Quantized space-time and dark matter

Eran Sinbar

Abstract- Planck's length is the scale in which the classical ideas of gravity and space-time cease to be valid and where uncertainty dictates the rules. This is the size of the information bits on the black holes event horizon and there is a good reason to assume that it is the size of the basic building blocks of the fabric of space. This article assumes three leading assumptions: 1. the quantization of space into a lattice (grid) of unit cells, which I will refer to as 3D voxels of space (voxels) in the size of Planck's length in each dimension. 2. The quantization of time into Planck's time sequences (pulses). 3. Light travels one space voxel for each time pulse. Based on these three assumptions, this article will show that the Newton gravitational constant (G) increases as the universe expands. This increase in the gravitational constant can illuminate some light on the mysterious dark matter.

Keywords- *quantized space-time, gravitation constant, dark matter*

1. *Introduction*

Hubble discovered the photonic red shift as a function of distance from the emitting galactic source. His conclusion based on the Doppler shift was that space is expanding.

This paper assumes the fabric of space quantization into basic building blocks .These building blocks are 3D voxels of space itself in the size of Planck's length in each dimension. Assuming that the expansion of space is due to new voxels of space generated in the void regions of space, then it's not a mandatory requirement that light which travels in these newly generated voxels of space will undergo a red shift phase. Figure 1 illustrates the expansion of space due to new voxels of space and the zero Doppler effect on the photons travelling through these new voxels.

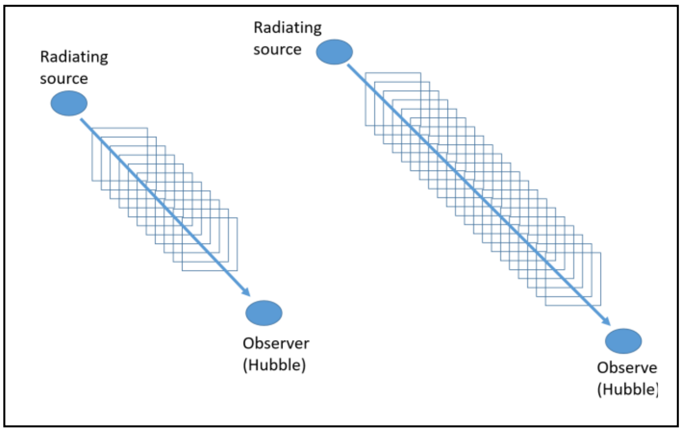

Figure 1: the blue circle illustrates a photon travelling from the radiating source towards Hubble's telescope. The small 2D rectangles illustrate the 3D voxels of space. The image on the right illustrates an expanded universe compared to the image on the left. In this figure, the assumption is that the expansion of space is due to new voxels of space generated in the void regions of space. Based on this assumption there should be no red shift effect. Since Hubble measured red shift as a function of distant from the photons galactic origin, this model cannot describe the expansion of space.

Let us assume another model in which the voxels of space expand as a function of time without the need to generate new voxels of space. In this case, as the photon travels through the expanding voxels, its wavelength expands and the photon undergoes through a red shift phase (Figure 2).

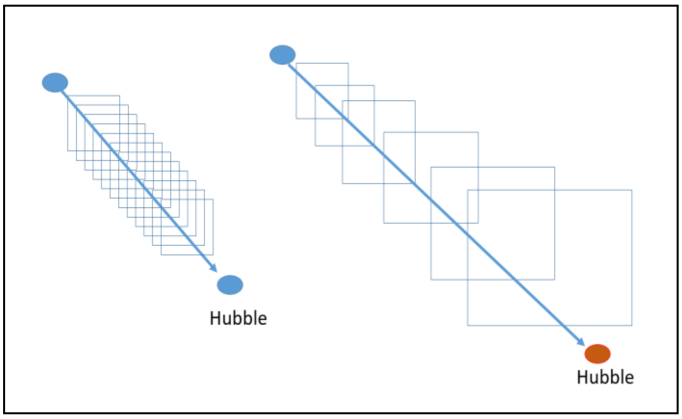

Figure 2: The image on the right illustrates an expanded universe compared to the image on the left. In this figure, the assumption is that the expansion of space is due to the expansion of the voxels themselves in the void regions of space. Based on this assumption there is a red shift effect due to the expansion of the photon travelling through the expanding voxels of space. Since Hubble measured red shift as a function of distant from the photons galactic origin, this model can describe the expansion of space.

There is a hidden assumption in figure 2 that if a wavelength is spread over N number of voxels of space it will keep spreading on the same number of voxels even if the voxels will expand in their size. This assumption explains the wavelength expansion due to voxel of space expansion, causing the red shift measured by Hubble.

