0.1 Average Temperature of CMB

The average temperature of the CMB is a critical aspect of the CMB as a phenomenon in the universe. This, along with the power spectrum characterize the primary features of the CMB, and thus, if the chronometric model is able to reproduce these aspects of the CMB, we can say that the model is, if nothing else, not falsified in light of modern astrophysical data. In order to determine these attributes from first principle, however, it is important to first get the bigger picture of how the CMB is accounted for within this model.

Light in the chronometric cosmos is broadly separated into two categories. The first we call pristine light, and the second we call residual. We call the light that has taken fewer than one half-cycle about the cosmos pristine and the light which has passed the $\rho = \pi$ manifold distance residual. The CMB then is concerned primarily with the residual light in the universe.

Given the relative sparsity of matter in the universe, light of this category would be able to take many circuits about the universe. The infinite time for this high-dispersion radiation to accumulate would directly imply that it is qualitatively distributed in accordance to Planck's law, and thus is in fact a black body spectrum.

[This will initiate the section on Plank law and that general calculation].

It is worth noting before continuing that the origin of this light is unimportant for general considerations. However for a more specific analysis we can easily consider the source of the pristine and residual light in the universe to be the galaxies and other luminous matter in the universe.

To show that the residual light is characteristic of a black body spectrum, we need only point to the stochastic nature of of the emission and motion of galaxies and other luminous material.

[This will end the Planck law calculation and start the extinction calculation].

0.1.1 Methodology

The methodology, then, for determining the average temperature of the black body spectrum in this model will be to utilize the residual light in the cosmos. The residual light will be considered explicitly as the light "left over" after traversing multiple half circuits of the cosmos, and is thus the light which has *not* gone extinct.

With this, we will discover a unique relationship between it and the pristine light in the universe, and further find how, after several cycles, this light creates the black body which can be measured, observed, and used to calculate the average temperature of the CMB.

This analysis will be quite general and is only intended to act as a first order approximation to the average temperature to the CMB. We will consider all galaxies to be *approximately* the same in radius (d), luminosity (L), and have an explicit number count (N). Using these factors we will calculate on average the amounts of pristine and residual light in the universe, and what of that reaches the Earth which will give us qualitative information regarding the CMB in this model. We will then utilize that to determine a range of values for the average temperature of the CMB.

0.1.2 Pristine Light Calculation

To start, we will first attempt to calculate the amount of pristine light in the universe. The pristine light we will take (as is the case for this analysis in general) to be coming from galaxies in the universe.

0.1.3 Residual Light Calculation

We will now attempt to calculate the residual light. In this case, we need only consider the amount of light that arrives at the Earth, as this is the only light which we can factor into the chronometric model's explanation of the CMB. In order to calculate this, then, we can shift the question to be how much light is absorbed by galaxies in the universe en route to the Earth? Essentially, how much of the sky is taken up by galaxies.

We consider the general volume of the $\mathbb{S}^3$ as a function of the manifold distance ρ.

$$V(\rho) = \tag{1}$$