Hubble Redshift in the Green Valley

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1. Introduction

In 1929, Edwin Hubble formulated a law that the velocity of a receding galaxy is proportional to its distance to the earth. This meant that a galaxy moving away from us twice as fast as another galaxy is twice as far away. Hubble based his law on Doppler's effect whereby the wavelength of light from the galaxy is redshift if the galaxy is moving away from us. Thus, by measuring the redshift of known spectral lines, Hubble claimed to estimate the recession velocity of the galaxy relative to the Earth.

Today, astronomers [1,2] take Hubble's Law as proof the Universe is expanding. If, however, the redshifts could be shown to have a non-Doppler origin, the Universe need not be expanding. Redshift without an expanding Universe is of utmost importance because many of the outstanding problems in cosmology would be simply resolved by Newtonian mechanics.

In this regard, our understanding of low Z Doppler redshift in nearby galaxies has been recently advanced by measurements [3] in the IR from the Japanese AKARI satellite and in the UV from NASA's Galaxy Evolution Explorer (GALEX). GALEX imaged both in the NUV and FUV at 230 and 150 nm. Young stars having intense UV emission are thought to appear as a blue cloud of star forming spirals while older stars look like the sequence of red ellipticals. However, GALEX also shows light at frequencies half-way between the blue and red – the so called green valley [4].

The green valley may be considered the color of the average frequency between red and blue frequencies. But this differs from that in painting, i.e., a green watercolor is produced by mixing yellow and blue - not red and blue. Regardless, making color a measure of galaxy evolution is complicated by the fact the observed star color is that of the surrounding cosmic dust having nothing to do with the color of the star itself.

Stars naturally produce cosmic dust that scatters and absorbs their emissions. Scattered light is eventually absorbed, and therefore our measurement of star temperatures based on UV emissions from young and old stars is always altered by cosmic dust. Typically, cosmic dust consists of submicron dust particles (DPs). Astronomers believe the IR light observed from a star is caused by the temperature increase of the cosmic dust upon the absorption of UV photons. Classical physics is assumed to determine the temperature increase of the DPs upon the absorption of a single photon, as instantaneous multi-photon absorption is unlikely. Based on the computed temperature T of the DP, the wavelength λ_o of IR emission is then given by Wien's law of thermal blackbody radiation, i.e., $\lambda_o T = 2898$ micron-K. For example, our yellow sun at $\lambda_o = 575$ nm has a Wien temperature of ~ 4050 K, although the actual sun temperature is closer to 4400 K. Since the maximum detectable IR wavelength [1] of AKARI is 160 microns, the DP temperature is resolved to ~ 18 K

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2. Classical Physics and Quantum Mechanics

Classical physics is not valid in deriving the thermal response of submicron DPs because their heat capacity [5] is restricted by quantum mechanics (QM). Unlike classical physics that allows the atom to have heat capacity from the macro to the nanoscale, QM requires the heat capacity of submicron DPs to vanish. Conservation of the absorbed UV photon therefore cannot proceed by an increase in DP temperature.

3. QED Induced Radiation

Lacking heat capacity, QM conserves the absorbed UV photon by the creation of QED radiation *inside* the DP. QED stands for quantum electrodynamics. Creation is prompt with QED inducing [5] the absorbed UV photon to assume the EM confinement of the DP by TIR. EM stands for electromagnetic and TIR for total internal reflection.

TIR confinement only occurring during the absorption of the UV photon is a natural consequence of submicron DPs that have a high surface to volume ratio. What this means is the energy of the absorbed UV photon is almost totally confined to the surface of the DP, and therefore a photon is created by QED having the wavefunction defined by the geometry and material of the DP. But the TIR confinement is not perfect and collisions with atoms eventually redirect the QED photon toward the normal to the DP surface allowing the QED photons to leak to the surroundings. Only redshift of the UV photon to a lower energy QED photon may occur; blueshift is not possible with single photon absorption.

QED radiation is fundamental physics not only applicable to DPs absorbing UV photons in the green valley of galaxy evolution, but to diverse areas [5] of physics including Geckos, olfaction, mating moths, memristors, and spindle assembly of the cell.

4. Analysis

QED induced redshift may be understood by considering the absorption of a single UV in a spherical DP of diameter D. Correcting for the reduced speed of light in the solid DP by its refractive index n_r, the QED photon created is observed at wavelength λ_o,

$$\lambda_o = 2Dn_r = 4an_r \quad (1)$$

where, $a = D/2$ is the DP radius. The redshift Z is,

$$Z = \frac{\lambda_o - \lambda}{\lambda} \quad (2)$$

where, λ is the wavelength of the UV photon. From [6], the DP radius varies from a = 0.005 to 0.25 microns, Fig. 1 shows the redshift Z of Lyman-alpha (Ly_α) and H_α lines for amorphous silicate DPs having $n_r = 1.45$. At the upper bound DP radius of 0.25 microns, the Ly_α lines are redshift to Z ~ 10 corresponding to NIR photons. But QED redshift also creates VIS photons from Ly_α photons, e.g., in a DP radius of 0.1 microns, a QED photon is created in the green valley having λ_o = 0.58 microns at Z ~ 3.75.

