The "Big Bang" theory originates from the celestial observation that stars in all directions seem to be moving away from the earth. An additional interesting fact: the greater the distance from the earth to the star, the greater the observed velocity. This velocity relative to the earth is calculated from the "red shift" of light frequencies associated with known spectrographs of various elements. There are several recognized causes for this red shift. One is a true Doppler type frequency shift caused by relative velocity. Another cause is a theoretical expansion of the metric of space, perhaps caused by the presence of "dark energy". A third cause involves the movement of light within a gravitational field.

SIMPLE GRAVITATIONAL RED SHIFT PER GENERAL RELATIVITY

In the case of the movement of light through a gravitational field, the equation currently recognized as the best description of light frequency red shifting is:

$$\frac{f_r}{f_\infty} = \frac{1}{\sqrt{1-\left(\frac{2GM}{rc^2}\right)}} \tag{61}$$

G = gravitational constant
M = mass of planet creating the gravitational field
c = speed of light
r = radius of observer from center of M
f_r = frequency of the light seen from radius r
f_∞ = frequency of the same light seen from radius infinity

Equation (61) follows from the Schwarzschild Solution of the General Theory of Relativity (see (46)). Using (44c) from the article *Gravity and Energy*, a better equation can be stated for two positions $r_A > r_B$ within a spherical gravity field:

$$\frac{f_B}{f_A} = \exp\left[\frac{GM}{c^2}\left(\frac{1}{r_B} - \frac{1}{r_A}\right)\right] \tag{62}$$

Equation (62) can be also be written:

$$\frac{f_r}{f_\infty} = \exp\left(\frac{GM}{rc^2}\right) \tag{63}$$

Equations (61) and (62) give information on the behavior of light in a spherical gravity field, but are not accurate representations of the frequency shift of light from distant planets as seen by observers here on earth. They don't contain enough information about the trip light is making between emitter and observer. This trip profile requires further investigation.

PHOTON TRAVEL BETWEEN TWO PLANETS

When there is the movement of a mass or energy between two planets, the calculated quantities depend on the strength of both gravitational fields. Suppose the net result will be found from the superpositioning of the effects of these two gravitational fields. See Figure 14.

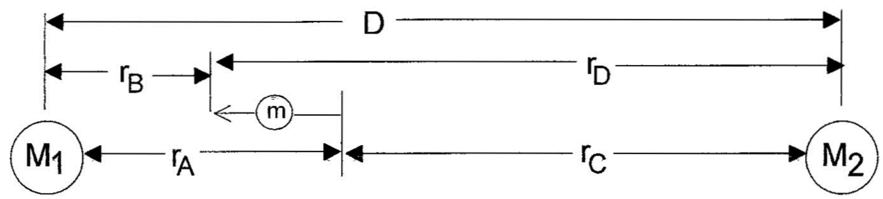

Figure 14

In Figure 14, an object (which could be a photon) of mass m is moving from position r_A to position r_B relative to a planet with mass M_1. Relative to the planet with mass M_2, this object is moving from position r_C to position r_D. Suppose this object provides for this movement by using its own energy (mass m work). As shown in the article *Gravity and Energy*, a good first estimate of the work W_{AB} gained by the object as it travels between r_A and r_B is:

$$W_{AB} = mc^2\left[\frac{GM_1}{c^2}\left(\frac{1}{r_B} - \frac{1}{r_A}\right)\right] - mc^2\left[\frac{GM_2}{c^2}\left(\frac{1}{r_C} - \frac{1}{r_D}\right)\right] \tag{64}$$

This composite W_{AB} can give the relationship between the frequency of a photon at r_A compared to the frequency of that same photon after it "falls" to r_B:

$$\frac{t_A}{t_B} = 1 + \frac{W_{AB}}{mc^2} \tag{65a}$$

$$\frac{f_B}{f_A} = 1 + \left[\frac{GM_1}{c^2}\left(\frac{1}{r_B} - \frac{1}{r_A}\right)\right] - \left[\frac{GM_2}{c^2}\left(\frac{1}{r_C} - \frac{1}{r_D}\right)\right] \tag{65b}$$

Continuing with the procedure found in the article *Gravity and Energy*, as an object falls within a gravitational field, the energy it gains becomes part of its mass, affecting both the force on the object and the expression for its momentum and kinetic energy. This principle is now applies to m of Figure 14. At position r (from M_1), the net force on the object is:

$$F = \frac{GM_1 m}{r^2} - \frac{GM_2 m}{(D-r)^2} \tag{66}$$

Following the logic of (41) to (43), a better estimate of W_{AB} can be found as:

$$W_{AB} = \int_{r_A}^{r_B} -\left(\frac{GM_1 m}{r^2} - \frac{GM_2 m}{(D-r)^2}\right)\left(1 + \left(\frac{GM}{c^2}\right)\left(\frac{1}{r} - \frac{1}{r_A}\right) + \left(\frac{GM_2}{c^2}\right)\left(\frac{1}{D-r} - \frac{1}{D-r_A}\right)\right)dr \tag{67}$$

