The Hubble constant and Intrinsic Redshift in Cosmic Dust

Introduction

Hubble first embraced a static Universe until his discovery of the relation of galaxy redshift to astronomical distance and velocity that subsequently led to Einstein's expanding Universe. However, until the time of his death, Hubble was not convinced [1] his redshift supported Universe expansion. Indeed, Hubble stated:

> "it is difficult to believe that the velocities are real; that all matter is actually scattering away from our region of space. It is easier to suppose that the light waves are lengthened and the lines of the spectra are shifted to the red, as though the objects were receding, by some property of space or by forces acting on the light during its journey to the Earth."

Today, Hubble's constant Ho is still controversial as Ho is not a constant, but depending on experimental method varies from about 67 to 73 km⁄s ·Mpc . Typically, the linear Hubble law does not fit the scatter of redshift data as shown in Figure 1.

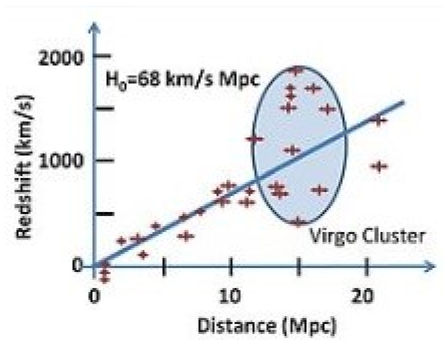

Figure 1. Hubble law and Virgo cluster

Moreover, Ho for the Universe is not plotted for each and every galaxy as the scatter is significant. Instead, galaxies in a certain distance range are binned together and averaged. Only then is the straight-line relation that defines Hubble's law obtained, but as shown above still does not fit the Virgo cluster.

Indeed, over the past 50 years, observations are numerous and compelling that the linear Hubble law: V = HoD describing the standard redshift–distance relationship is not correct. Here, V stands for galaxy velocity and D for the distance to the galaxy from the Earth. Notably, observations show the presence of quasars physically connected to galaxies suggesting both moving together should have the same redshift, but the quasars are found to have far higher redshifts than the galaxies. What this means is the redshifts are intrinsic (non–cosmological) and do not have anything to do with galaxy velocity therefore posing a serious dilemma for a cosmology based on an expanding Universe.
But what is the cause of the intrinsic redshift?

Numerous explanations of intrinsic redshift have been proposed, e.g., the intrinsic redshift is thought related to the age of a galaxy where younger galaxies have a larger redshift than older galaxies. As a galaxy or quasar ages the size of the intrinsic redshift is therefore predicted to decrease. A variable mass hypothesis is proposed [2]to explain intrinsic redshifts , but a mechanism that relates age to redshift is not identified. Since corrections for intrinsic redshift reduce galaxy velocities, the cosmological implications include a lower Hubble constant, e.g., removing intrinsic redshift by selecting galaxies [3] known to have lower excess redshifts gave 55 km⁄s⁄ Mpc < expected 67 to 73 km⁄s ·Mpc.

However, the intrinsic redshifts are more likely non-Doppler in nature, thereby overstating [4] the velocity dispersions above that of Newtonian mechanics suggesting dark matter is necessary to hold the galaxy clusters together. Indeed, intrinsic redshifts give the false impression dark matter is present, when in fact it does not exist, thereby explaining why the search for dark matter particles to date has not succeeded.

Proposal

Differing from Hubble, intrinsic redshifts are caused by cosmic dust throughout the ISM. The dust may be of various sizes , but only NPs of submicron atomic aggregates of silica or other elements are of interest here. NPs stand for nanoparticles. The dust NPs may be considered free particles isolated from each other forming locally distinct dust clouds within or peripheral to the galaxies. Both Hubble and intrinsic redshift by cosmic dust are contrasted in Figure 2.

