



Reconnection with Turbulence & Instabilities

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Talks at http://www.cmso.info/html/meetings/CMSO-RC-12_talks.htm

Motivation

- Understand reconnection in turbulent systems
 - Conditions for onset
 - Energy budget
 - Rate
- Understand how turbulence is driven by reconnection
 - Feedback of turbulence on reconnection process

Experiments

- *RSX: How does current sheet geometry shred to smaller scales?* Tom Intrator Given that flux ropes form, how do they interact?
- *MRX: 3D, impulsive reconnection events & associated turbulence in MRX.* Seth Dorfman Formation of 3D flux ropes through 2-fluid effects
- *MST: Role of tearing mode harmonics in magnetic relaxation of the RFP.* John Sarff Nonlinear coupling of tearing modes, role in sawtooth crash

Reconnection with Small Scale Turbulence

- Large scale current sheet with turbulence on small scales ([Lazarian](#), [Vishniac](#), [Eyink](#))
 - Multiple X-points
 - Diverging outflow channels
 - Affects reconnection rate, modes of energy deposition.
 - Connections to diffusion in a turbulent medium

Reconnection in Large Scale Turbulence

- Driven or decaying MHD turbulence which forms small scale X-points, O-points, current layers ([Matthaeus, Zhdankin](#))
 - Dissipation in the current layers as an energy sink for turbulence
 - Statistics of X & O-points, dissipation rates in current sheets

The Plasmoid Instability

- Breakup of high S Sweet-Parker current layers into plasmoids (Baalrud, Huang)
 - Mechanism for fast MHD reconnection
 - Opportunity for “hybrid” reconnection: transition from MHD to 2-fluid
 - What is the plasmoid distribution & does it constitute turbulence?

Shear Flow Turbulence

- Unstable shear flow parallel to a weak magnetic field breaks up into vortices & winds up the field (Daughton)
 - Reconnection of wound up field, growth of microinstabilities, breakup into flux ropes.

Perspectives & Conclusions (1/2)

- Twenty years ago, turbulence & small scale structure associated with reconnection would probably have been subsumed into “turbulent resistivity” – now we’re looking deeper.
 - Role of kinetic instabilities is hard to pin down
 - Understand rate, burstiness, energy balance.
 - Important for developing observational diagnostics

Perspectives & Conclusions (2/2)

- 3D effects are macroscopically & microscopically important
- Lab & natural plasmas have global drivers, constraints, boundary conditions, which theory is not quite ready to tackle.
 - Progress is rapid; some encouraging discussions at this meeting.
 - Imperative for understanding triggering & outcome of reconnection.