CMBR as Solar illumination of the Oort Cloud modified by Cosmic Dust

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INTRODUCTION

Cosmic Background Radiation (CMBR) evolved from models [1] of the Big Bang by Gamow beginning in 1948. Only later in 1965 did Penzias and Wilson [2] discover the microwave radiation coming from space. Dicke and others came to the conclusion that the Big Bang left behind residual radiation which would still be present in the Universe as black body EM radiation with a temperature of about 10 K. However, Dicke [3] did not believe that the radiation came from a cold source, and instead cold temperatures were produced during the Big Bang in the expansion of the Universe.

However, Universe expansion is not required as cold temperatures are a natural consequence of our Solar System. Beyond the Planetary System, the Oort Cloud [4] at 10,000 AU is naturally cold. In 1950, the Oort Cloud was inferred by studying the orbits of different comets as comets were permanent members of the Solar System and not random bodies. Unlike the disk-like Planetary System in the ecliptic of the Sun, the Oort cloud is spherical. The Oort Cloud in relation to the Planetary System is shown in Figure 1.

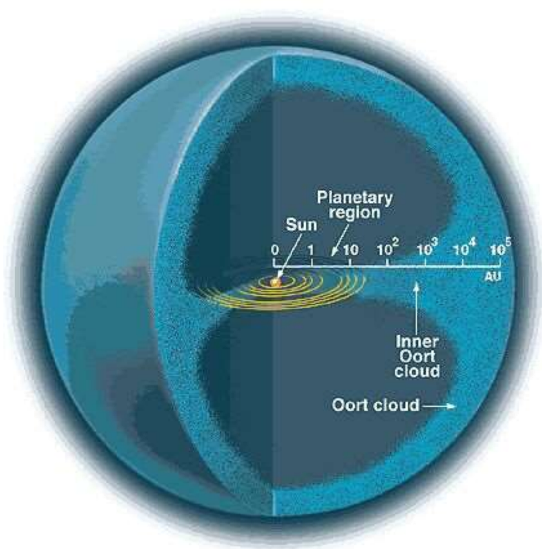

Figure 1. Sun and Planetary System in relation to the Oort Cloud

The equilibrium temperature T of the Oort Cloud may be estimated by assuming blackbody thermal radiation emitted by the Sun at temperature Ts is absorbed without refection by the Oort Cloud.

$$T = Ts\sqrt{\left(\frac{R_S}{2D}\right)}$$

where, Ts = 5800 K and Rs = 693 x 10^6 m. From Figure 1, the distance D is arbitrarily taken as the inner radius of the Oort Cloud, D ~ 10,000 AU. For AU = 150 x 10^9 m, T = 2.79 K. Similarly, the Earth at 1 AU from the Sun gives T = 279 K. The temperature of the CMBR at 2.725 K is close to the 2.79 K estimated from blackbody radiation at D = 10,000 AU as shown in Figure 2.

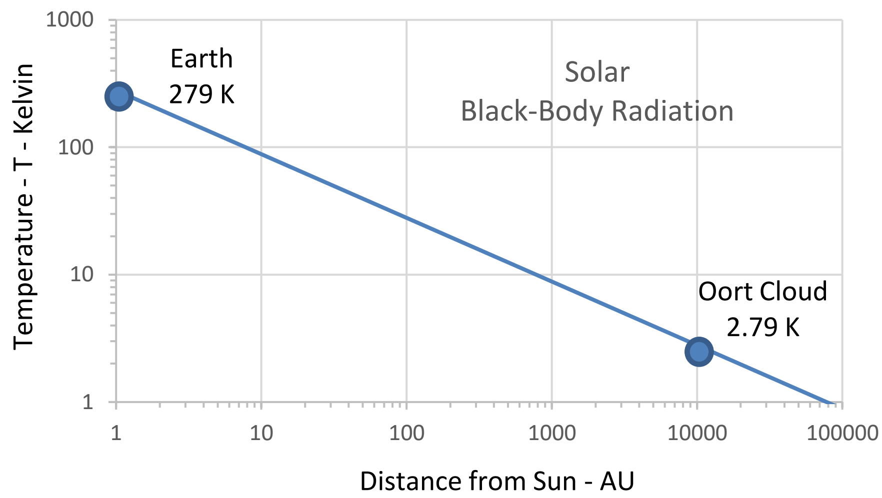

Figure 2. Blackbody approximation to CMBR Temperature

The notion the Solar System alone defines the CMBR radiation is supported by Planck's law,

$$\mathrm{Er} = \frac{h\upsilon^3}{c^2}\frac{1}{e^{\frac{h\upsilon}{kT}} - 1}$$

The peak of Spectral Radiance occurs at $dEr/d\upsilon = 0$. Numerically, $h\upsilon/kT = 2.821$. The CMBR at T =2.725 K corresponds to $\upsilon_{max} \sim 160$ GHz and $\lambda = 1.871$ mm as shown in Figure 3.

