The Dark Energy Problem

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The proposal for dark energy based on Type Ia Supernovae redshift is examined. It is found that the linear and non-Linear portions in the Hubble Redshift are easily explained by the use of the Hubble Sphere model, where two interacting Hubble spheres sharing a common mass-energy density result in a decrease in energy as a function of distance from the object being viewed. Interpreting the non-linear portion of the redshift curve as a decrease in interacting volume between neighboring Hubble Spheres removes the need for a dark energy.

1 Introduction

The discovery in 1998 of fainter than expected Type Ia supernova resulted in the hypothesis of an apparent acceleration in our expanding universe [1]. Type Ia supernovas have a previously determined standard-candle distance which has shown to be the same as their redshift distance for low z values. However, their fainter brightness at far distances indicate that they are further away than expected when compared with their redshift distance. This lead to the conclusion that the standard candle distance is correct but that there is an apparent acceleration in the expansion of the universe occurring in the range where the Type Ia supernovas were measured. This explanation was designed the preserve the linearity of Hubble's Law while explaining the further distance of the Type Ia supernova. The existence of dark energy, a repulsive gravitational field that is a manifestation of the cosmological constant, was theorized as the likely cause of the acceleration [2]. Experimentalists are now embarking on the task of proving the existence of dark energy with little examination or critical analysis of the cause and effect of the initial observations. We can show that the observed effects of the Type Ia supernova redshift are explainable by another phenomena which satisfies known laws of physics.

2 Assumptions

We begin by making the following assumptions:

Assumption 1: *The gravitational and electromagnetic force ranges are not infinite.*

Although there is as of yet no widely accepted model of unifying the gravitational and electromagnetic (QED) forces, they both follow an inverse-square law and have similar divergence properties so we assume they are fairly equivalent in nature but by no means infinite in range. We assume the gravitational and electromagnetic force ranges have a steep decline in effect similar to the profile for the strong nuclear force but at a range $= 10^{26}$ meters $= R_u/2$ which BB theorists currently estimate as the radius of the Universe. We will call the sphere that is centered around our point of observation on Earth as our Hubble sphere, and it encompasses what we see out to the radius $R_u/2$ which we assume as the limit of the gravitational and electromagnetic forces. Likewise, objects at a distant d from us on Earth also have a Hubble sphere that is centered on their point of observation.

Assumption 2: *The Universe is bigger than the Hubble sphere and is perhaps infinite.*

When we refer to the Universe we are referring to all space including what lies beyond our Hubble sphere, which we cannot view because light is infinitely redshifted at the boundary of our sphere due to the steep decay of the gravitational and EM forces at a distance $R_u/2$. We currently accept that a decrease in energy between two points can cause a redshift in photons. This explanation should be adequate for the purposes of our discussion on how the apparent redshift-acceleration may be the cause of two overlapping Hubble spheres, each with their own center of observation. This explanation also answers Olber's Paradox in which an infinite Universe would contain so many stars that the darkness of night would be overwhelmed with starlight. The answer to the paradox is that there is no starlight that can reach us beyond our Hubble sphere radius because of the limit of the electromagnetic force range.

Assumption 3: *If one views an object at a distance d from Earth, the light from that object is affected by the mass-energy density of our local Hubble sphere interacting with the mass-energy density of the distant object's Hubble sphere.*

The intersecting volumes of two neighboring Hubble spheres correspond to a common mass-energy density between the spheres that decreases as the distance between the centers of the spheres increases, resulting in less common volume.

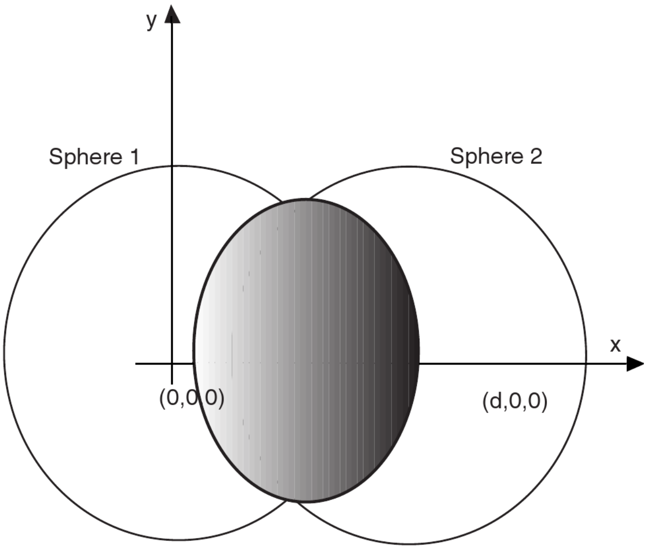

Fig. 1: Hubble sphere's 1 and 2 intersect sharing a volume (shaded gray).