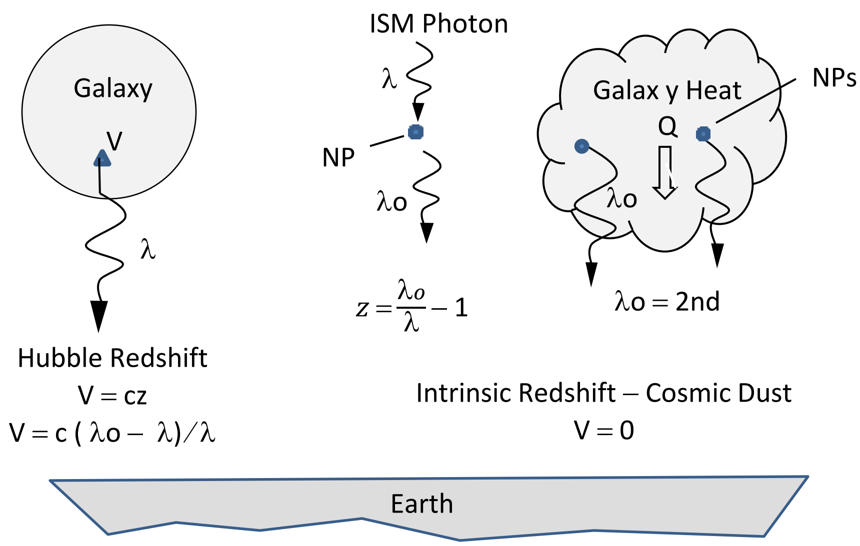

Figure 2. Hubble and Intrinsic Redshifts by Cosmic Dust

Intrinsic redshift may be caused by the interaction of single ISM galaxy photons with a NP, or more likely, by galaxy heating Q of NPs in local dust clouds, both of which are illustrated in Figure 2. Unlike single ISM photons, galaxy heating Q does not depend on ISM photon wavelength λ, and instead emission wavelength λo only depends on diameter d and refractive index n of the NP, i.e., $\lambda o = 2nd$. Of importance, the NPs do not need to be recessing at velocity V to produce intrinsic redshift. In contrast, Hubble redshift requires the galaxy be recessing $V > 0$. But if the intrinsic redshift in dust is interpreted as Hubble redshift, the Doppler velocities V are highly overstated as the local region is not moving at all. Hence, cosmic dust gives the false impression that different regions of the same galaxy have significantly diverse Hubble velocities, but more importantly suggest dark matter that depends on overstated velocities does not exist.

Theory

1. Background

Fundamentally, cosmic dust is submicron comprising NPs having nanoscale dimensions with physical properties that can only be described by quantum mechanics (QM). In particular, the QM heat capacity of the NP atoms vanishes which differs from their finite heat capacities at the macroscale. Today, Astronomy assumes dust NPs have finite heat capacity allowing the absorption of a galaxy photon or heat to be conserved by an increase in temperature, but this assumption is invalid by QM. Vanishing heat capacity requires any absorption of heat in dust NPs to be conserved by a non–thermal mechanism selected here as simple QED whereby the heat absorbed by a NP is converted into EM radiation standing across the NP dimensions.

2. Heat Capacity of the Atom

By the QM Planck law, the NP heat capacity of constituent atoms depends on the EM confinement wavelength λ as illustrated in Figure 3.

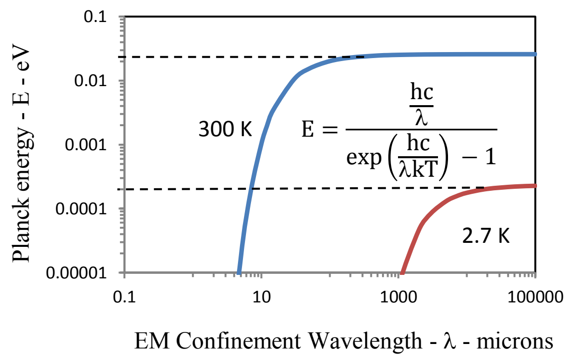

Figure 3 QM Planck law – Thermal Energy of the Atom. In the inset, E is Planck energy, h Planck's constant, k Boltzmann's constant, λ EM confinement wavelength, and T absolute temperature

Classical physics (noted by dotted lines) allows NP atoms irrespective of EM confinement to always have kT heat capacity. QM differs by only allowing kT heat capacity at 300 and 2.7 K for $\lambda > 100$ and 3000 microns, while otherwise requiring kT heat capacity to decrease and vanish at $\lambda < 1$ micron. In the ISM, NPs in the size range < 0.5 microns [5] therefore have vanishing heat capacity thereby precluding conservation of galaxy light by an increase in temperature.