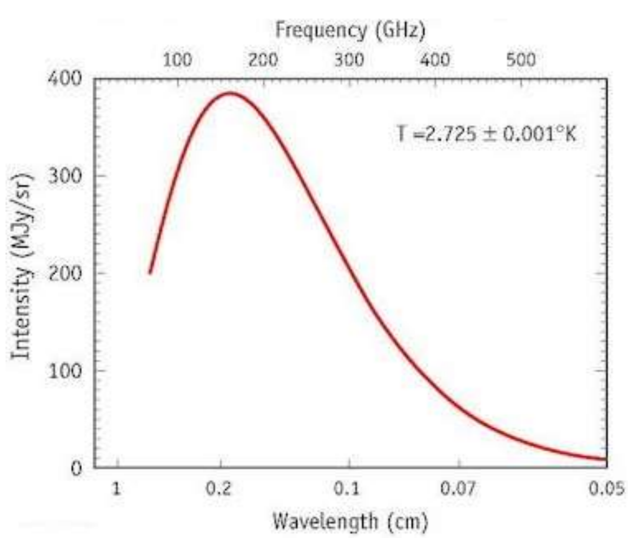

Figure 3. CMBR Spectrum

However, the CMBR is not uniform everywhere in the Universe. The anisotropy is evident as the resolution of the CMBR increases from COBE to WMAP to Planck shown in Figure 4.

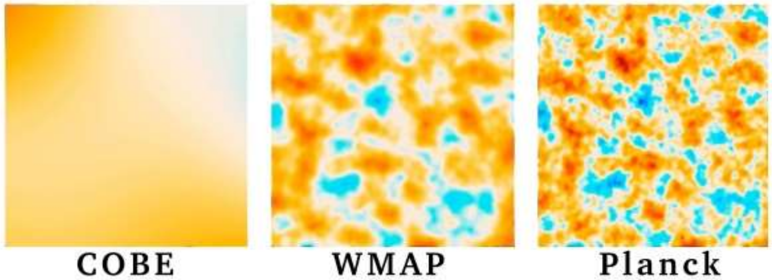

Figure 4. Anisotropy of the CMBR

In this paper, the CMBR anisotropy is given by the Anomalous Microwave Emission (AME) from cosmic dust in our Solar system. In order to do statistical tests on the true CMBR, the AME must be removed. But the effect of dust on EM radiation must be understood before CMBR is cleaned. Especially notable is the intense AME in the Galactic plane [5] shown in Figure 5. Dust rings [6] around Mercury, Venus and Earth also be cleaned as shown in Figure 6.