The decrease in common mass-energy density between the spheres results in a redshift of photons emitted from the center of either Hubble sphere to the center of the other Hubble sphere. Regardless of which direction we look, we always see a redshift because there is matter all around the outside of our Hubble sphere that gravitationally attracts the matter inside our Hubble sphere. The Hubble sphere by this account is a three-dimensional Euclidean sphere, which is assumed to have a constant mass-energy density.

3 The common energy of Hubble spheres

If we examine Figure 1, we see the intersection of two Hubble spheres with their centers separated by a distance d. The shaded gray area is the intersecting volume, which also represents common mass-energy between the spheres. The center of sphere 1 can be imagined as our viewpoint from Earth and the center of sphere 2 can be the distant object we are viewing.

From Figure 1 we can find the ratio of intersecting volume between the spheres to the volume in our sphere as:

$$\frac{Volume_{common}}{Volume_{local}} = \frac{\frac{\pi\left(16R_u^3 - 12dR_u^2 + d^3\right)}{12}}{\frac{4}{3}\pi R_u^3} =$$

$$= \frac{3}{48}\left(\frac{d^3}{R_u^3} - 12\frac{d}{R_u} + 16\right), \qquad (1)$$

where Volume$_{common}$ is the intersecting volume between the spheres and Volume$_{local}$ is the volume of our own sphere.

If we assume homogenous mass-energy throughout both spheres, then the ratio of common mass-energy between the spheres to the energy in our own sphere is proportional to the ratio of the intersecting volume between the spheres to our sphere's volume. We also know that the mass-energy in a given sphere is proportional to the $h\nu$, so we arrive at:

$$\frac{\nu_2}{\nu_1} = \frac{Volume_{common}}{Volume_{local}} = \frac{3}{48}\left(\frac{d^3}{R_u^3} - 12\frac{d}{R_u} + 16\right) =$$

$$= 1 - \frac{3d}{4R_u} + \frac{d^3}{16R_u^3}, \qquad (2)$$

The change in frequency $\Delta\nu/\nu_1 = (\nu_2 - \nu_1)/\nu_1$ is the similar to the measured value of z with respect to wavelength λ large, but we now look at it with respect to ν and $\Delta\nu/\nu$ is found to be:

$$\frac{\Delta\nu}{\nu} = -\frac{3d}{4R_u} + \frac{d^3}{16R_u^3}. \qquad (3)$$

From (3) we see that the energy viewed from our observation point decreases with the distance d to the object (which is also the distance between the centers of the spheres), and is essentially linear for $d \ll R_u$ where R_u is the radius of each Hubble sphere. This linear decrease in energy is interpreted as an increase in redshift or a linear increase in velocity with distance by Big Bang (BB) theorists and amounts to the linear portion of Hubble's Law. For situations where d gets close to R_u there is a slight increase in energy resulting from the d^3 term in (3), suggesting to the BB theorist that the object being viewed is decelerating and is closer to us than would be expected from the previously linear Hubble slope when $d \ll R_u$.

Instead of accepting a non-linearity in the Hubble curve, BB theorists believe that the curve is still linear and that the shorter distance computed at larger d based on measured wavelength is still correct. The fainter-than-expected brightness of the Type Ia supernova is then a result of an apparent acceleration in the object due to some unknown "dark energy" with a negative gravitational force. In reality, the Hubble Law coincides fairly well with standard candle observations until d approaches R_u, where it then becomes non-linear and produces a result that mimics acceleration of the viewed object, if one still believes that Hubble's Law is linear. The d^3 term in (3) results in an apparent acceleration of the object viewed at larger distances and in fact this acceleration is not a real but instead is a non-linearity in Hubble's Law.

4 Conclusions

The results of the analysis of intersecting Hubble spheres shows that a linear redshift results by assuming that the gravitational and electromagnetic forces have a finite range, R_u. The linear relationship for smaller d explains Hubble's Law without requiring an expansion of the Universe or our own Hubble sphere. The derivation also explains the apparent acceleration of objects as our distance d to them approaches R_u. Therefore, a simpler explanation of a non-expanding Universe exists which to current knowledge is at least the size of $2R_u$ and possibly much bigger. The Cosmic Microwave Background Radiation (CMBR) has been shown by others to be a result of absorption and scattering of the intergalactic medium [3]. The additional production of Helium and other element ratios is easily found by allowing the Universe as much time as it needs to produce these results in stellar cores. The proposed explanation is a far simpler one than the requirement to balance photon to proton ratios in the theorized early Universe of the Big Bang, with the added concern of an inflationary period to allow smoothness in the CMBR.

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