Interaction of ULF waves with different ion species: Pitch angle and phase space density implications

*J. Ren[1], Q. G. Zong[2], Y. Miyoshi[3], X. Z. Zhou[4], Y. F. Wang[5], R. Rankin[6]
[1] Magnetosphere, Nagoya Univ.

ULF waves can accelerate/decelerate the charged particles including the ring current ions via drift-bounce resonance, which play an important role in the dynamics of ring current during storm times. This study compares the different behaviors of oxygen ions (10.5-35.1 keV) and protons (0.3-12.3 keV) which simultaneously interact with Pc5 ULF waves observed by Cluster on 3 June 2003. The ULF waves are identified as the fundamental mode oscillations. Both oxygen ions and protons show periodic energy dispersion and pitch angle dispersion signatures, which satisfy the drift-bounce resonance condition of N=2. The different behaviors of oxygen ions and protons include (1) the resonant energy of oxygen ions is higher than that of protons due to mass difference; (2) the phase space density (PSD) of oxygen ions show relative variations (3.6–6.3) that are much larger than that of protons (<0.4), which indicates a more efficient energy exchange between oxygen ions and ULF waves; (3) the PSD spectra show that oxygen ions are

accelerated, while protons are decelerated, which depend on the radial gradient of their PSD; (4) the pitch angle distributions (PADs) of the oxygen ions and protons show negative slope and bidirectional field-aligned features, respectively, which is related to the preexisting state of ion PADs before the interaction with the ULF waves. In addition, the resonant ions with peak fluxes tracing back to the magnetic equator are always collocated with the accelerating (westward) electric field, which indicate that the ions are mainly accelerated near the magnetic equator and the electric field intensity of ULF waves peaks there.