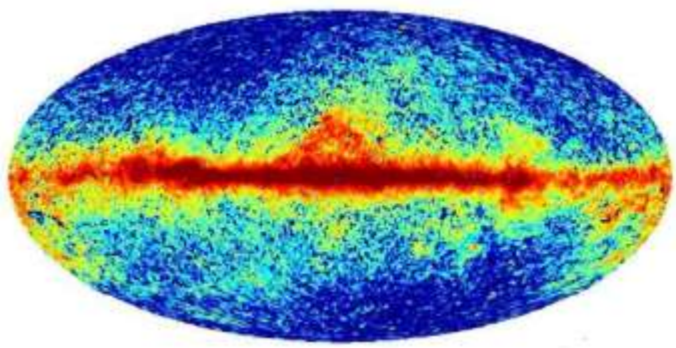

Figure 5. AME from dust in the Solar system

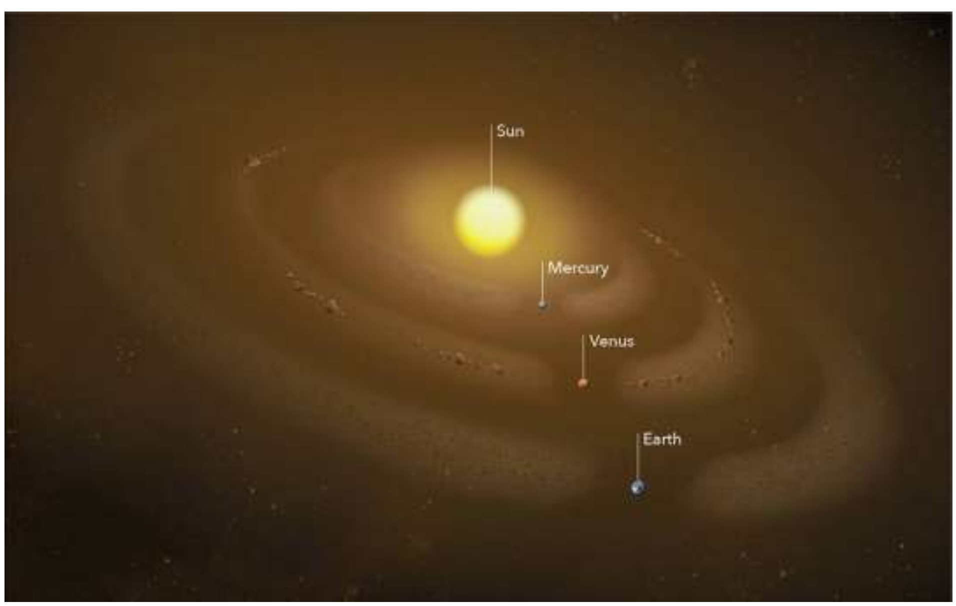

Figure 6. Dust rings around Mercury, Venus and Earth

In cosmology, the Copernican principle states the Earth is not a privileged location in the Universe, i.e., if the Universe appears isotropic in all directions from the Earth, then the Universe is isotropic everywhere. Locally, Figures 4 and 5 show the CMBR is anisotropic to about one part in a thousand, but on a large scale, the anisotropy is significant as shown in Figure 7. Indeed, the large scale anisotropy shows an 'Axis of Evil' suggesting the Copernican Principle is not satisfied, i.e., the quadrupole and octupole axes are almost coincident and aligned with the Galactic plane erroneously making the Earth the center of the Universe!!!

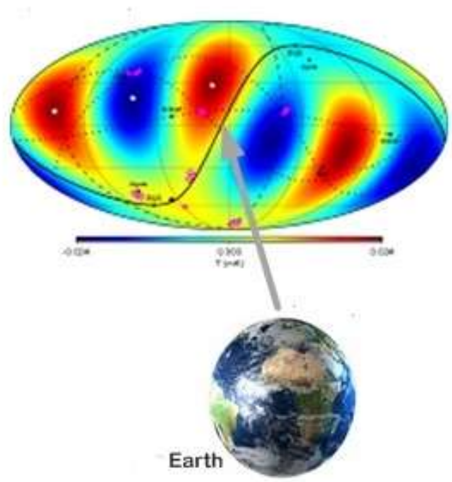

Figure 7. CMBR Quadrupole and Octupole Axes Aligned with Galactic plane

DISCUSSION

Cosmic Dust and Redshift

Light from galaxies beyond the Oort Cloud measured on Earth must pass through the Kuiper Belt and dust rings of the Planetary System. In this paper, the light absorbed in dust redshifts the galaxy light which if inferred by the Doppler effect highly overstates actual galaxy velocities. Indeed, visual observations of galaxy dynamics do not confirm the inferred Doppler velocities unless dark matter exists to slow the high velocities to Newtonian levels.

The difficulty with high galaxy velocities from overstated redshift is not new. Hubble found it difficult to believe the galaxy velocities were real and instead found it easier to suppose that the lines of the spectra are shifted to the red by some property of space acting on the light during its journey to the Earth. Following Hubble's reasoning, the galaxy velocities here are not real and cosmic dust that permeates the Solar System and Universe is the property of space that redshifts spectral lines. Later, Arp proposed the redshifts were intrinsic giving the false impression dark matter is present, when in fact it does not exist, perhaps explaining why the search for dark matter particles to date has not succeeded.

Based on classical physics, astronomers [7] claim the light from distant galaxies upon absorption in cosmic dust simply raises dust temperature and upon re-emission explains the IR spectra in the ISM. But the dust is nanoscopic governed by QM, the Planck law of which shows atoms in nanoparticles (NPs) of cosmic dust cannot conserve galaxy light by an increase in temperature [8] because their heat capacity vanishes. QM stands for quantum mechanics. The Planck law at 2.7 and 300 K is shown in Figure 8.

