



Wednesday
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3:10 pm
Room 1003 EECS

Dr. Michael Hesse

Naval Postgraduate School

Magnetic Reconnection: What Do We Know Now, and What Remains Unsolved

Magnetic reconnection (MR) is one of the most important transport and energy-release processes in collisionless plasmas. Although governed by highly localized kinetic physics, MR enables system-scale changes, often involving explosive conversion of stored magnetic energy into particle energy. MR powers such diverse plasma phenomena as solar and stellar flares, geomagnetic storms, and the aurora, and underlies many of the deleterious effects collectively referred to as space weather. Magnetic reconnection therefore constitutes an important and accessible example of a fundamentally multiscale physical process.

While the global consequences of magnetic reconnection have been understood at a conceptual level for some time, the detailed physics governing its operation remained elusive until recently. The advent of the Magnetospheric Multiscale (MMS) mission, which has provided—and continues to provide—unprecedented in situ measurements, has supplied both new empirical insight and critical ground truth for theory and numerical modeling. MMS has largely resolved how MR operates at its core: the small spatial region that enables large-scale plasma dynamics. More recent results have begun to illuminate the mechanisms of energy conversion and the physical coupling between this central region and its surrounding environment. This presentation will summarize the current understanding of MR and highlight emerging research directions that follow from these recent advances.

About the Speaker: Dr. Michael Hesse, who received his PhD from Ruhr-Universität in Bochum, is Vice Provost for Research and Innovation at the Naval Postgraduate School (NPS), where he oversees research priorities that advance the Navy, Marine Corps, and Department of Defense. Prior to NPS, Dr. Hesse was Director of the Science Directorate at NASA's Ames Research Center, leading a staff of about 500 engaged in Earth science, planetary and astrophysical research, and space biological research. Before joining Ames, Dr. Hesse spent three years at the University of Bergen in Norway where he led the Geomagnetic Expert Service Centre, a multi-national consortium providing space weather services to ESA. Prior to moving to Bergen, Dr. Hesse had a distinguished 25-year career at NASA's Goddard Space Flight Center (GSFC), culminating in his role as the Director of the Heliophysics Science Division, and founding Director of the Community Coordinated Modeling Center (CCMC). Dr. Hesse has published more than 300 papers (H index of 76). He is Fellow of the American Geophysical Union and member of Academia Europea; and has received several awards including NASA Outstanding Leadership Medal, NASA Distinguished Service Medal, and AGU Space Weather and Nonlinear Waves and Processes Prize.