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Nonlinear simulations of Neutral-beam-driven Compressional Alfvén Eigenmodes / Kinetic Alfvén Waves in NSTX[1] ELENA BELOVA, N.N. GORELENKOV, PPPL, N.A. CROCKER, UCLA, J.B. LESTZ, E.D. FREDRICKSON, PPPL, S. TANG, UCLA — Results of 3D nonlinear simulations of neutral-beam-driven compressional Alfvén eigenmodes (CAEs) in the National Spherical Torus Experiment (NSTX) are presented. Hybrid MHD-particle simulations for the H-mode NSTX discharge (shot 141398) using the HYM code 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 CAEs is their coupling to kinetic Alfven wave (KAW) that occurs on the high-field side at the Alfven resonance location. Nonlinear simulations demonstrate that CAEs can channel the energy of the beam ions from the injection region near the magnetic axis to the location of the resonant mode conversion at the edge of the beam density profile. This mechanism provides an alternative explanation to the observed reduced heating of the plasma core in the NSTX. A set of nonlinear simulations show that the CAE instability saturates due to nonlinear particle trapping, and a large fraction of beam energy can be transferred to several unstable CAEs of relatively large amplitudes and absorbed at the resonant location. Absorption rate shows a strong scaling with the beam power.

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