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Investigation of interaction between fast ions and tearing modes in MST plasmas using full orbit tracing JUNGHA KIM, JAY ANDERSON, WILLIAM CAPECCHI, PHILLIP BONOFIGLO, STEPHANIE SEARS, Univ of Wisconsin, Madison, YURI TSIDULKO, Budker Institute of Nuclear Physics — Under proper conditions, global reconnection events generate an anisotropic runaway ion distribution in MST plasmas. Full orbit tracing with time-dependent fluctuating fields, calculated by the nonlinear resistive MHD code DEBS, is used to inform a refined model of ion heating to explain this phenomenon, where tearing modes and ions interact on two distinct scales. There is anisotropic heating of thermal ions ($T_\perp > T_\parallel$), likely through a stochastic heating mechanism that requires high diffusivity and a tearing mode induced radial electric field with correlation length of a few cm. This process does not, however, continuously energize ions into the runaway regime. At sufficient energy, the ion guiding center deviates from the background magnetic field, which reduces the effective diffusivity to classical levels even in a stochastic magnetic field. These "fast" ions are accelerated by a parallel electric field (length scale of meters) induced by the equilibrium change accompanying tearing modes. This process relies on multiple global tearing modes; here we focus on a single tearing mode. This is compared to an experimental state where a transition to a single, dominant tearing mode is observed to accelerate fast ions and alter their confinement properties. Work supported by US DOE.

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