.0, respectively, scaled as $\omega = (9 - D)/3.6$. The sinusoidal fit yields only slightly higher values vs. the Bessel function, deviating at most by 0.11 (0.33 vs. 0.22), or 50% ([0.33 – 0.22]/0.33) at ω = 2.0. Considering that the J_0 Bessel function is symmetric about the y axis, one can envision some parallel to the decreasing recessional speeds shown in Figure 3 (and Table 1) as the distance from earth extends beyond 9E+9 ly. While all this remains highly speculative, is it at least possible that the observed behavior of galactic recessional speeds could be somehow related to Rydin's "Big Wave" theory?

4. Conclusion

Analysis of the redshift vs. distance data for galaxies spanning the full range of the observable universe (vs. just the 'nearby' range, which is typically the limit on which Hubble's law is based, and then assumed to apply throughout the universe) suggests an anomalous increase then decrease of galactic recessional speed, peaking about 9E+9 ly from earth. Unfortunately, I cannot draw any conclusion approaching more than speculation as to the possible cause, other than perhaps electromagnetic phenomena somehow connected to the Electric/Plasma Universe hypotheses or an ancient 'Big Bang-like' explosion in the relatively near vicinity of the Milky Way, via a very liberal interpretation and extension of Rydin's "Big Wave" theory. Nonetheless, the analysis casts doubt on cosmic expansion resulting from a 'universe-birthing' Big Bang (and the recent additions of dark matter and energy to counteract ‘holes’ in this ‘Standard Model’) and provides ‘food for thought’ as to what truly might be occurring and the actual interpretation of the reputed cosmological redshifts vs. distance.

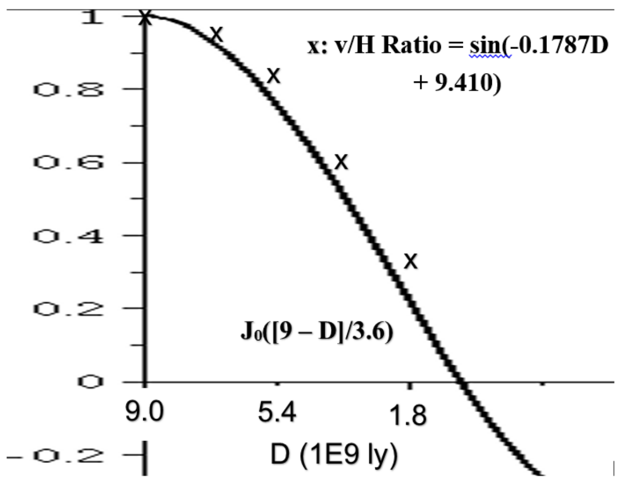


FIGURE 5. Comparison of Sinusoidal v/H Ratio Fit to J_0 Bessel Function (Scaled for Distance)

5. References

1. *https://en.wikipedia.org/wiki/Hubble% 27s_law*.
2. *http://astronomy.swin.edu.au/cosmos/C/Cosmological +Redshift*.
3. *http://www.johnagowan.org/spacetxt.html*.
4. *http://www.xuru.org/rt/NLR.asp#CopyPaste.*
5. *https://en.wikipedia.org/wiki/Great_Attractor; https://en.wikipedia.org/wiki/CfA2_Great_Wall*.
6. *http://www.Electricuniverse.info;www.plasma-universe.com*.
7. *http://home.earthlink.net/~rarydin/bigwave.html*.

6. Acknowledgement

I would like to acknowledge John Gowan for reviewing my paper and offering some insights. After drafting this paper, I contacted him for any feedback he might offer, and he was kind enough to respond as follows:

As to the slowing of the cosmic expansion at large redshift, I can offer several possible explanations:

(1) First we must assume the data is correct as reported. I have wondered if the high redshift data was accurate in terms of its accompanying distance estimates - are the distance estimates the result of relative luminosity data as compared to a standard candle, or are they just using the redshift formula to calculate an expected distance - which would explain why their data fit the calculated redshift vs distance curves on my map so nicely. If this is the case, then I can't really use their (high redshift) data to validate my map, since they are just doing the same thing I am doing. (I use Steven Weinberg's assumption that redshift is due to the size difference between the observed universe and our current universe.)

(2) If we accept the data as reported, then it may be that the rate of expansion during the early universe is slower because the average density of the universe is greater, and so the average strength of the cosmic gravitational field is larger due to the inverse square law.

(3) The total gravitational field of the cosmos will decrease with time as the mass of the stars is converted to light. This effect will allow the universe to expand more rapidly as it ages. (See my paper: "Does Light Produce a Gravitational Field?" http://www.johnagowan.org/lightfield.html) [The prime argument made here is that “Light traveling freely in space does not produce a gravitational field - contrary to most ‘establishment’ thinking. Because the ‘Interval’ of light = zero, light has no specific location in space-time (light is ‘non-local’), and hence cannot provide a center for such a field. Since an un-centered gravitational field violates energy (and symmetry) conservation (including the ‘Equivalence Principle’), light moving freely in vacuum cannot and does not produce a gravitational field. This result is important for theories attempting to unify gravity with the other forces.”]

(4) Others have noticed this anomaly at about redshift 1 (halfway to the ‘big bang’) and have attributed it to ‘dark energy’ asserting its dominance due to the simple increase in the volume of space-time. But I think ‘dark energy’ is simply the reduction of the total cosmic gravitational field, as muted above via the conversion of mass to light in stars and other astrophysical phenomena. Perhaps an especially vigorous period of star formation occurred at about this time.

(5) Note that my map is not intended to be a highly accurate map, but rather a ‘proof of concept’ map, demonstrating that this is a valid way of visualizing the cosmos from our own unique vantage point. However, it does immediately bring into question certain concepts in cosmology such as ‘inflation.’

Not being a proponent of the Big Bang, cosmic expansion, etc., I cannot justifiably comment on Gowan’s insights other than to acknowledge my acceptance of Gowan’s redshift vs. distance data as accurate in my analysis, as per his first insight. I do note the potential for his third and fourth insights possibly offering an explanation if the reduction in mass (due to conversion to light) can be attributed to something other than the universe ‘aging’ relative to some initial ‘Big Bang.’ I concur with Gowan’s rejection of some mysterious ‘dark energy’ as per his fourth insight. However, I remain skeptical regarding any sort of gravitational explanation for the anomaly shown in Figures 3 and 4 given the difficulty in relating it to some sort of inverse distance-squared behavior.