



## **Inner Source and Interstellar Pickup Ions observed by MMS-HPCA**

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Pickup Ions in the solar system are either of interstellar origin, or come from an inner source whose existence is confirmed, but which has not been directly observed. The Hot Plasma Composition Analyzer of the Magnetospheric Multiscale mission (MMS-HPCA) measures the energy and directional flux of ions with  $M/Q$  from 1 eV/e to 40 keV/e and is used to measure the composition and dynamics of reconnection plasmas near the earth. During the first phase of the mission, from 1 September 2015 to 8 March 2016, the spacecraft at 12 Earth Radii apogee swept through the dayside from 1800 to 0600 local time. Although the apogee was designed to maximize encounters with the magnetopause, there were many instances when the spacecraft crossed the bow shock and sampled the solar wind. In November and December, while the spacecraft were downstream of the interstellar neutral focusing cone, HPCA detected pickup ions, such as He<sup>+</sup>, O<sup>+</sup>, and Ne<sup>+</sup>. He<sup>+</sup> was distributed in an energy range of 14 eV - 20.6 keV, peaking at 757 eV; presumably of interstellar origin. O<sup>+</sup> was observed in the energy range of 390 eV - 10.6 keV, and also seems to come from the interstellar medium. Ne<sup>+</sup> was observed to be tightly distributed around a center energy of 5.5 keV, which implies an inner source origin. The mass – energy – angle analysis of these pickup ion distributions is presented, and their interpretation in terms of interstellar and inner source ions is discussed.