From Figure 3, the NPs require EM confinement at submicron wavelengths to achieve vanishing QM heat capacity. But cosmic dust is not observed to have any surface structure that might be construed as EM confinement suggesting the absorption of galaxy light in submicron dust NPs is itself the source of momentary EM confinement

3. EM Confinement

Indeed, EM confinement of atoms in cosmic dust is a natural consequence of the high S/V ratio of NPs. S/V stands for surface-to-volume. Upon absorption of single ISM photons or galaxy heat , almost all of the photon energy is therefore spontaneously deposited in the NP surface. What this means is the NP atoms are momentarily placed under EM confinement. Since the NPs are submicron, the EM confinement is also submicron and the heat capacity of the NP vanishes. But the NPs in the ISM need not be submicron as the heat capacity of the atom at 2.7 K decreases about 3 orders of magnitude at

$\lambda < 1$ microns, and therefore cosmic dust NPs > 1 micron also have reasonably high S/V ratios making EM confinement still valid. Conservation of the galaxy photon by a single NP or a large number of NPs in a dust cloud heated in a galaxy therefore proceeds by a non–thermal mechanism called simple QED.

4. Simple QED

The QED of light-matter interaction in NPs is usually thought to proceed by the complex relativistic theory advanced by Feynman [6] and others. However, the simple QED proposed to conserve the heat Q from absorbed galaxy light under EM confinement is far simpler and can be readily understood. Briefly stated:

> Under the QM restriction that the heat capacity of the atom under high EM confinement vanishes, simple QED conserves the heat absorbed in a NP surface by spontaneously creating standing EM radiation inside the NP having half wavelength $\lambda/2 = d$, where d is the NP diameter.

The Planck energy E of the standing EM radiation is,

$$E = \frac{h\left(\frac{c}{n}\right)}{\lambda} = \frac{hc}{2nd} \tag{1}$$

where, the velocity of light c is corrected for the slower speed in the solid state by the refractive index n of the NP. Once the EM confinement formed as the ISM light or galaxy heat deposited in the NP surface is depleted in creating the standing EM radiation, the EM confinement vanishes allowing the standing EM radiation to escape the NP and travel to Earth as cosmic dust redshifted galaxy light.

5. Cosmic Dust Redshift

Upon absorption, the EM energy of the single ISM galaxy photon or a number of NPs in a local dust cloud is redshift by simple QED depending on the properties of the NP. Redshift only occurs as the NP absorbs a single ISM galaxy photon because the probability of successive absorptions of ISM photons by the same NP is extremely unlikely. In single photon absorption, only redshift occurs as blueshift with EM energy exceeding that of the galaxy photon is forbidden by the conservation of energy.

In a local dust cloud, the conversion of galaxy heat Q to EM radiation is far more efficient than single ISM photon absorption as each NP acts as a continuous wave laser, each NP emitting a different frequency because of slight differences in diameter d and index n. The cosmic dust redshift z_D of the galaxy photon having wavelength λ and the V/c ratio are,

$$z_D = \frac{(2nd - \lambda)}{\lambda} \text{ and } \frac{V}{c} = \frac{[(Z_V + 1)^2 - 1]}{[(Z_V + 1)^2 + 1]} \tag{2}$$

In the absorption of a single ISM Lyman alpha (Lyα) and hydrogen alpha (Hα) photon, the redshift Z_D and the V/c ratio is shown for the Lyα line in Figure 4.

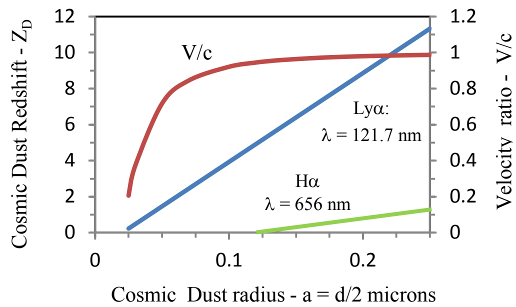

Figure 4. Cosmic Dust Redshift of Single ISM Lyα and Hα photons for NPs of Amorphous Silicate n = 1.5

Discussion

In cosmology, the Hubble law based on redshift gives the radial distance and velocity of an astronomical body along line-of-sight from the Earth, i.e., the velocity increases with distance. However, Hubble's original redshift data in 1929 was limited showing only a mild tendency for velocity to increase with distance. Today, the Sloan Digital Sky Survey containing many galaxies shows peculiar patterns of redshift that show the Hubble law does not apply, e.g., the observation [7] that quasars have far higher redshifts than the galaxy to which they are physically connected. In Figure 5, galaxy 7603 with z = 0.029 shows quasars (Objects 2 and 3) having z = 0.243 and 0.391, respectively.

