Mass dependence of ion temperature spatial distributions in the magnetosphere

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Heating and acceleration of magnetospheric plasma have been studied using in-situ plasma and field observations. There are a large number of observation reports that cold and hot plasma coexist in the Earth’ s magnetosphere. However, the dominant heating/acceleration mechanisms and regions are not well understood. Moreover, it remains unclear whether the heating/acceleration mechanisms depend on mass. It can help the more understanding of the heating/acceleration mechanism to investigate the hot and cold plasma in the Earth’ s magnetosphere. However, only a few satellite missions have been able to observe the thermal component of magnetospheric plasma with mass determination. Therefore, a small number of studies focused on mass-dependent processes in the typical energy range (<1-10 keV) of magnetospheric ions. In this study, we first separated the plasma into hot and cold populations, and then perform statistical analysis for each population. We also perform similar analysis for different ion species such as O+ and He+.The Fast Plasma Investigation (FPI) instrument on board the MMS satellite, which is in a low-inclination elliptical orbit with an apogee of about 12 Re and a perigee of about 1000km, measures the three-dimensional distribution function in velocity space in a few eV to 40 keV energy range. Using data for the period of September 2015 to September 2016, we examined density and temperature spatial distributions for hot and cold component plasma. Specifically, we separated the plasma into hot component plasma and cold component plasma by performing two-Maxwellian fitting to the observed three-dimensional distribution functions. Next, we divided an equatorial plane into 0.5 Re × 0.5 Re bins and then calculated the median of density and temperature for each bin. We will perform similar analysis with the data obtained by the HPCA instrument on board MMS to investigate mass dependence of the heating/acceleration mechanism.

Keywords: Heating and acceleration of magnetospheric plasma , MMS satellite, Temperature spatial distribution

