R006-30
A 会場 ：9/27　AM1 （9:00-10:30）
9:15〜9:30

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Characteristics of energetic ions contributing to the storm-time ring current: Long-term observations by Arase/MEP-i

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This study investigates plasma transport and energization in the inner magnetosphere and the near-Earth magnetotail. It is well known that the inner magnetosphere is composed of plasma with a wide range of energies, from eV to MeV. The plasma pressure is contributed mostly from ions with energies of ~1 to a few hundreds of keV. The energetic ions are primarily transported from the near-Earth plasma sheet and energized during the transport. The spatial distribution of the energetic ions and its temporal evolution determines the variations of the plasma pressure in the inner magnetosphere and in turn the buildup and decay of the ring current.

The distribution function of the energetic ions in velocity space is a key to fully understanding the storm-time energetic ion dynamics. This study thus examines the temporal and spatial variations of phase space densities of energetic ions for different values of the first adiabatic invariant (mu). We identify the mu values that make the most significant contribution to the total plasma pressure. We then focus on the dependence of the contributing mu values on the radial distances and ion species. We primarily use data from the MEP-i (Medium-Energy Particle experiments - ion mass analyzer) on board the Arase spacecraft. MEP-i measures ions with energies of ~10 to 180 keV/q and distinguishes between different ion species. The mu values covered by MEP-i depends mostly on the radial distance because the magnetic field strength on the Arase trajectories changes predominantly with the radial distance. We confirm that the MEP-i energy range can cover typical contributing mu values, 0.05 to 0.5 keV/nT, in a wide range of the radial distances.

We conduct a statistical study for 37 magnetic storms observed by the Arase spacecraft in 2007 to present: 10 intense storms with the minimum Dst (Dst_min) smaller than -70 nT and 27 moderate storms with Dst_min between -70 and -50 nT. We perform the energy spectral analysis for different ion species to identify the contributing mu values, for each of three different storm phases: the main phase, around storm maximum, and early recovery phase. The MEP-i observations show that the plasma pressure is maximized at L of 3 to 4; the maximum pressure is predominantly contributed from ions with mu values of 0.1 keV/nT or slightly lower on average. The results suggest that lower-energy ions of hot plasma sheet populations (typically 1-10 keV) make the important contribution to the core part of the storm-time ring current. At higher L shells, L>4, the contributing mu values are 0.1 keVnT or higher, up to 0.3 keV/nT, and more importantly, different between ion species. It is higher for heavier ions such as O+ than H+. The results suggest that heavier ions are energized more preferentially in the near-Earth magnetotail and that mass-dependent energization processes contribute to the plasma pressure in the outer part of the ring current.