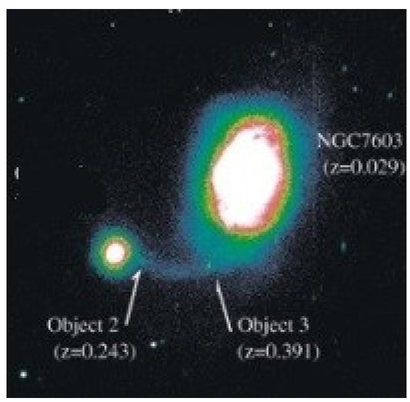

Figure 5. Redshifts of Galaxy NGC7603 and Objects 2 and 3

What this means is the Hubble redshift has nothing to do with the velocity of the quasar suggesting the redshift is intrinsic. But what causes the intrinsic redshift is not known.

In this paper, the intrinsic redshift is proposed to be cosmic dust. Indeed, the error in assuming the cosmic dust redshift is cosmological given by the Hubble law is significant. For Lyα and Hα redshifts, Figure 4 shows the velocity ratio V/c to depend on the absorption and re–emission from dust NPs depending on their radius a = d/2, e.g., for a = 125 nm and n = 1.5, d = 250 nm and 2nd = 750 nm gives the redshift z for Lyα and Hα lines of and 5.16 and 0.143, respectively. For the Lyα and Hα lines, the Hubble velocity V is 0.948 and 0.132 c both of which are significant fractions of the speed of light, but in fact the dust may not be moving at all. Clearly, intrinsic redshift in cosmic dust invalidates the Hubble law while explaining the proximity of significantly discordant redshifts observed in Figure 5.

Extensions
Contrary to Hubble's law, quantization is proposed to explain clustering of redshifts of distant galaxies and quasars in multiples of each other. Since cosmological bodies are unlikely to be physically arranged in a quantized pattern around the Earth, Hubble's law relating distance and velocity cannot be satisfied. Instead, another mechanism is producing the intrinsic redshift that does not depend on Universe expansion. Cosmic dust can produce intrinsic redshift, but requires a distribution of NPs throughout the Universe .

In this regard, galactic clustering of filamentary cosmic dust and voids are observed in large-scale structure models of the Universe . Figure 6 shows filaments in the 2dF Galaxy Redshift Survey.

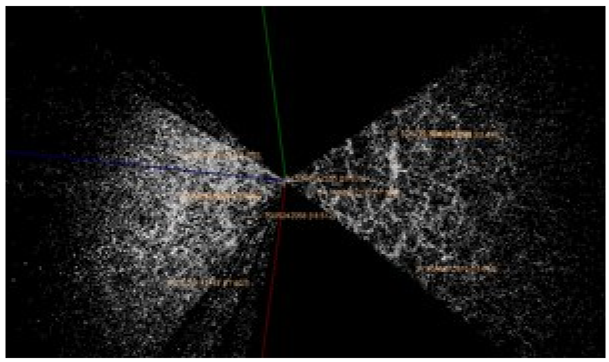

Figure 6. 2dF Galaxy Redshift Survey – Galactic Clustering Filaments

Galactic clustering is described [8] by redshift periodicities (z = 72 km/s and 144 km/s) due to parallel line segments while the largest redshift (z = 0.15) is caused by circumferential circuit. Intermediate periodicities are due to other geometric irregularities. Periodicities are thought to be relics of quantization that occurred in the primordial atom.

