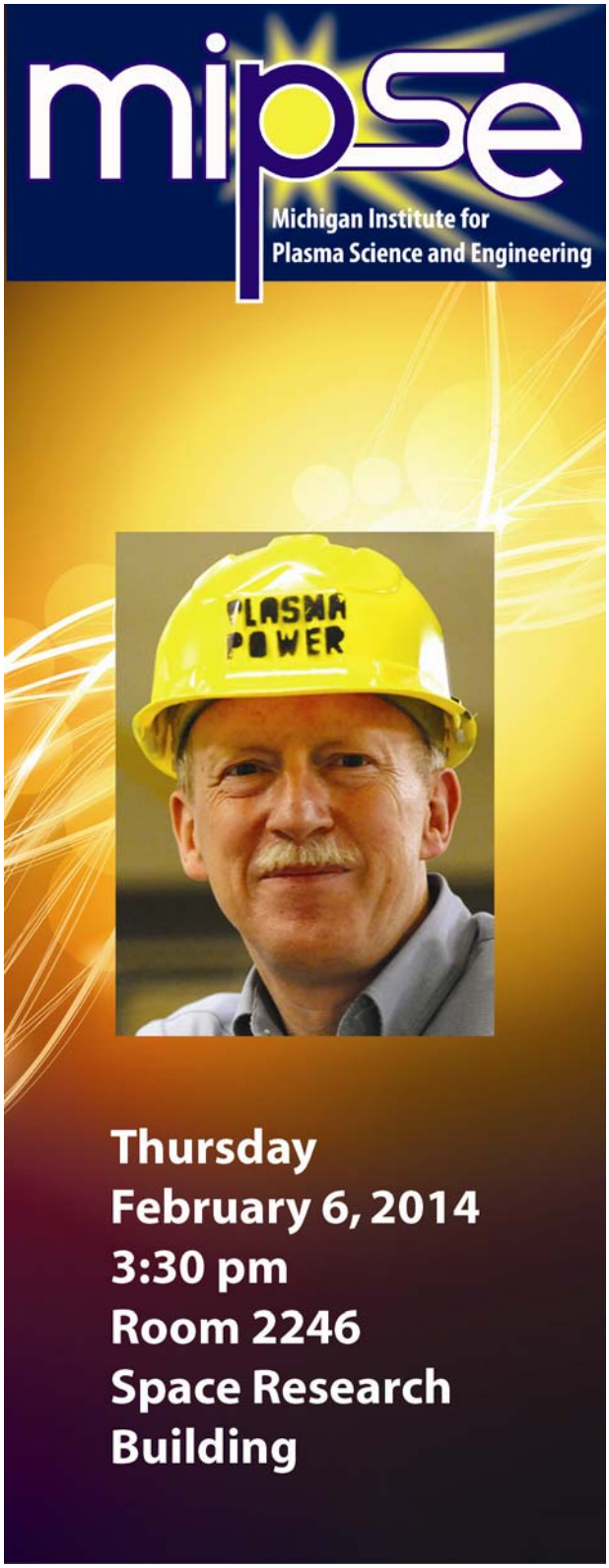

Prof. Michael Mauel

Columbia University

Exploring Plasma Dynamics with Laboratory Magnetospheres

Laboratory magnetospheres are facilities to explore plasma science and technology in magnetic geometries relevant to planetary magnetospheres. During the past decade, we have discovered how to create, measure, and control the high-temperature plasma trapped in three large laboratory magnetospheres, at Columbia University, MIT, and the University of Tokyo. With its high-field superconducting magnets, the Levitated Dipole Experiment (LDX) at MIT is the world's largest laboratory magnetosphere and, also, the largest steady-state high-temperature plasma in the nation. This presentation briefly reviews these experiments and highlights investigations of adiabatic drift-resonant transport and heating of trapped "radiation belt" electrons [1], low-frequency MHD turbulence [2], centrifugal instability [3], first principle validation of "whole plasma" space transport models, and the formation of high-temperature plasmas with profiles similar to Earth's inner magnetosphere [4]. The results of recent experiments will be discussed: control of interchange turbulence using localized current injection, and investigation of the plasma response to injected transients. Future science missions include multi-point in situ measurements from "swarms" of injected smart-probes and Alfvén wave spectroscopy in higher-density plasmas.

[1] Phys Rev Lett, 90, 185001 (2003).
[2] Phys Rev Lett, 105, 205004 (2010).
[3] Phys Rev Lett, 94, 175002 (2005).
[4] Nature-Phys, 6, pp. 207-212 (2010).

About the Speaker: Michael Mauel received his Sc.D. from MIT (1983) in plasma physics. Mauel joined Columbia University (CU) in 1985 where he is Professor of Applied Physics. At CU his research focuses on high temperature magnetized plasma physics applied to fusion energy and space weather. He has built experimental programs in plasma processing in with IBM and laboratory space physics with NASA, NSF, and AFOSR support. He co-directs the Levitated Dipole Experiment (CU & MIT) that uses high-field superconducting magnets to explore the application of magnetospheric physics to the confinement of high-pressure plasma in the laboratory and first demonstrated steady-state, high-pressure plasma confinement without a toroidal field. In 1994, Mauel was Teacher of the Year at CU's School of Engr. & Applied Science, received the Rose Prize for Excellence in Fusion Engineering, was named Jefferson Science Fellow by the NAS, and was awarded certificates of appreciation from the Sect. of Energy and the Asst. Secretary of State. Dr. Mauel is a fellow of the APS, served as Chair of the APS-DPP and is now Chair of the Plasma Science Committee of the NRC.