Geophysical Research Abstracts
Vol. 20, EGU2018-10777-1, 2018
EGU General Assembly 2018

The Reconnection Diffusion Region for Symmetric and Asymmetric Reconection from MMS

James Burch (1), Roy Torbert (2), Michael Hesse (3), Tai Phan (4), Robert Ergun (5), Matthew Argall (2), James Webster (6), Kevin Genestreti (7), Barbara Giles (8), Daniel Gershman (8), Daniel Graham (9), Christopher Russell (10), Li-Jen Chen (11), Shan Wang (11), Drew Turner (12), Barry Mauk (13), Rumi Nakamura (7), and Joo Hwang (1)

(1) Southwest Research Institute, Space Science and Engineering Division, San Antonio, TX, United States (jburch@swri.edu), (2) Univeristy of New Hampshire, Durham, NH, United States (roy.torbert@unh.edu, Matthew.Argall@unh.edu), (3) University of Bergen, Bergen, Norway (michael.hesse@uib.no), (4) University of Californmia, Berkeley, Berkeley, CA, United States (phan@ssl.berkeley.edu), (5) LASP, University of Colorado, Boulder, CO, United States (Robert.Ergun@lasp.colorado.edu), (6) Rice University, Houston, TX, United States (jmw11@rice.edu), (7) Space Research Institute, Graz, Austria (Kevin.Genestreti@oeaw.ac.at), (8) NASA-GSFC, Greenbelt, MD, United States (barbara.giles@nasa.gov, daniel.j.gershman@nasa.gov), (9) Institute for Space Physics, Uppsala, Sweden (dgraham@irfu.se), (10) University of California, Los Angeles, Los Angeles, CA, United States (ctrussell@igpp.ucla.edu), (11) University of Maryland, College Park, MD, United States (lijen@mailaps.org, swang90@umd.edu), (12) The Aerospace Corporation, El Segundo, CA, United States (drew.l.turner@aero.org), (13) Applied Physics Laboratory, Johns Hopkins University, Laurel, MD, United States (Barry.Mauk@jhuapl.edu)

The Magnetospheric Multiscale (MMS) mission has made comprehensive electron-scale measurements within a large number of reconnection diffusion regions at the dayside magnetopause, where reconnection is asymmetric, and in the geomagnetic tail, where it is symmetric. Both predicted and newly-discovered phenomena have been investigated and found to be strongly dependent on the level of symmetry of the reconnecting layers as well as the magnetic guide fields that thread the layers. Examples of phenomena observed in both types of reconnection include electron crescent-shaped distributions, which result from acceleration by an electric-field component in the N direction of boundary-normal (LMN) coordinates and subsequent meandering motions as the electrons gyrate across a boundary separating magnetic fields with different directions. Only single crescents have been observed at the magnetopause while double and triple crescents are observed in the tail. On the day side EN accelerates magnetosheath electrons into the reconnecting layer, while in the tail EN accelerates neutral-sheet electrons toward the lobes with the subsequent meandering motion resulting from their alternating motion between positive and negative BL. On the day side energy conversion (or magnetic dissipation) by reconnection occurs at the electron stagnation point and the X-line, but X-line conversion or dissipation is only significant for moderate to strong guide fields. This difference has been shown to result from two different channels for out-of-plane current—crescent distributions at the stagnation point and field-aligned flow along the guide field at the X-line. In the tail the X-line and the electron stagnation point are coincident, and the out-of-plane current is carried by crescent distributions throughout the diffusion region. Other regions of strong dissipation in the tail are located in the tailward and Earthward exhaust regions at the edges of the EDR. Strong wave activity occurs in both asymmetric and symmetric reconnection with lower-hybrid waves, electrostatic waves, whistlers, and upper hybrid waves commonly occuring in both geometries. Because of the lower values of density and magnetic field strength in the tail, the characteristic frequencies are much lower so that upper hybrid and Langmuir waves associated with electron crescent distributions are more often observable. These and other distinguishing characteristics of asymmetric and symmetric reconnection are explored in this work.