PHYSICS AND ASTRONOMY

SEMINAR

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"Stochastic Reconnection in the Solar Wind and the Interstellar Medium"

Abstract

Magnetic field line stochasticity, typically resulting from a turbulent cascade, produces broad outflows from reconnection events and eliminates the bottleneck that leads to slow Sweet-Parker reconnection. Externally forced turbulence gives reconnection speeds of order the large scale eddy velocity, although there may be a minimum speed due to current sheet instabilities. We have used the Johns Hopkins Turbulence Database of MHD turbulence to study the nature of reconnection in a turbulent medium and compared reconnection events in the database to large scale reconnection events in the solar wind. We find that coarse grained smoothing of the simulation data presents the appearance of X-point reconnection, without any microscopic basis for this picture. Individual cuts through the simulation data yield events that closely correspond to spacecraft data. We have also extended our theoretical work to environments where the magnetic Prandtl number is large and small scale flows are strictly laminar. We find that when viscosity is large, current sheet intermittency produces coherent reconnection events that produce reconnection over marginally damped scales in a single eddy turn over time. We conclude that in a turbulent environment reconnection is always fast.

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MacLaurin Building – Room D111