MMS/Cluster joint measurements at the vicinity of the plasma sheet boundary layer

Olivier Le Contel1, Alessandro Retino1, Alexandra Alexandrova1, Thomas Chust1, Konrad Steinvall2, Soboh Alqeeq1, Patrick Canu1, Dominique Fontaine1, iannis Dandouras3, Christopher Carr4, Sergio Toledo5, Andrew Fazakerley6, Natasha Doss6, Stefan Kiehas7, Rumi Nakamura7, Yuri Khotyaintsev8, Frederick Wilder9, Narges Ahmadi9, Daniel Gershman10, Robert Strangeway11, and the Cluster/MMS team*

1LPP (UMR7648)/CNRS, Paris, France (olivier.lecontel@lpp.polytechnique.fr)
2Swedish Institute of Space Physics, Uppsala, Sweden
3Institut de Recherche en Astrophysique et Planétologie, Toulouse, France
4Space Magnetometer Laboratory, Imperial College, London, UK
5Departamento Electromagnetismo and Electronic, Universidad de Murcia, Murcia
6Mullard Space Science Laboratory, University College London, Dorking, UK
7Space Research Institute, Austrian Academy of Sciences, Graz, Austria
8Laboratory of Atmospheric and Space Physics, Colorado, USA
9NASA Goddard Space Flight Center, Greenbelt, MD, USA
10Institute of Geophysics and Planetary Physics, Los Angeles, USA
11Space Science Center and Department of Physics, University of New Hampshire, Durham, New Hampshire, US

*Full list of authors appears at the end of the abstract

On 28th of August 2018 at 5:30 UT, MMS and Cluster were located in the magnetotail at about 16 earth radii (RE). They both suddenly crossed plasma interfaces. Located in the post midnight sector, Cluster transitioned from a cold plasma sheet to a hot plasma sheet whereas MMS, located at 4 RE duskward of Cluster, transitioned from a similar cold plasma sheet to the lobe region via a very short period in a hot plasma sheet. At 05:50 UT MMS returned to a hot plasma sheet and detected a quasi-parallel earthward flow ~ 400 km/s and increased energetic ion and electron fluxes. We use measurements from both missions during this conjunction to describe the possible macroscale evolution of the magnetotail as well as some associated kinetic processes. In particular, we analyze fast and slow non linear electrostatic waves propagating tailward which are detected in the so called electron boundary layer as well as in the hot plasma sheet. We discuss their possible generation mechanisms and link with the large scale evolution of the magnetotail. Finally, we investigate possible effects related to the dawn-dusk asymmetry of the magnetotail.