Equation (67) is a challenge to solve. And this equation is just the first step in finding the more complex exact expression for W_{AB}, similar to the way that (34) is the exact expression for a single gravitational mass experiment. The nonlinear nature of equations produced by the procedure that gives (34) makes the exact solution to the problem of two gravitational masses virtually impossible. Therefore, an approximate solution for this problem will be written by inspection of (34) and (64). Although approximate, this solution will still be better than (64).

$$1+\frac{W_{AB}}{mc^2}=\exp\left[\frac{GM_o}{c^2}\left(\frac{1}{r_B}-\frac{1}{r_A}\right)+\frac{GM_e}{c^2}\left(\frac{1}{D-r_B}-\frac{1}{D-r_A}\right)\right] \tag{68a}$$

$$\frac{f_o}{f_e}=1+\frac{W_{AB}}{mc^2} \tag{68b}$$

In (68), planet M_1 is now the observer planet M_o and planet M_2 is now the emitter planet M_e.

APPLICATION OF EQUATION (68)

Suppose the observer is standing on the surface of planet M_o. In the case where $M_o = M_e$ and $r_o = r_e$ (the surfaces of the two planets), the frequency f_o seen by the observer would be the same as the frequency f_e of the photon emitted from the surface of planet M_e for any value of D. Also, the photon emitted from M_e would lose the same amount of energy traveling to the mid point between planets as it would gain falling from the mid point to the surface of M_o. However, if M_e were substantially larger than M_o, or if radius r_e were substantially smaller than radius r_o, then frequency f_o seen by the observer would be lower than the original emitted frequency f_e of the photon. If M_o were the planet of larger mass or smaller radius, then the observed frequency would be higher than the emitted frequency. In the extreme case of one planet being larger than the other, (68) reduces to the single planet model (62), which is an exact solution.

RED SHIFTING NEAR INTERMEDIATE OBJECTS

In Figure 15, the experiment of Figure 14 is shown along with a third mass M_3 that is influencing the gravitational force on object m. In this experiment, it is assumed that mass m is still traveling from r_A to r_B as in Figure 14. However, in this case, the work gained by mass m must also include any energy exchange with the gravitational field of M_3.

The first estimate work W_{AB} gained by considering M_1 and M_2 is the same as before per (64). The work W_{ABi} gained by mass m due to the gravitational field of some other mass M_i is;

$$W_{AB}=GmM_i\left(\frac{1}{r_{Bi}}-\frac{1}{r_{Ai}}\right) \tag{69}$$

This general description of the work W_{ABi} for any planet M_i can be used to generate a general equation for the frequency change of a photon traveling between n planets.

$$\frac{f_o}{f_e}=\exp\left\{\sum^{n}\left[\frac{GM_i}{c^2}\left(\frac{1}{r_{Bi}}-\frac{1}{r_{Ai}}\right)\right]\right\} \tag{70}$$

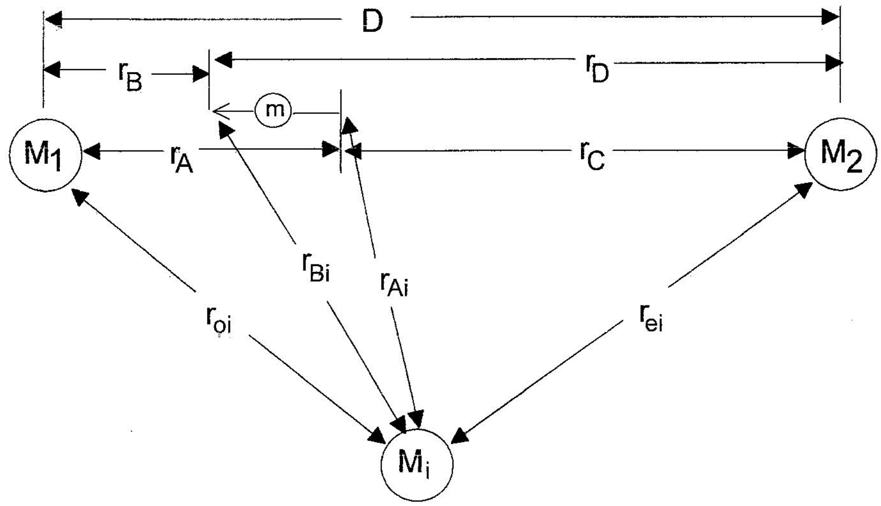

Figure 15

Equation (70) shows the frequency change observed as the photon goes between two locations designated by r_A and r_B. If the experiment concerns photons traveling from the surface of M_2 to the surface of M_1, then (70) can be restated for a system with a total of n planets.

$$\frac{f_o}{f_e} = \exp\left\{\sum^{n}\left[\frac{GM_i}{c^2}\left(\frac{1}{r_{oi}} - \frac{1}{r_{ei}}\right)\right]\right\} \tag{71}$$

In (71), the photon frequency observed is a function of all surrounding planets and their relationship to the emitter and observer, with those closest to the observer tending to increase the observed frequency and those closest to the emitter tending to reduce the observed frequency.

