



Coronal Plasma Turbulence characteristics and flow speeds using Radio sounding experiment by Akatsuki spacecraft

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The inner corona is the region where solar wind primarily gets energized and gains the momentum to travel in the interplanetary medium pervading the entire heliosphere. The complex interplay of the magnetic field, high temperatures, and turbulence controls the dynamics in this low beta plasma region, rendering the in-situ measurements quite challenging. In this context, the coronal radio sounding technique becomes useful in providing information in parts of the near Sun coronal medium where solar wind generates and accelerates.

In this work, we have studied the turbulence characteristics and estimates of the plasma flow speeds in the inner corona region (heliocentric distances: 5 to 13 solar radii) by utilizing various methodologies on the data acquired from the Coronal radio sounding experiments conducted by the Akatsuki spacecraft (also known as Venus Climate Orbiter), during the 2021 Venus-solar conjunction event. The radio signals were recorded simultaneously at the two ground stations, namely (a) IDSN, Bangalore, and (b) UDSC, Japan. The single station data is analyzed to study the plasma turbulence characteristics and electron density fluctuations based on the isotropic quasi-static turbulence model [1]. VLBI (Very Long Baseline Interferometry) technique is also used to estimate the flow speeds in this region using the differential Doppler residuals and cross-correlation parameters of the radio signals received at the two-ground stations [2]. These results are compared with estimates provided in previous studies and reported from coronagraph observations. An interesting result is an acceleration in the plasma flow speeds (from 230 km/s to 600 km/s) with increasing helio-centric distances at higher helio-latitudes during an event of the extended coronal hole. The turbulence spectrum characteristics of coronal features and their relation with the source region of solar wind will be discussed.

1.D.B. Wexler, J.V. Hollweg, A.I. Efimov, L.A. Lukanina, A.J. Coster, J. Vierinen, and E. A. Jensen, "Spacecraft Radio Frequency Fluctuations in the Solar Corona: A *MESSENGER-HELIOS* Composite Study", *The Astrophysical Journal*, **871**, 202, January 2019, doi: 10.3847/1538-4357/aaf6a8

2.Ma, Molly & Calvés, et. al., "VLBI Data Processing on Coronal Radio-sounding Experiments of Mars Express." *The Astronomical Journal*, 162,141, October 2021, doi: 10.3847/1538-3881/ac0dc1.