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Anisotropic electron tail generation during tearing mode magnetic reconnection[1] AMI DUBOIS, ABDULGADER ALMAGRI, JAY ANDERSON, DANIEL DEN HARTOG, JOHN SARFF, University of Wisconsin - Madison
— Magnetic reconnection (MR) plays an important role in particle transport, energization, and acceleration in space, astrophysical, and laboratory plasmas. In MST RFP plasmas, strong ion energization occurs during discrete MR events associated with the release of large amounts of equilibrium magnetic field energy, while the thermal electron temperature decreases due to enhanced stochastic transport. Recent high-speed x-ray spectrum measurements imply the generation of a non-Maxwellian electron tail during MR, characterized by a power-law spectral index decreasing from 4.15 to 2.15, and then increasing rapidly to 6.77 after MR due to stochastic transport. The x-ray emission peaks in the radial direction and is symmetric in the toroidal direction, indicating an anisotropic electron tail is generated. Fokker-Planck simulations predict higher x-ray emission in the parallel versus anti-parallel direction if runaway were active, consistent with the mean electric field during MR being 10X smaller than the Dreicer field. Hence the measurements of anisotropic energetic x-ray flux imply that the electron tail formation during MR results from a turbulent process.

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