At this point, a special case shown in Figure 16 will be examined. Identical emitter and observer planets are involved, so there is no frequency shift due to these planets alone as the photon travels from planet surface to planet surface. Using (71), for the observer planet, r_{oi} is the radius of the planet surface and r_{ei} is the distance to the emitter planet. For the emitter planet r_{ei} is the radius of the planet and r_{oi} is the distance to the observer planet. But, assume there is a uniform distribution of planets in the region of space occupied by the emitter planet M_e and that all the planets are about the same size. For all these other planets, r_{oi} is the distance to the observer and is very large compared to r_{ei}, the distance to the emitter. This r_{oi} shown in Figure 16.

The observed frequency shift will not be caused by the emitter and observer planets, but by the other planets in the experiment. With r_{oi} being very large for these other planets, the effect of the

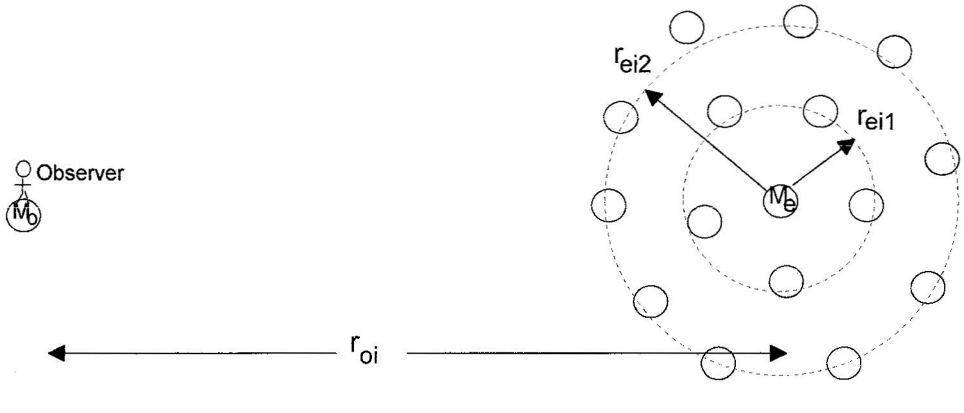

Figure 16

planets located at distance r_{ei1} from M_e have an effect $\frac{f_o}{f_e} = \exp\left[\frac{GM_i}{c^2}(-\frac{1}{r_{ei1}})\right]$ individually. If r_{ei2} is a distance twice r_{ei1}, then the individual effect of each planet there will be $\frac{f_o}{f_e} = \exp\left[\frac{GM_i}{c^2}(-\frac{1}{2r_{ei1}})\right]$. Considering only individual planets at these two radii, naturally the planets at r_{ei1} have greater influence. Assume the distribution of these planets is one planet for every volume $1.0r_{ei1}^3$. In the space between 0.8 r_{ei1} and 1.2 r_{ei1} there will be 5 planets. However, between $0.8r_{ei2}$ and $1.2r_{ei2}$ the number of planets influencing the experiment is 40. The total effect of far away planets is significantly greater than that of nearby planets. In other words, as we observe stars farther and farther away from us, it is possible that larger and larger relative r_{ei} values accompanying the greater separation will produce an increasing red shifting of the observed frequencies.

This is one possible reason for the tendency of stars to have larger red shifts as the separation distance gets larger. There are other possibilities too. For example, the individual M_i values could increase as the distance increases. Or if the densities or sizes of far away stars groups were greater, the same effect would result. If the far away stars are galaxies, then the density of the masses within the galaxies or number of individual masses within the galaxies could be increasing as their distance to us increases. However, these other scenarios require a reason for this star system mass gradient to occur. If increasing r_{ei1} values is the effect that produces the increasing observed red shift, then the universe is a more likely structure of randomly distributed, more evenly spaced systems of masses and the cause of the increasing red shift is a natural function of geometry.

Carrying this idea to the extreme, for extremely large distances between observer and emitting stars, all visible light from these ultra-distant stars could red shift into non-visible light frequencies (such as microwaves). This idea could answer Olber's Paradox. This paradox is about a static universe that is filled with a uniform distribution of stars extending to infinity. Every point in the sky would be the location of a far away star, so the sky would be completely filled with light. The information in this article shows that a black sky could be the natural result of this uniform, static universe. As stars get farther away, their frequencies shift lower, first into microwaves (the cosmic microwave background is a well know feature of our actual universe) and then to even lower frequencies. Eventually, the frequencies get so low as to lose almost all their energy.

SUMMARY

One of the features of the Big Bang theory that makes it seem plausible is the experimental observation that stars that are progressively farther away from earth seem to have progressively increasing red shifts and therefore greater velocities away from us. However, the Doppler velocity effect is not the only possible reason for increasing red shifting of spectra from distant stars. Other potential explanations for this pattern of red shifting seem also to be unlikely, such as the presence of "dark energy" and the related theory that the metric of the universe is expanding.

The theory in this article indicates that uniform random star distributions in a static universe could also produce the observed effects. It is unclear how much this static universe theory, Big Bang theory (Doppler red shifting) and other sources of red shifting contribute to the total explanation of the data. Which theory (if any) is correct is a matter of conjecture at this point.