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Interaction Between Neutral-Beam-Injected Ions and Tearing Modes in Reversed Field Pinch V.V. MIRNOV, University of Wisconsin-Madison and CMSO, C.C. KIM, University of Washington, Seattle — A long pulse (20 ms) high current (40 A) energetic (25 keV) neutral beam used for plasma heating now operates routinely on the Madison Symmetric Torus (MST) Reversed Field Pinch (RFP). This motivates our interest in studying fast particles and their interaction with tearing modes in the RFP. An analytic model has been developed recently in the asymptotic limit of large Larmor orbits[1]. The contribution from the fast particles is expressed locally in terms of the hot ion density gradient on the mode rational surface. Major MST core resonant modes (1,6) and (1,7) are localized far away from the axis and, correspondingly, weakly interact with the injected ions. In some nearly non-reversed MST regimes, an additional resonant tearing mode (1,5) is excited which is localized around the axis and, therefore, effectively interacts with the fast ions. An improved version of the model[1] is developed that includes effects of mode asymmetry and a non constant-ψ approximation. This model is applied to the above MST regimes with realistic density profiles for the high energy component and geometry of the (1,5) mode. The theory predicts reduction of the growth rate that is in reasonable agreement with the experimental observations. These effects are also analyzed with the use of NIMROD by extending a hybrid drift-kinetic-MHD model to include fast ion motion. Work supported by DOE and NSF.

[1]V.V. Mirnov et al., Int. Sherwood Fusion Theory Conf. (2010), IAEA Fusion Energy Conf., THS/P5-11 (2010).

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