LETTERS TO PROGRESS IN PHYSICS

The Earth Microwave Background (EMB), Atmospheric Scattering and the Generation of Isotropy

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In this work, the presence of substantial microwave power in the atmosphere of the Earth is discussed. It is advanced that this atmospheric microwave power constitutes pools of scattered photons initially produced, at least in substantial part, by the $\sim$3 K microwave background. The existence of these microwave pools of photons can serve to explain how the Earth, as an anisotropic source, is able to produce an Earth Microwave Background (EMB) at $\sim$3 K which is isotropic.

The $\sim$3 K microwave background [1] has always been associated with the primordial universe [2]. Conversely, I have advanced an oceanic origin for this signal [3–7], a scenario supported by Rabounski and Borissova [8–10]. The Earth has an anisotropic surface comprised of water and solid matter. However, the microwave background is isotropic. As a result, if the Earth is the emitter of the $\sim$3 K signal [1], isotropy must be achieved by scattering oceanic photons in the atmosphere.

Initially, I invoked a Compton process in the atmosphere in order to generate isotropy from an anisotropic oceanic source [3]. Yet, given the nature of the scattering required and the energies involved, such a mechanism is not likely. I therefore proposed that Mie scattering should be present [4]. Finally, I discussed both Rayleigh and Mie scattering [6]. Rayleigh scattering should be more important at the lower frequencies, while directional Mie scattering would prevail at the higher frequencies [6].

Currently [2], the microwave background is believed to be continuously striking the Earth from all spatial directions. Under steady state, any photon initially absorbed by the atmosphere must eventually be re-emitted, given elastic interactions. Since the incoming microwave background is isotropic [1, 2], then even scattering effects associated with absoption/emission should not reduce the signal intensity on the ground, because of steady state [6]. Thus, there should be no basis for signal attenuation by the atmosphere, as I previously stated [6]. Nonetheless, current astrophysical models of the atmosphere assume that such attenuations of the microwave background occur [i.e. 11, 12]. These models also appear to neglect atmospheric scattering [i.e. 11, 12].

I have mentioned that scattering processes are a central aspect of the behavior of our atmosphere at microwave frequencies [6]. In addition, since steady state assumptions should hold, any scattering of radiation, should build up some kind of reservoir or pool of scattered photons in the atmosphere. Scattering is known to become more pronounced with increasing frequencies. Consequently, larger photon reservoirs might be seen at the shorter wavelengths.

It is known that the atmosphere interferes with the measurements of the microwave background [11]. However, this interference has been attributed to atmospheric emissions [i.e. 11, 12], not to scattering. Experimental measurements have demonstrated that atmospheric emissions increase substantially with frequency [11, 12]. For instance, emissions attributed to the water continuum tend to increase with the square of the frequency [12]. Atmospheric contributions are so pronounced at the elevated frequencies, that they can contribute in excess of 15 K to the microwave background temperature measurements at wavelengths below 1 cm [see table 4.2 in ref 11]. At a wavelength of 23.2 cm, Penzias and Wilson [1] obtained a 2.3 K contribution to their measurement just from the atmosphere [see table 4.2 in ref 11]. Even at a wavelength of 75 cm, an atmospheric contribution of 1K can be expected [see table 4.2 in ref 11]. Atmospheric modeling used in microwave background studies confirms the increase in interference with frequency and its decrease with altitude [i.e. 11, 12].

A pronounced increase in emission with frequency is expected if scattering is present. As such, it is reasonable to postulate that astrophysics is dealing with scattering in this instance [6], not with simple emission [11, 12]. Microwave background measurements at the elevated frequencies are therefore primarily complicated not by a lack of absolute signal, as I previously believed [6], but rather, by the tremendous interference from the scattered signal reservoirs in the atmosphere. In order to eliminate this effect, we are therefore forced to study the elevated frequencies from mountains top or at higher altitudes using balloons, rockets and satellites [11].

Should the microwave background arise from the universe [2], the atmosphere of the Earth would still generate the same reservoirs of scattered radiation. The atmosphere cannot distinguish whether a photon approaches from space [2] or from the oceanic surface [6]. Thus, establishing the presence of the scattered pool of photons in the atmosphere cannot reconcile, by itself, whether the microwave background originates from the cosmos, or from the oceans. Nonetheless, since a steady state process is involved, if a ∼3 K signal is indeed produced by the oceans, then a ∼3 K signal will be detected, either on Earth [1] or above the atmosphere [13]. The Planckian nature of this signal will remain unaltered precisely because of steady state. This is a key feature of the steady state regimen. Importantly, experimental measures of emission [11, 12] do confirm that substantial microwave power appears to be stored in the scattering reservoirs of the atmosphere. Consequently, a mechanism for creating isotropy from an anisotropic oceanic signal [5] is indeed present for the oceanic ∼3 K Earth Microwave Background.

Dedication: This work is dedicated to my three sons, Jacob, Christophe and Luc.

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