In contrast, galactic clustering of redshift by cosmic dust occurs by successive absorption of galaxy light by groups of NPs along the line–of–sight to the quasar, i.e., the redshift of one NP is in turn redshift by the next NP, and so forth. Because the redshift is radial, the proposal was made [3] quasars are ejected from nearby active galaxies and exhibit DIR that decrease smoothly and continuously from quasars to galaxies. DIR stands for decreasing intrinsic redshift. The distance between the galaxy and the quasar is assumed filled with filamentary regions of NPs separated by voids, a typical region containing N_k number of NPs oriented in the direction of the quasar. Each dust NP absorption producing an incremental Δz increase in redshift producing redshift in multiples of each other following Equation (2). Indeed, the redshift decreases from the quasar to the galaxy.

<u>Single ISM Photon</u> In the ISM ,single photon heating occurs because it is unlikely multiple collisions occur with the same NP as illustrated in Figure 2. A single Hα photon having $\lambda = 656$ nm with Hubble velocity $V = 72$ km/s occurs at $z = V/c = 0.00024$ [8] in a NP having diameter $d = 656(z+1)/2n = 218.7$ nm. For NPs having $d > 218.7$ nm ,the redshift z is greater while redshift does not occur for $d < 218.7$ nm. If the redshifted Hα is absorbed successively N_k times by NPs all having $d = 218.7$ nm, the total redshift is $N_k * z$ and Hubble velocity $N_k * V$ as shown in Figure 7. The largest redshift $z = 0.15$ [8] corresponds to $N_k = 625$ successive NP absorptions and re–emissions. However, sequential redshifted Hα photons are not necessary, as the largest redshift may be produced in a single 251.47 nm NP with a single Hα photon.

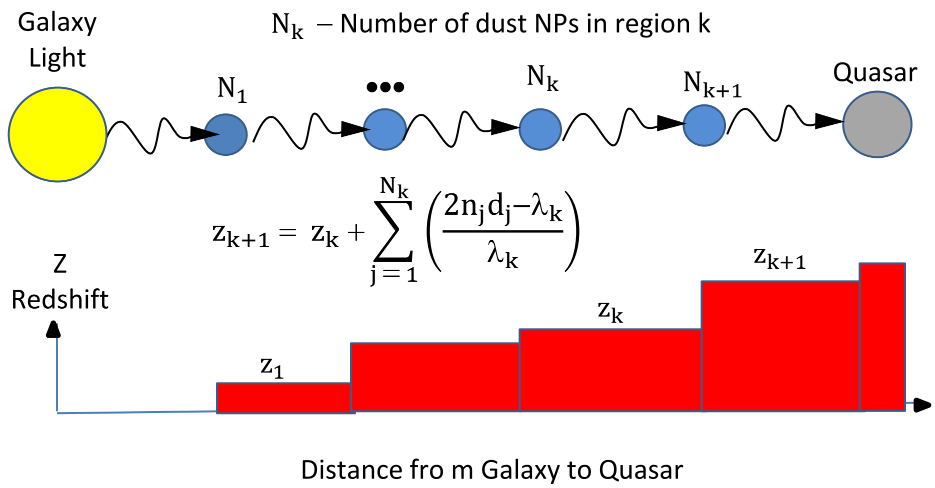

Figure 7. Quantization by Galactic Clustering of Cosmic Dust NPs

Galaxy Heating Under galaxy heat Q, all NPs in the dust cloud produce a continuous broadband emission spectrum under steady galaxy heating as shown in Figure 2. Depending on NP diameters, the cloud emits natural and redshifted Hα and Lyα lines. By simple QED, a Hα photon redshifted to z = 0.00024 is produced if the heat Q is absorbed in NPs of diameter d = 218.7 nm. Unlike single photon absorption, galaxy heating produces many redshifted Hα photons including many unrecognizable lines. Since the Planck energy of the Hα is 1.89 eV, the heat Q produces N_k = Q/1.89 Hα photons , and continues to do so, provided Q = M$*$1.89 eV, where M = 1,2,3,.. Interpreted as a Hubble velocity, V = 72$*$M, but in fact, the NPs need not be moving at all.

Conclusion

The Hubble constant is not a constant, but varies throughout the Universe. Moreover, the Hubble law is not valid because of the intrinsic redshift of cosmic dust. It is noteworthy that quasars do not follow the Hubble law. In fact, Hubble based his law on galaxies, but if he had first studied quasars, he would not have concluded the Universe was expanding. An expanding Universe based on the Hubble law is therefore unlikely suggesting the Universe is static and infinite as Einstein once thought.

References

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