Please Post

THE UNIVERSITY of WISCONSIN MADISON

Department of Physics Colloquium

Friday, November 13, 2009 • 4:00 P.M. • 2241 Chamberlin Hall

cookies & coffee served at 3:30 p.m

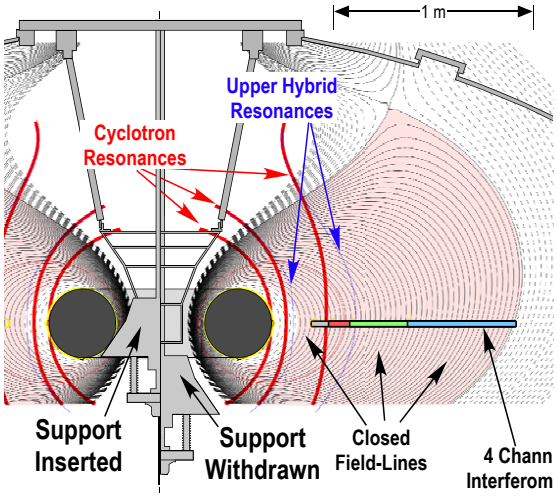
Inward Turbulent Diffusion of Plasmas in a Levitated Dipole

Michael Mauel

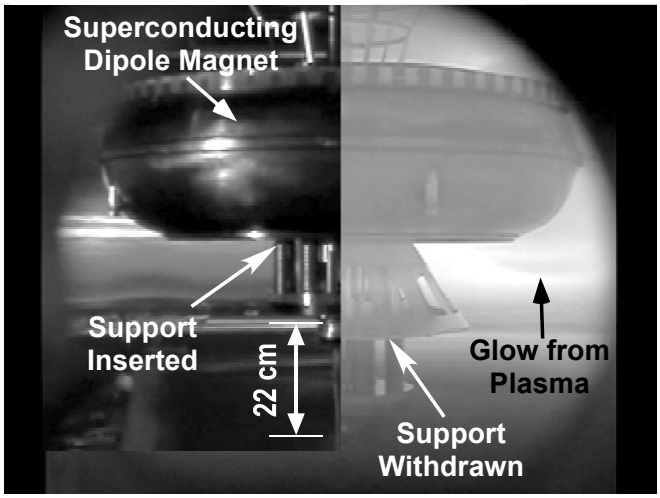
Columbia University

Host: Forest

The rearrangement of plasma due to turbulence is among the most important processes that occur in planetary magnetospheres and in experiments used for fusion energy research. Remarkably, fluctuations that occur in active magnetospheres drive particles inward and create centrally peaked profiles. Until now, the strong peaking seen in space has been undetectable in the laboratory because the loss of particles along the magnetic field is faster than the net driven flow across the magnetic field. Here, we report the first laboratory measurements in which a strong superconducting magnet is levitated and used to confine high temperature plasma in a configuration that resembles planetary magnetospheres. Levitation eliminates field-aligned particle loss, and the central plasma density increases dramatically. The buildup of density characterizes a turbulent pinch and is found equal to the rate predicted from measured electric field fluctuations. Our observations show that dynamic principles describing magnetospheric plasma are relevant to plasma confined by a levitated dipole.



(a) Magnetic Geometry



(b) Dipole Supported and Levitated