Waves and wave-particle interactions in magnetopause reconnection

*Daniel Bruce Graham[1], Yuri Khotyaintsev[1], Andris Vaivads[1], Cecilia Norgren[1], Mats Andre[1], James Webster[2], James L Burch[3], Per-Arne Lindqvist[4], Göran Marklund[4], Olivier Le Contel[5], Robert Ergun[6], Roy Torbert[7], William Paterson[8], Daniel Gershman[8], Barbara Giles[8], Craig J Pollock[8], John Dorelli[8], Levon Avanov[8], Benoit Lavraud[9], Yoshifumi Saito[10], Werner Magnus[11], Christopher T Russell[12], Robert Strangeway[12]

1. IRF Swedish Institute of Space Physics, Uppsala, Sweden, 2. Rice University, Houston, TX, USA, 3. Southwest Research Institute, San Antonio, TX, USA, 4. KTH Royal Institute of Technology, Stockholm, Sweden, 5. LPP, CNRS, Palaiseau, France, 6. LASP, University of Colorado, Boulder, CO, USA, 7. University of New Hampshire, Durham, NH, USA, 8. NASA Goddard Space Flight Center, Greenbelt, MD, USA, 9. IRAP, CNRS, Toulouse, France, 10. JAXA, Chofu, Japan, 11. Space Research Institute, Austrian Academy of Sciences, Graz, Austria, 12. Department of Earth and Space Sciences, University of California, Los Angeles, California, USA

The role of waves in magnetic reconnection remains an outstanding question. Waves can produce particle heating and acceleration, particle diffusion, and anomalous resistivity, all of which can impact ongoing reconnection. Therefore, it is crucial to characterize the waves associated with magnetic reconnection. We investigate the waves that develop near the electron and ion diffusion regions of asymmetric reconnection at Earth's magnetopause using the Magnetospheric Multiscale spacecraft. In particular, we show that near the stagnation point intense lower hybrid drift waves are produced, which result in cross-field particle diffusion, broadening the density gradient in ion diffusion region and magnetospheric separatrices. We also show that agyrotropic beams generated in EDRs can become unstable to high-frequency electrostatic waves. These waves are sufficiently large to thermalize the beam, potentially modifying the electron dynamics near or within EDRs. We discuss the role these waves play in ongoing magnetic reconnection.

Keywords: Magnetic reconnection, Plasma waves, Wave-particle interactions

