



Hot He⁺ events in the inner magnetosphere observed by Cluster

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Singe-charged helium ion (He⁺) is a good marker of plasmaspheric ions in the magnetosphere because the direct ion supply from the ionosphere or outer magnetosphere normally have much lower He⁺/O⁺ ratio than ions in the plasmasphere. Since the plasmaspheric ions are very cold (less than 10 eV), the location and energy of magnetospheric He⁺ can be and have been used in understanding the transport and energization of the plasmaspheric ions in the inner magnetosphere.

These He⁺ are normally observed simultaneously with protons (H⁺) because the plasmasphere normally contains more H⁺ than He⁺, because the ion drift velocity is the same for different species if the energy is the same, and because the ion acceleration by the potential electric field or wave activity is not very active in the inner magnetosphere as compared to the boundary regions or auroral region. Therefore, the inner magnetospheric processes are not expected to filter He⁺ from H⁺ very much.

However, the Cluster Ion Spectrometry (CIS) COnposition DIstribution Function (CODIF) instrument occasionally observed hot He⁺ (peak differential energy flux at 50-500 eV) without the same types of hot H⁺ signature at the same energy in the inner magnetosphere inside 65° invariant latitude ($L < 6$). During the 2001-2006, we found nearly 20 examples in spacecraft 4 that has largest dataset among all spacecraft. We morphologically classified these hot He⁺ events and examined them against the geomagnetic activity. We present these observations.