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A Model of the Universe without Expansion of Space

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Abstract : A model of the universe without invoking space expansion is proposed to explain the observed redshift-distance relation and the cosmic microwave background radiation (CMB). The main hypothesized feature of the model is that photons traveling in space interact with the CMB photon gas. This interaction causes the photons to gradually lose energy through dissipation and, therefore, experience redshift. The interaction also causes some of the photons to be scattered off their track toward an observer and, therefore, results in beam intensity attenuation. As observed, the CMB exists everywhere in space and its photon density is relatively high (about 410 per cm^3). The small average energy of the CMB photons (about 6.3×10^{-4} eV) can reduce the energies of traveling photons gradually and will not alter their momenta drastically as in, for example, Compton scattering, to totally blur the images of distant objects. An object moving through a thermalized photon gas, such as the CMB, experiences a drag. The cause is that the object sees a blue shifted photon gas along the direction of motion and a redshifted one in the opposite direction. An example of this effect can be the observed CMB dipole: The earth travels at about 368 km/s (600 km/s) relative to the CMB. In the all-sky map from the COBE satellite, radiation in the Earth's direction of motion appears 0.35 mK hotter than the average temperature, 2.725 K, while radiation on the opposite side of the sky is 0.35 mK colder. The pressure of a thermalized photon gas is given by $P\gamma = E\gamma/3 = \alpha T^4/3$, where $E\gamma$ is the energy density of the photon gas and α is the Stefan-Boltzmann constant. The observed CMB dipole, therefore, implies a pressure difference between the two sides of the earth and results in a CMB drag on the earth. By plugging in suitable estimates of quantities involved, such as the cross section of the earth and the temperatures on the two sides, this drag can be estimated to be tiny. But for a photon traveling at the speed of light, 300,000 km/s, the drag can be significant. In the present model, for the dissipation part, it is assumed that a photon traveling from a distant object toward an observer has an effective interaction cross section pushing against the pressure of the CMB photon gas. For the attenuation part, the coefficient of the typical attenuation equation is used as a parameter. The values of these two parameters are determined by fitting the 748 μ vs. z data points compiled from 643 supernova and 105 γ-ray burst observations with z values up to 8.1. The fit is as good as that obtained from the lambda cold dark matter (ΛCDM) model using online cosmological calculators and Planck 2015 results. The model can be used to interpret Hubble's constant, Olbers' paradox, the origin and blackbody nature of the CMB radiation, the broadening of supernova light curves, and the size of the observable universe.

Keywords : CMB as the lowest energy state, model of the universe, origin of CMB in a static universe, photon-CMB photon gas interaction
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