**Measurement and simulation of electron thermal transport in the MST Reversed-Field Pinch**


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Comparison of measurements and simulations in the MST Reversed-Field Pinch (RFP) to evaluate the importance of nonideal effects on electron thermal transport. Two key observations:

- Plasma parameters change dramatically during fast reconnection events—fluctuations increase, stochasticity increases, confinement drops...
- Pressure profiles are measured during a sawtooth crash, whereas ad infinitum exhibit pressure fluctuations which may be investigated.

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**Transport simulation**

Single fluid, 3D, nonlinear, resistive MHD simulations at zero β reproduce many observed RFP dynamics.

- Diode is a single-fluid MHD simulation code run in cylindrical geometry.
- Simulation Landau number \( 2 \times 10^7 \) matches the \( 3 \times 10^7 \) in experiment.
- Diode uses 45,000 meshes.

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**The Reversed-Field Pinch (RFP)**

In the RFP, the magnetic field is produced primarily by the toroidal plasma current.

- Only a small externally applied toroidal field is required—specific advantage for fusion application.
- Large magnetic shear and weaker toroidal (nonaxisymmetric) effects.
- Simulates enhanced equilibrium/plasma cross section with respect to the tokamak and stellarator.
- Basic science: magnetic self-organization and nonlinear plasma physics.

**The device model**

A moderate current RFP with some unique features:

- Thick aluminum shell serves as:
  - Vacuum vessel
  - Single-turn TF coil
  - PF shaping boundary
  - Stabilizing shell
- Typical parameters:
  - \( R = 1.5 \text{ m}, \theta = 0.5 \text{ m} \)
  - \( l = 0.6 \text{ MA}(\theta = 0.17) \)
  - \( l \times \theta = 10^2 \text{ m}^3 \)
  - \( 200 \text{ V} = T_e < 1 \text{ keV} \)
  - \( T_e < 0.1 \text{ s} \)

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