Determination of Atmospheric Composition of Circumbinary Planets in the Habitable Zone using Lightning Transmission Spectrum

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Abstract: The study of extrasolar planets (exoplanets) has witnessed an extensive growth in research and the method of detection of their compositions has evolved with it. Circumbinary planets-exoplanets revolving about binary stars are particularly a new find since the last few decades. The atmospheric composition of an exoplanet can reveal a lot about the planetary properties beyond mass, radius and orbit as they hold key to a variety of phenomenon from intense infrared radiation to super-sonic winds and electric currents [1].
Lightning (a transient, strong source of *electromagnetic radiation*) can be used to determine the atmospheric composition of exoplanets in the habitable zone around their stars. This has been studied by examining the radiation from *Gamma and X-ray to Radio, VLF, ELF and Schumann resonances* [2] and the more prominent *RF spectra, Acoustic signatures* obtained from Lightning Transmission Spectrum [3-4]. In this paper, I will present the data obtained by Lightning Transmission Spectrum of the planets in the Solar system and their simulation results [5] and how data from both the spectrum is consistent with the Composition data by Juno [6-7], Venus Express [8], Mars Express [9], Pioneer Venus Orbiter, Cassini [10-11].

Thus, I establish a study that similar detection and simulation of lightning flashes in the atmospheres of Circumbinary planets can give us robust results. The future projects like JWST, HabEx Study Team and LUVOIR [12] are considering large apertures to achieve extremely high contrast imaging of spectrum from such exoplanets which will help us realize the foresaid study. Exoplanetary lightning research can therefore, with time, not only help determine cloud-forming chemical constituents but also submit information on structure and composition of the atmospheres and also the dynamics of the layers in those atmospheres.

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