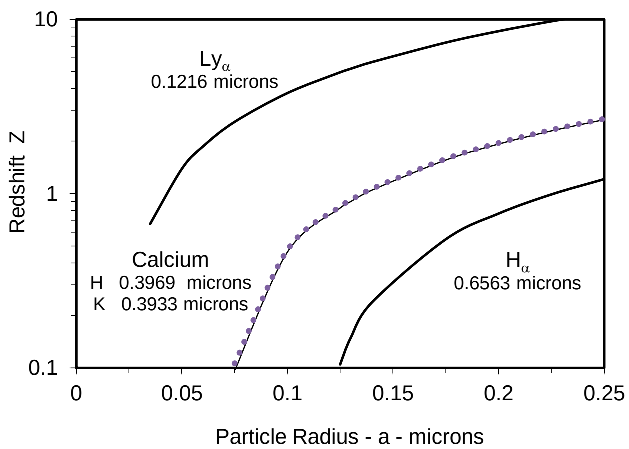

Fig. 1 QED Redshift in Cosmic Dust- Amorphous Silicate

In support of Hubble's law, the Doppler redshift of the calcium H and K lines at 396.9 and 393.3 nm have been used to argue [7] that both H and K lines redshift the same amount for a given redshift Z. See (Fig. 22-1 of [7]) for photographs of the lines at redshifts Z from 0.004 to 0.204. But the precision necessary to support this argument is difficult to achieve because the H and K lines are very close together. Fig. 1 shows no observable difference for Z from for 0.004 to 0.204. Precise measurements are required.

4. Discussion

Green Valley Not only does cosmic dust redshift the UV photons to the IR without a temperature increase, but the UV is also redshift by QED to produce the VIS colors from the blue through the green to the red. Hence, the color of a galaxy is neither blue nor red, but may have a color in between. Indeed, QED redshift may be considered to produce the entire EM spectrum upon the absorption of UV by cosmic dust, the color depending on the size and material of the DPs while the intensity depends on their number. In a random distribution of DPs, the most likely DP is its average which corresponds to a green color because green is the average frequency between blue and red. But the green color is not unique as other DP distributions produce different colors.

Wavelength QED redshift of the UV radiation from a galaxy depends on the dimensions and materials of individual DPs. Hence, QED redshift within a cosmic dust cloud is not the same everywhere as in Hubble's law. Based on the calcium H and K lines, the evidence for the same Doppler redshift for all wavelengths in Hubble's law is not convincing. Measurements of calcium H and K lines to show they are redshift the same amount for the same Doppler redshift Z are not given. Generally, astronomers accept Hubble law without proof of its validity. For example, the AKARI-GALEX data (Fig. 5 and A-1 of [1]) at low redshift Z < 0.15 simply assume [1] the validity of the standard cosmological model with Ho =70 km·Mpc/s. Precise Doppler redshift data showing calcium H and K lines redshift the same would be convincing.

Comparison Differences between QED and Doppler redshift may be compared to determine if the UV photons can be redshift to green photons, i.e., a redshift of Z = 1.28 is required to create a 525 nm green photon from a 230 nm NUV photon. But AKARI-GALEX data is limited to Z < 0.15, and therefore green photons cannot be produced by the Doppler redshift. But green photons are observed, and therefore it follows that Hubble's law fails at Z < 0.15, or for that matter for all Z. In contrast, the QED redshift of Z = 1.28 to create a green photon from the NUV is easily achieved in a 175 nm DP having a 1.5 refractive index. Hence, it is likely Hubble actually observed QED redshift in cosmic dust – not a Doppler effect.

5. Conclusions

1. Color has nothing to do with the age of the star. Color depends on UV absorption by surrounding cosmic dust. Young stars need not emit blue light, and instead may emit red light or even IR light depending on the properties of the cosmic dust. Certainly, old stars emit less UV than young stars, but otherwise the star color depends on the absorption of UV emission by cosmic dust.

2. In galaxy evolution, the green valley is a composite of a rainbow of VIS colors produced by the absorption of UV radiation emitted by the star in the surrounding cosmic dust. QED redshift for the absorption of 150 to 230 nm UV radiations in submicron DPs produces VIS light from the blue at 380 nm to the red at 760 nm. At the upper DP diameter of 0.5 microns, the NIR is produced at 1.5 microns. DPs up to 10 micron diameters [8] in AGN stars may produce the

MIR < 30 microns. But the FIR requires larger DPs, e.g., the FIR at 200 microns would be produced from 70 micron DPs which is not unreasonable based on stellar disks with an upper DP size of 1 to 10 mm. *Ibid*. All of the QED induced redshift is produced without any temperature increase in the DPs.

3. More data to verify that Hubble's law gives the same redshift Z for all wavelengths is required beyond that discussed here. The calcium H and K lines are virtually identical to each other and make such a comparison difficult. Nevertheless, the fact that Doppler's effect cannot explain the Z = 1.28 necessary to redshift UV light to the green valley in the nearby Universe at Z < 0.15 is sufficient to claim cosmic dust invalidates Hubble's law.

4. The AKARI-GALEX conclusion that a large majority of young stars are hidden by cosmic dust is consistent with the conclusion here that color has nothing to do with the age of a star. However, the large amount of cosmic dust observed today does not suggest an early transition from a transparent to dusty Universe consistent with the Big Bang scenario, but rather that cosmic dust was always there consistent with an infinite Universe once proposed by Einstein.

5. QED induced redshift has further consequences. DPs hold in question the Hubble redshift as proof the Universe began in the Big Bang suggesting Einstein's static Universe in dynamic equilibrium is a far more credible cosmology. Other consequences [5] of QED redshift in cosmic dust are:

Dark Energy not needed to explain a Universe that is not expanding
Period-luminosity relation qualified in Cepheid stars
Dark Matter not source of Gravitational Lensing
Galaxy Rotation Problem resolved without Dark Matter
No need for MOND to explain Galaxy Rotation Problem
Tolman Surface Brightness reduction corrected to (1 + Z)
Explain the Independence of Redshift in Sunyaev-Zeldovich Effect
Light Curve dilation in Supernovae Explosions

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