Cosmic Dust, Refraction and Emissivity

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Abstract—Cosmic dust is pervasive within our galaxy and it is reasonable to suspect it is dispersed in various ways throughout the universe. Cosmic dust has emissivity when exposed to electromagnetic energy sources. The emissivity of cosmic dust contributes to cosmic radio noise and concentrations of it alters electromagnetic waves by refraction. Cosmic dust is concentrated in our Sun's heliosphere and the resultant emissivity products in the microwave and infrared should be detectable by land based and satellite radio telescope instruments. It is possible that many of the claimed microwave and infrared measurements of the universe have in part or their entirety mapped the energy patterns of the cosmic dust in the heliosphere rather than energy patterns beyond it.

I. COSMIC DUST

The Background Imaging of Cosmic Extragalactic Polarization (BICEP2) telescope at the South Pole claims to have detected primordial gravity waves, but this has been challenged by data from the Planck satellite.[1][2] At this writing, a newspaper article provides a summary of the issues.[3] The primary challenge to the BICEP2 claim is the presence of what is termed *cosmic dust* and its *emissivity.* Emissivity is further defined as extinction, scattering and absorption. The *absorption* process is where EM energy is absorbed and re-emitted at various frequencies.

The Planck satellite is designed to detect radiation from the *cosmic dust,* which reveals its presence by emitting selected frequencies because of the dust's EM size. The cosmic dust has to be within the influence of an energy source to cause absorption. Cosmic dust comes in many sizes and when it is captured within our Sun's heliosphere the emissivity dynamics change considerably.[4] The Planck satellite radio telescope is relatively small and does not have a sharp focal point in order to accommodate the large detector array that covers a frequency range between 30 and 857 GHz Just how much the cosmic dust in the heliosphere has effected all of the devices that take measurements from inside the heliosphere are brought into question by ref.(4).

Concentrations of cosmic dust can cause the refraction of electromagnetic (EM) waves. Dust detectors have been on many satellites and a range of characteristics have been identified. A good source for a description of cosmic dust characteristics is from a Russian academic site.[5]

Astronomers distinguish *cosmic dust* by its astronomical location which are interplanetary dust, comet dust, circumplanetary dust and interstellar dust. Heliosphere dust should have been added to that list as it is well outside of circumplanetary dust and its concentrations in the heliosphere become distinctly different from general interstellar dust. The various broadband energy emissions from the Sun would be the primary energy source that would cause EM emissions from various sized dust particles in the heliosphere.

Ref.(4) states that small grains less than or about 0.01 μm are completely excluded from the inner heliosphere and larger dust grains, greater than or about 1.0 μm, pass into the inner solar system and are concentrated near the Sun. Ref. (4) also stated that there are neutral hydrogen and helium atoms amongst the dust in the heliosphere, but it is hard to envision they would remain neutral very long in the particle rich environment of the heliosphere.

The dust and particles captured by the Earth's gravity are influenced by the Earth's magnetic field and energy sources from the Sun. Regions where these energetic particles are concentrated are referred to as the Van Allen Belts (VAB). One might suspect that the energy levels of particles in the heliosphere would be much higher than those in the VAB. It is estimated that the earth's gravity attracts and brings to the surface several tons of interplanetary dust and larger chunks every day.

II. DISPERSION MEASURE

Dispersion measure (DM) is used by astronomers to describe a viewing column that contains free electrons from earth to some distant object. The numeric values being applied to the DM implies there is a consistent average value regardless of viewing direction. Astronomers use the DM value to determine the distance to pulsars. I have been unable to determine how astronomers know that the whole of a viewing column, regardless of the direction or distance, contains just electrons. If the viewing column contains dust along with electrons, the DM would change

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with the viewing column composition. If the composition of the viewing column is not known, other methods would have to be used to estimate distance to a radio frequency emitting object.

Any viewing column that contains a cluster of galaxies could have a collective DM that would act like a giant magnifying lens in space, and objects behind the lens could be seen magnified through the lens. A viewing area of space that has an average index of refraction greater than one will result in the familiar dispersion of EM waves that is seen through a prism; this effect is greater at lower EM frequencies.

The initial report on Fast Radio Bursts (FRB) claimed they were from beyond our galaxy, but later reports contest this claim.[6] The FRB radio wave DM characteristics are similar to that seen within our galaxy distances, otherwise the dispersion would have been much greater if beyond the galaxy.

The conclusion of ref.(4) contains the following: "Grains in the size range near 0.2 μm are diverted into dust plumes along the flanks of the heliosphere inside of the termination shock, with the plumes located in the polar regions for the defocusing polarity model and in the ecliptic region for the focusing polarity model. In the true time-variable heliosphere, these dust grains will sample both polarities of the SWMF (solar wind magnetic field) and the different magnetic morphologies and solar wind conditions that will exist over the course of the solar cycle. We speculate that this may lead to these dust density enhancements being smeared into some shape in between these extremes, perhaps an asymmetric dust shell inside of the termination shock but somewhat upstream of the Sun. *Such a feature has the potential to create an unaccounted for contribution to the infrared and microwave sky background. This possibility requires further investigation.*" I added italics to the last two sentences to emphasize their significance.

There is a need to bring one more factor into the discussion, the time variability of radio active sources.[7] When the seasonal and solar flare variations of the decay rate were announced, there was a flood of speculation, with most blaming neutrinos for the variation. There could be a much simpler explanation, the permittivity/permeability varies. Permittivity and permeability are a function of mass types and the magnetic field and EM activity of the Sun influences everything in the solar system, and variations in its permeability and permittivity could be one of the Sun's variables. To prove or disapprove this will require long term measurements of permittivity and permeability, and it should be done at a minimum of two facilities that are widely separated.

III. CONCLUSIONS

The Planck satellite radio telescope is relatively small and cannot have a sharp focal point in order to accommodate the area of the detector array that covers a frequency range between 30 and 857 GHz There are inconsistencies between the Planck satellite results and previous cosmic microwave background (CMB) and other astrophysical studies, such as NASA's Wilkinson Microwave Anisotropy Probe (WMAP).[9] Just how much the cosmic dust in the heliosphere has effected all of the devices that take measurements from inside the heliosphere is brought into question by ref.(4). Satellites will have to be launched that pass beyond the heliosphere to measure the difference between what is detected inside the heliosphere to compare with what is detected outside of the heliosphere.

The trapping of neutral hydrogen atoms in the heliosphere, which exposes them to the same energy transfer processes that cause emissivity by other particles, brings into question some of the conclusions related to the 1951 detection of the 21cm line.[10] The question can be asked, "Did Ewen and Purcell at Harvard detect the 21 cm radiation coming from space beyond the heliosphere or was it from neutral hydrogen atoms being stimulated or altered within the heliosphere? Particle energy levels within the heliosphere could be somewhat larger in comparison to the particle energy levels within the VAB.

A statement attributable to the Planck scientists brings into question whether they had read the history of scientific discovery. "In other words, it will be impossible to ever take better images of this radiation than those obtained from Planck."[10] It is readily determinable that scientists of earlier eras based their conclusions upon incomplete information. Making the above quote without knowing or even considering the emissivity of cosmic dust particles in the heliosphere would be considered making a conclusion based upon incomplete information. History has shown that subsequent measurements using improved measurement instruments and measurement techniques have altered previous scientific conclusions. Even the numeric value of the Planck constant is being adjusted because of new and improved measurement processes.[11]

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