

Fast-ion energy loss during TAE avalanches in the National Spherical Torus Experiment

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Strong TAE avalanches on the National Spherical Torus Experiment are typically correlated with drops in the neutron rate in the range of 5% - 15%. In previous studies of avalanches in L-mode plasmas, these neutron drops were shown to be consistent with modeled losses of fast ions due to the strong, multi-mode TAE bursts. In this study, TAE avalanches in an NSTX H-mode plasma were studied. At the measured TAE mode amplitudes, simulations with the ORBIT code found that fast ion losses were negligible. However, the ORBIT simulations predicted that the TAE would scatter the fast ions in energy, resulting in a significant drop in fast ion β , even in the absence of fast ion losses. Convoluting the fast ion distribution with the energy dependence of the D-D fusion cross-section rate found that this drop in fast ion β was consistent with the measured drop in neutron rate. Further, the estimated change in the fast ion energy is comparable to the estimated energy in the TAE wave-field.

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