Physics Colloquium

Physics Faculty and Search Committee Candidate:

M.J. Pueschel

Thursday, March 2nd at 4:10 pm in LL 316. Refreshments available at 3:45.

Turbulence in Magnetized Plasmas: from Fusion Reactors to Astrophysics

Plasma is arguably the most common, most complex, yet least understood state of baryonic matter in the universe. With modern supercomputers, we have powerful tools to help us understand nonlinear phenomena and turbulence in laboratory, space, and astrophysical plasmas. Here, we discuss how magnetic reconnection occurs both in the solar corona and in fusion reactors, and how similar processes may allow turbulence to derail plasma confinement. A newly discovered plasma instability is then shown to enhance reconnection rates and may cause turbulence in electron-positron plasmas from terrestrial experiments to exploding neutron stars.

M.J. Pueschel obtained his Ph.D. for simulation and theory work at the Max Planck Institute for Plasma Physics on electromagnetic turbulence in fusion plasmas, and is currently a staff scientist at the University of Wisconsin-Madison. His efforts on different fusion reactor concepts, turbulence physics, energetic particles, magnetic reconnection, and plasma instabilities led to the discovery of nonlinear electromagnetic stabilization, the non-zonal transition, gradient-enhanced tearing, the gradient-driven drift coupling instability, and a possible resolution of the coronal heating problem. At present, he is working with six graduate students and many national and international collaborators on a variety of projects, such as stellarator optimization, turbulent saturation physics, or higher quantum states of plasma instabilities.