Flow speed dependence of ion temperature, electron temperature, and their ratio in the near-Earth magnetotail reconnection region

*Kaori Watanabe[1], Masahiro Hoshino[1], Kunihiro Keika[1], Yoshifumi Saito[2], Naritoshi Kitamura[1]

1. Univ. of Tokyo, 2. ISAS/JAXA

Plasma in the Earth's magnetotail are heated up to 1-10 keV and stored in the plasma sheet. One of the heating or acceleration mechanisms is the magnetic reconnection. Heated or accelerated plasma are transported both earthward and tailward as fast flow with a speed of several hundred kilometers per second. However, what determines the partition among ion and electron thermal energy and kinetic energy is an unresolved problem. It has been reported that ion temperature T_i, electron temperature T_e, and their ratio T_i/T_e vary spatially and depend on the conditions of fast flows [Wang et al., 2012, Runov et al., 2018] but there are few studies which focus on macroscopic profiles of them in reconnection regions in the magnetotail.

In this study, we examine the relation between flow speed and average profiles of T_i, T_e, and T_i/T_e in the magnetotail reconnection region by using data obtained from FPI and FGM on board the MMS spacecraft. We use the observations for a period from May to August 2017 and take out the data in the region of $X_{GSM} < -15$ Re, -10 Re $< Y_{GSM} < 10$ Re, and beta > 0.1. We then divide them into different groups according to flow speed normalized by alfven speed and show B_z/B_{lobe}– B_x/B_{lobe} maps of T_i, T_e, and T_i/T_e of each group. The results show that ion temperature increase with increasing flow speed while electron temperature decrease. Ion temperature are hotter around the X-point. The structure of inflow and outflow regions is pronounced in the profile of electron temperature. T_i/T_e in inflow region are greater than in outflow region, which means that ion and electron temperatures become comparable by passing through the diffusion region. The results suggest that electron get less energy when more energy is partitioned into plasma kinetic energy. We will discuss about the profiles of anisotropy of plasma temperatures to know more details about the heating mechanisms.

Keywords: temperature ratio, flow, MMS

