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The destabilising effect of dynamical friction on fast particle-driven waves M.K. LILLEY, Imperial College London, B.N. BREIZMAN, Institute for Fusion Studies, S.E. SHARAPOV, EURATOM/UKAEA Fusion Association —
The non-linear evolution of waves excited by the resonant interaction with energetic particles is known to depend on relaxation processes that restore the unstable distribution function. With Krook type collisions and velocity space diffusion the wave may exhibit steady-state, amplitude modulation, chaotic and explosive ('hard') regimes near marginal stability. However, our recent analysis surprisingly shows that only the explosive behaviour is possible in the near-threshold nonlinear regime when dynamical friction (drag) is the dominant collisional process in the phase space region surrounding the wave-particle resonance. These results indicate that the nonlinear evolution of, e.g., Alfvénic instabilities driven by super-Alfvénic neutral beam injection (NBI), or by fusion-born alpha-particles with drag-determined distribution functions should be more prone to the 'hard' regime than those driven by ion-cyclotron resonance heating (ICRH) with dominant RF quasi-linear diffusion. The experimentally observed differences between the steady-state, amplitude modulation and chaotic regimes of ICRH-driven TAE instabilities on the Join European Torus (JET) and the bursting frequency-chirping TAEs on MAST are then considered. Possible nonlinear scenarios of Alfvénic instabilities driven by fusion-born alpha-particles in ITER are also discussed.

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