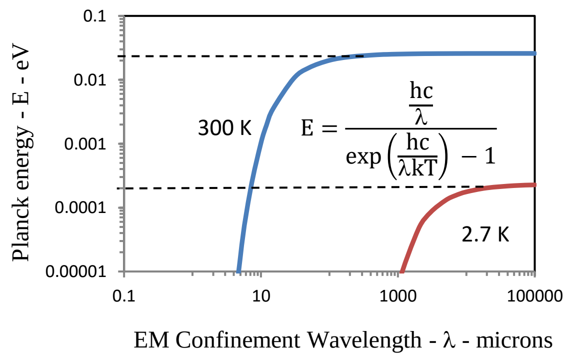

Figure 8: QM Planck law – Thermal Energy of the Atom
In the inset, E is Planck energy, h Planck's constant, k Boltzmann's constant,
λ EM confinement wavelength, and T absolute temperature

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. In the ISM, NPs in the size range < 0.5 microns [8] therefore have vanishing heat capacity thereby precluding conservation of galaxy light by fluctuations in temperature.

However, vanishing QM heat capacity requires the NPs to have high EM confinement at submicron wavelengths. 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. Indeed, no special treatment of surfaces is required as EM confinement is a natural consequence of the high S/V ratio of NPs. S/V stands for surface-to-volume. Upon absorption of galaxy light, 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 $\lambda < 1000$ microns, and therefore cosmic dust NPs > 1 micron also have reasonably high S/V ratios making EM confinement still valid, e.g., Lyman-alpha (Lyα) and Hydrogen-alpha (Hα) photons are redshift to VIS and near IR levels in NPs < 1 micron while far IR photons are produced from NPs > 1 micron. Unlike classical physics thought to create IR spectra from NPs by increased temperature, QM produces VIS to far IR spectra by the nonthermal process [8] of simple QED as shown in Figure 9.

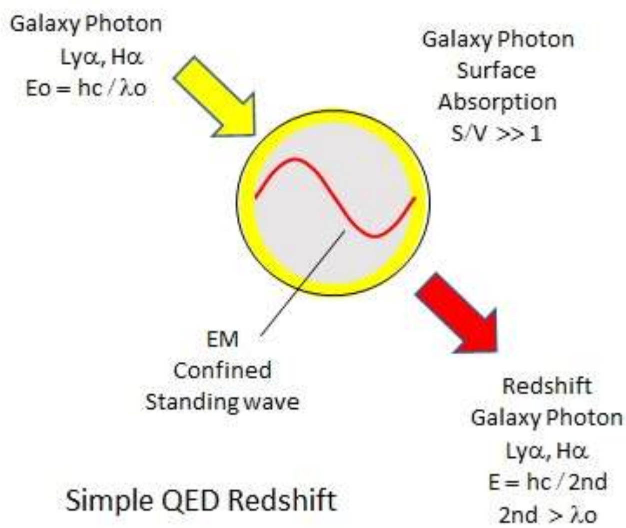

Figure 9. Simple QED induced Cosmic Dust Redshift

Simple QED produces EM radiation in NPs, but has nothing to do with the QED of light-matter interaction by Feynman and others. Simple QED [8] is far simpler and is 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 of galaxy light 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,

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

where, the velocity of light c is corrected for the slower speed in the solid state by the refractive index n of the NP. The standing wave is created under the EM confinement formed from the galaxy light deposited in the NP surface, but once depleted the EM confinement vanishes allowing the standing EM radiation to escape the NP and be observed on Earth as redshifted galaxy light. The cosmic dust redshift Z_D of the galaxy photon having energy Eo and wavelength λo is,

$$Z_D = \frac{2nd - \lambda o}{\lambda o} > 0$$

Unlike reddening where shorter wavelengths are not increased by scattering, cosmic dust redshift Z_D corresponds to a physical increase (2nd-λo) in the wavelength of galaxy light. Therefore, the true galaxy velocity V is computed by correcting the measured redshift Z_{meas} for the redshift Z_D of cosmic dust,

$$\frac{V}{c} = \frac{[(Z_V + 1)^2 - 1]}{[(Z_V + 1)^2 + 1]}$$

where, $Z_V = Z_{meas} - Z_D$.

