Parametric dependence of fast-ion transport events on the National Spherical Tokamak Experiment

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Neutral-beam heated tokamak plasmas commonly have more than one third of the plasma kinetic energy in the non-thermal energetic beam ion population. This population of fast ions heats the plasma, provides some of the current drive, and can affect the stability (positively or negatively) of magneto-hydrodynamic instabilities. This population of energetic ions is not in thermodynamic equilibrium, thus there is free-energy available to drive instabilities, which, of course, leads to redistribution of the fast ion population. Understanding under what conditions beam-driven instabilities arise, and the extent of the resulting perturbation to the fast ion population, is important for predicting and eventually demonstrating non-inductive current ramp-up and sustainment in NSTX-U, as well as the performance of future fusion plasma experiments such as ITER. This paper presents an empirical approach towards understanding the stability boundaries for some common energetic-ion-driven instabilities seen on NSTX.

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