# Excitation of Alfvén Eigenmodes by Low Velocity Beam Ions in the JET and DIII-D Tokamaks*

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New data on the DIII-D and JET tokamaks reveal a rich variety of Alfvénic activity excited by neutral beam ions traveling at only a small fraction of the local Alfvén velocity. These observations challenge our detailed understanding of the excitation of Alfvénic phenomena and provide a validation platform for testing fundamental theoretical predictions. In addition, precise internal measurements of density and temperature fluctuations reveal new information on the kinetic properties of Alfvén eigenmodes that challenge ideal MHD descriptions of these instabilities. Recent experiments on the JET facility with 3.5 T magnetic field and low plasma density demonstrate that Cascade modes are excited by 50 keV beam ions corresponding to only $v_A/6$, where $v_A$ is the local Alfvén velocity. Toroidal Alfvén eigenmodes are excited by ions traveling at only $v_A/4$, well below the $v_A/3$ sideband condition for the primary resonance. Detailed stability analysis reveals a key role played by finite orbit effects and in particular the beam ion anisotropy for these low energy excitations. Similarly, studies on DIII-D with 2.0 T magnetic fields reveal that the direction of injection of neutral beam injection is a critical factor in the excitation of Alfvén eigenmodes. As in JET, a key to directional sensitivity is the finite orbit width of the fast ions. New observations are also obtained on the excitation of $n$=0 modes in both JET and DIII-D driven by low energy (50-80 keV) beam ions. Internal measurements reveal much smaller temperature-to-density fluctuation levels for these modes, suggesting that the fluctuations cannot be interpreted as due to the radial displacement of magnetic field lines.

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