4th Asia-Pacific Conference on Plasma Physics, 26-31Oct, 2020, Remote e-conference

Wave Composition, Propagation, and Polarization of MHD Turbulence Within 0.3AU as Observed by PSP

Turbulence, a ubiquitous phenomenon in interplanetary space, is crucial for the energy conversion of space plasma at multiple scales. This work focuses on the propagation, polarization and wave composition properties of the solar wind turbulence within 0.3AU, and its variation with heliocentric distances at MHD scales (from 10s to 1000s in the spacecraft frame). For the propagation, we find that: (1) At 0.166AU<R<0.23AU, the propagation angles (relative to the local background magnetic field) cluster around 160° at periods larger than 30s and concentrate around 90° at 10s, with double peak distributions around these two angles during the transition. (2) At R>0.23AU, the propagation angles are mainly distributed between 90° and 180° at periods larger than 30s, while they are concentrated around 90° at periods shorter than 30s. Based on our wave composition diagnosis, we find that: the outward/anti-sunward Alfvén mode dominates over the whole range of scales and distances, the spectral energy density fraction of the inward/sunward fast mode decreases with distance, and the fractional energy densities of the inward and outward slow mode increase with distance. The outward fast mode and inward Alfvén mode represent minority populations throughout the explored range of distances and scales. On average, the degree of anisotropy of the magnetic fluctuations defined with respect to the minimum variation direction decreases with increasing scale, with no trend in distance at all scales. Our results provide comprehensive insight into the nature of the MHD fluctuations of the solar wind within 0.3AU, which helps to understand the transport of MHD turbulence in the inner heliosphere.