In Figure 10, the cosmic dust redshift Z_D of Lyα and Hα light is shown for amorphous silicate n = 1.5. The range of NP sizes [9] for radii r = d/2 from 0.025 to 0.25 microns shows simple QED produces cosmic dust redshifts of Lyα and Hα photons at 0.25 microns of 11 and 1.5, respectively. If not corrected for cosmic dust redshift, dust redshift velocities approach the speed of light at d = 2r ~ 0.2 microns.

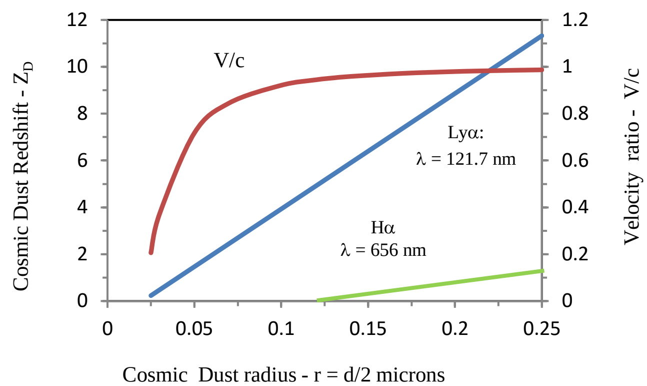

Figure 10. Cosmic Dust Redshift of Lyα and Hα Light

Cosmic Dust and CMB Anisotropy

The Planck satellite surveyed the whole sky polarization [10] over a range of frequencies spanning the radio (30 GHz) to the submillimetre (857 GHz) for CMB anisotropies. Although the AME in BICEP2 measurements at 150 GHz supported the presence of gravitational waves formed in the rapid expansion following the Big Bang, the AME may be more simply produced by cosmic dust in the Solar System. Subsequent extrapolation of 353 GHz Planck satellite data to 160 GHz showed the AME was caused by dust [11] and not remnants of gravitational waves. Only dust is considered in this paper.

Currently, the AME mechanisms [12] by which dust radiates at microwave frequencies are:
1. Vibrational electric dipole emission due to thermal fluctuations in the charge distribution in the grain,
2. Magnetic dipole emission due to thermal fluctuations in the magnetization of grain material, and
3. Rotational electric dipole emission due to the rotating electric dipole moment of a spinning grain.

In the ISM, the power radiated by dust is due to vibrational electric dipole emission, peaking in the far-infrared at 100 microns ~ 300 GHz, the low-frequency tail of which can be extrapolated to microwave frequencies, but falls far below the observed 10-60 GHz AME. However, if grains contain magnetic materials, e. g., magnetite or iron the thermal fluctuations in the magnetization will result in strong magnetic dipole emission.

Classically, the absorbed Lyα photon is dissipated by an increase in temperature, but is forbidden by QM. Hence, the above dust mechanisms depending on thermal fluctuations must be rejected by QM. In large NPs, absorbed Lyα photons may only be conserved by redshift; whereas, small NPs conserve Lyα photon energy by spinning. In this regard, the Lyα photon having Planck energy Eo and wavelength λo is the common galaxy light that is redshifted to VIS and IR levels. Typically, redshift occurs in a NP having simple QED inducedPlanck energy E $<$ Eo. After NP emission of a redshifted galaxy photon, the excess energy (Eo –E) is conserved by removing electrons to create positive charges q+ within the dust because E $>$ ionization potentials as illustrated in Figure 11.

