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Fast Electron Transport in Improved-Confinement RFP Plasmas
D.J. CLAYTON, A.F. ALMAGRI, D.R. BURKE, B.E. CHAPMAN, C.B. FOREST, UW-Madison — Hard x rays (HXRs), with energies reaching 150 keV, are detected in MST discharges with reduced tearing mode amplitudes, indicative of improved confinement of fast electrons. In standard discharges, tearing modes create stochastic magnetic fields, fast electrons diffuse out of the core at a rate proportional to their velocity, and emitted x rays do not exceed energies of about 10 keV. By comparison, when tearing modes are sufficiently reduced, magnetic flux surfaces are restored and fast electrons become well-confined, diffusing at a rate independent of velocity. HXRs are measured from the core of PPCD discharges, in which the current profile is inductively modified to reduce tearing mode amplitudes. For these plasmas, the Fokker-Planck code CQL3D can be used to infer Z_{eff} and the particle diffusion coefficient D_r from measured spectra; typical values are $Z_{eff} = 5$ and $D_r = 5$ m^2/s. HXRs are also detected when a large magnetic island forms in the plasma core, usually the result of quasi-single helicity, where one tearing mode grows large while the rest are suppressed. Stochasticity is reduced within the island and fast electrons are well-confined in this region. Work supported by the USDOE.

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