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Molecular and metalic ions in the magnetosphere: ISSI team preliminary results

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Molecular and metallic ions are vastly unexplored in near-Earth space because only a few terrestrial missions have been equipped with dedicated instrumentation to separate these molecular and metallic ions, within only a limited energy range (cold ions of < 50 eV and energetic ions of ~100 keV). Nevertheless, existing data from past and on-going missions including those not designed for the required mass separation are capable of detecting many of these ions with available tools, although severe limitations exist (sensitivity and energy range in addition to mass resolution and mass range). By combining these patchy and incomplete data, we found several features that indicate sources of these heavy ions.
(1) Combination of Kaguya and Cluster/RAPID during high flux events of solar wind heavy ions suggests that the Moon can be a substantial source for low charge-state metallic ions in the magnetosphere when the Moon is located upstream of the Earth. This interpretation is consistent with Geotail/STICS statistics of increased flux of low charge-state heavy ions near new-Moon for medium activity (Kp=2-4).
(2) The major route of molecular ion supply (<10 keV) to the inner magnetosphere can be via low-latitude (< 60° invariant latitude, according to e-POP/IRMS) in addition to the cusp (according to Cluster/CIS and Akebono/SMS) during high outflow flux period. This indicates extraordinary upward convection (or ion flow) at the sub-auroral region.
(3) A case study of lidar data during high flux events of solar wind heavy ions suggests that upward

expansion of Na signal can be associated with molecular ion escape to the magnetosphere that is also observed by Cluster/RAPID and e-POP/IRM, although this expansion can be related to a major magnetic storm rather than solar wind event.