38th COSPAR Scientific Assembly 2010

Space Plasmas in the Solar System, including Planetary Magnetospheres (D)
Multiscale Magnetospheric Processes: Theory, Simulations and Multipoint Observations (D31)

IN-SITU OBSERVATIONS OF MAGNETIC RECONNECTION IN THIN CURRENT SHEETS

Alessandro Retinò, alessandro.retino@oeaw.ac.at
Space Research Institute, Austrian Academy of Sciences, Graz, Austria
Rumi Nakamura, rumi.nakamura@oeaw.ac.at
IWF, Graz, Austria
Andris Vaivads, andris.vaivads@gmail.com
Swedish Institute of Space Physics, Uppsala, Sweden
David Sundkvist, sundkvist@ssl.berkeley.edu
SSL, University of California Berkeley, Berkeley, California, United States
Kentaro Tanaka, tkentaro@stp.isas.jaxa.jp
Japan Aerospace Exploration Agency, Kanagawa, Japan
Satoshi Kasahara, kshr@stp.isas.jaxa.jp
Institute of Space and Astronautical Science, Sagamihara, Japan
Yuri Khotyaintsev, yuri@irfu.se
Swedish Institute of Space Physics, Sweden
Forrest Mozer, fmozer@ssl.berkeley.edu
Space Sciences Laboratory, University of California, United States
Masaki Fujimoto, fujimoto@stp.isas.jaxa.jp
Japan Aerospace Exploration Agency, Kanagawa, Japan
Wolfgang Baumjohann, baumjohann@oeaw.ac.at
Space Research Institute, Austrian Academy of Sciences, Graz, Austria
Stuart Bale, bale@ssl.berkeley.edu
University of California, Berkeley, Berkeley, California, United States

A key question in plasma physics is how electromagnetic energy is converted into energy of charged particles. Magnetic reconnection is a universal process that is responsible for mayor energy conversion in laboratory plasma, in the solar corona and solar wind, in planetary magnetospheres and that is considered to play an important role in distant astrophysical objects.

Reconnection is inherently a multi-scale process where electron, ion and MHD scales are strongly coupled. Reconnection is initiated rapidly in thin current sheets and subsequently generates fast flows that affect large volumes of space for long time. Understanding the fundamental physics of reconnection from an experimental point of view requires observations at different scales.

The only place where such observations are currently possible is the near-Earth space where simultaneous multi-point measurements are available *in-situ* through ESA/Cluster and NASA/THEMIS spacecraft, in particular high-resolution measurements that are able to resolve particle distribution functions and electromagnetic fields down to the smallest scales.

Here we present a few examples of Cluster observations within reconnecting thin current sheets in the terrestrial magnetosheath, magnetopause and magnetotail and we discuss our current knowledge and open issues of the microphysics of reconnection. We briefly discuss how future measurements such as those from NASA/MMS spacecraft will contribute to improve our understanding of the microphysics.