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Nonlinear Dynamics of Beam-driven TAEs in NSTX GUOYONG

FU, Princeton Plasma Physics Laboratory, DEYONG LIU, University of California, Irvine, FENG WANG, Princeton Plasma Physics Laboratory — Energetic particle modes and Alfvénic modes driven by super-Alfvénic beam ions were routinely observed in neutral beam heated plasmas on NSTX. These modes can significantly impact beam-ion transport, thus causing beam-ion redistribution and losses. Recent simulation results of TAEs show mode radial structure consistent with the reflectometer measurements of electron density fluctuations [1]. In this paper we report on new simulations of multiple TAEs in NSTX plasmas using the M3D-K code. The results show strong interaction between TAEs and fishbone that either enhances or reduces saturation level of individual modes depending on mode number and other parameters. As beam ion beta increases beyond a threshold, mode saturation levels are found to increase sharply. Correspondingly the locally flattening regions merge together resulting in global particle transport and substantial particle loss. These results are similar to the TAE avalanche observed in NSTX.

[1] D. Liu et al, Phys. Plasmas 22, 042509 (2015)

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