2. *Expansion of voxels and dark matter*

Assuming that the expansion of space is due to the expansion of the voxels of space and not due to generation of new voxels, let us describe carefully the outcome of these assumptions. The length of the voxel in each dimension is Planck's length, so we assume practically that as the space expands Planck's length increases. Assuming that time is quantized to Planck time sequences (time pulse), in every quantized time pulse, a photon travels a distance of one Planck length and this defines and limits the speed of light. When Planck's length increases the distance, which the photon travels for each time pulse increases meaning the speed of light c increases. (Figure 3)

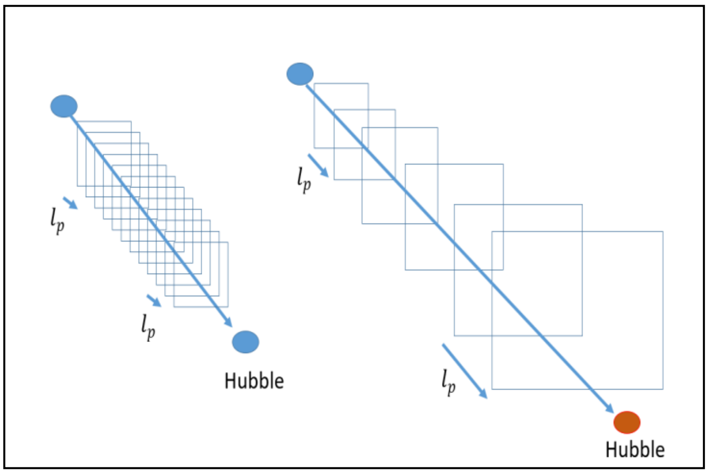

Figure 3: for each quantized Planck time (time pulse), the photon travels a distance of Planck's length l_p from one space voxel to the next. Since in my model of the expanding universe (illustration on the right) the voxels and Planck's length increase, the photon travels a larger distance for each time pulse. This leads us to the assumption that as the void of space expands Planck Length l_p increases and the speed of light C increases. Since there is a gravitational time dilation, I assume that in the expanding void of space where the gravitational field is low the time pulse will never be longer than in a gravitational field near a star or on earth.

Based on the photonic energy equation: $E = \frac{hc}{\lambda}$

E = the energy of a photon, h = Planck constant, c = speed of light, λ = photonic wave length

$$l_p = \sqrt{\frac{Gh}{2\pi c^3}}$$

G= gravitational constant, l_p = Planck's length, h = Planck constant, c = speed of light

$$l_p{}^2 * \frac{2\pi c^3}{G} = h$$

$$\frac{hc}{\lambda} = l_p{}^2 * \frac{2\pi c^4}{\lambda G} = \frac{l_p{}^2 * \frac{2\pi c^4}{G}}{\lambda}$$

The wavelength λ is an integer number N times Planck's length l_p.

$$\boxed{\frac{hc}{\lambda} = \frac{l_p{}^2 * \frac{2\pi c^4}{G}}{N * l_p} = \frac{l_p * \frac{2\pi c^4}{N}}{G}}$$

Based on Hubble's measurements as the universe expands the photon shifts towards the red spectrum and its energy decreases. Based on our assumptions, the expansion of the universe is due to the expansion of the voxels that build up space.so if l_p increases during the expansion, since $\frac{2\pi c^4}{N}$ will not decrease, the gravitational constant G must increase during the expansion of space, even more than the increase rate of the voxel (increase in Planck's length l_p to each dimension).

Conclusion

This article assumes three leading assumptions: 1. the quantization of space into 3D voxels of space (voxels) in the size of Planck's length in each dimension. 2. The quantization of time into Planck's time sequences (pulses) .3. Light travels one space voxel for each time pulse. These assumptions lead to the conclusion that the red shift Hubble measured due to the expansion of space is due to the expansion of the voxels themselves. If the voxels expand, Planck's length increases and the speed of light increases (photon is travelling one Planck's length every pulse of Planck time). Since the measured photonic energy decreases (red shift effect measured by Hubble), the gravitational constant G must increase even more than the increase in Planck's length as can be seen in the equation above. This increase in the gravitational constant G as a function of the expansion of space, might explain some effects that relate by mistake to dark matter. Let us assume a galaxy with a disc of stars circling a massive black hole in its center with the mass M. Let us assume that there are two stars orbiting the center of the galaxy, m1 and m2. m1 is at a distance $l1$ from the center of the black hole and m2 is at a distance $l2$, from the center of the black hole ,where $l2 > l1$ and $m1 = m2 = m$. The expansion of space increases as the distance from the center of the black hole increases due to the decrease of the black hole gravitational field as a function of distance. We can theoretically receive the following gravitational force equation (due to the massive black hole):

$$\frac{G1 * M * m1}{L1^2} = \frac{G2 * M * m2}{L2^2}$$

$$m2 = m1 = m$$

$$L2 > L1$$

$$G2 > G1$$

Since the gravitational force is equal to m1 and m2, they will orbit at the same angular frequency (ω). If an observer will not take into consideration the fact that G2>G1 he might assume that there is some added mass to m2 and he will refer to this added mass by mistake as dark matter