Coupling of Neutral-beam-driven Compressional Alfvén Eigenmodes to Kinetic Alfvén Waves in NSTX and energy channelling

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Results of the first self-consistent simulations of neutral-beam-driven compressional Alfvén eigenmodes (CAEs) in the National Spherical Torus Experiment (NSTX) are presented. Three-dimensional hybrid MHD-particle simulations for the H-mode NSTX discharge (shot 141398) show unstable CAE modes for a range of toroidal mode numbers, n=4-9, and frequencies below the ion cyclotron frequency. It is found that the essential feature of CAE modes in the NSTX is their coupling to kinetic Alfven wave (KAW) that occurs on the high-field side at the Alfven resonance location. Radial width of the KAW is found to be comparable to the fast ion Larmor radius. High-frequency Alfven eigenmodes are frequently observed in beam-heated NSTX plasmas, and have been linked to enhanced thermal electron transport and flattening of the electron temperature profiles. Coupling between CAE and KAW suggests a new mechanism to explain these observations, in which beam-driven CAEs dissipate their energy at the resonance location, therefore significantly modifying the energy deposition profile.