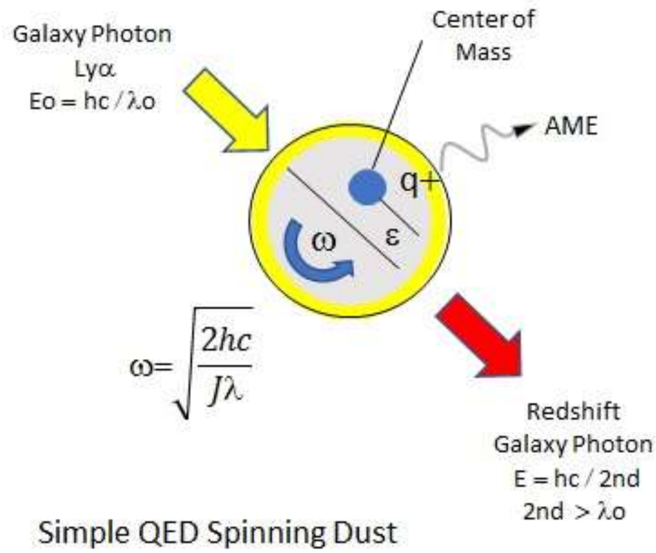

Figure 11. Simple QED Anomolous Microwave Emission

~~Since th~~e collision of the galaxy photon is likely to be offset ε from the center of mass of the dust, the Lyα momentum $p = h/\lambda o$ produces a torque $p \cdot \varepsilon$ that spins the dust at rate ω, the consequence of which is the simple QED induced charge q+ produces microwave AME. Simple QED induced AME conserves the Lyα energy hc /λo with rotational energy ½ J ω^2 of the NP giving the spin rate $\omega = \sqrt{(2 h c / J \lambda o)}$, where, J the NP rotational moment of inertia, $J = 2 m a^2 / 5$ and m the NP mass. For amorphous silica having density 2650 kg / m^3, the spin rate ω over NP radii $0.001 < a < 0.04$ microns corresponds to AME from 0.1 to 860 GHz as shown in Figure 12.

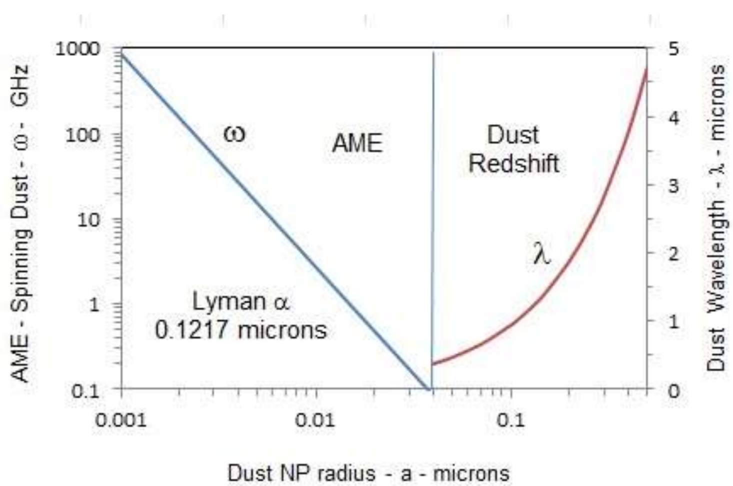

Figure 12. Cosmic Dust and Redshift

For large NPs having $a > 0.04$ microns, the Lyα photon produces redshift the emission wavelength λ from the VIS to the near IR. Smaller NPs having $a < 0.04$ microns produce AME. In Figure 12, the AME is based on $E = 0 \rightarrow (Eo - E) = Eo$ giving the upper bound AME rate.

CONCLUSIONS

The Big Bang and subsequent expansion of the Universe used to explain the 2.725 K black-body temperature of the CMBR never occurred. Instead, the 2.725 K is the consequence of the Sun as a black body heating our Solar System at distance comparable to the inner Oort Cloud boundary. The equilibrium 2.725 K temperature of the Oort boundary depends only on the size and temperature of the Sun and the distance from the Sun to the dust particles forming the Oort Cloud boundary dust particles, provided the particles are macroscopic and not nanoscopic.

Redshift of galaxies beyond the Oort Cloud are highly overstated on Earth by the dust in our Solar System. Although simple QED suggests dust absorption significantly redshifts emission lines from distant galaxies, any precise correction of galaxy velocities is difficult. Regardless, it can unequivocally be stated an expanding Universe based on redshift does not exist with Galaxy dynamics given by Newtonian mechanics.

Simple QED applied to the absorption of Lyα photons in dust NPs < 1 micron provides the basis for assessing CMBR anisotropy. Cosmic dust having radii < 0.04 microns produce the AME while redshift occurs for NPs > 0.04 microns.

Current AME mechanisms that excite NP rotation by IR emission from thermal fluctuations cannot be valid by QM. Similarly, the UIR bands thought formed by increased temperatures of PAH molecules are also not valid.

Simple QED induced AME based on charge created upon absorption of Lyα photons exceeds the ionization potentials of most materials. Cosmic dust need not be magnetic to produce AME.

The AME is caused by dust – not as a relic of gravitational waves in an expanding Universe following the Big Bang. The CMB spectrum is produced by thermal blackbody radiation from the Solar System reaching an equilibrium temperature of 2.725 K at a distance comparable to the inner Oort Cloud boundary.

References

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