



Statistical Study of ICW Events and Associated Ion Velocity Distributions in the Inner Heliosphere

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Ion cyclotron waves (ICWs) frequently occur in the solar wind and are detected by PSP within 0.3 AU (Bowen et al. 2020), by MESSENGER from 0.3 AU to 0.7 AU (Jian et al. 2010, Boardsen et al. 2015) and by STEREO at 1 AU (Jian et al. 2009; He et al. 2011). However, the relation between the wave properties and the kinetic features of different ion components (proton core, proton beam and helium) are not widely discussed in the existing literature. We statistically analyze the polarization and propagation properties of hundreds of ICW events using measurements from the Solar Orbiter spacecraft. We find three types of ICW events in terms of their occurrence and duration: clustering ICW events with long durations; sporadic ICW events immersed in a quiet background magnetic field; and ICW events alongside discontinuities. We perform an investigation of the ion velocity distribution functions (VDFs) and draw comparisons of the kinetic behavior of each ion component during intervals with and without ICWs. The plasma parameters of the different ion components are acquired by our newly developed fitting program.