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Anisotropic fast ion distribution generated by magnetic reconnection in MST plasmas JUNGHA KIM, JAY ANDERSON, University of Wisconsin - Madison, ROBERT HARVEY, CompX, JOHN SARFF, University of Wisconsin - Madison — While reconnection-driven ion heating is common in laboratory and astrophysical plasmas, the underlying mechanisms for converting magnetic to kinetic energy remains an incompletely solved problem. This work focuses on the particular case of reversed field pinch plasmas, which are often characterized by rapid ion heating during impulsive reconnection that governs the magnetic equilibrium. Comparison of NPA-measured slices of the distribution's tail and global neutron flux with the output of Fokker-Planck modeling confirms several new details. Due to poor confinement of thermal ions, ion heating at magnetic reconnection events typically dissipates within a millisecond. However, successive bursts of reconnection can repeatedly heat thermal ions before they can fully equilibrate, until a small fraction of thermal ions reaches a phase space of good confinement on the order of 20 milliseconds. These well-confined fast ions also experience less friction and are susceptible to runaway from inductive electric fields parallel to the plasma current. Fast ion acceleration reinforced by low diffusivity can create an anisotropic fast ion distribution that produces modest amounts of fusion neutrons without the aid of external heating. Work supported by DOE.

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