TAE Physics in Spherical Tokamaks

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Instabilities in the TAE-frequency range are often excited by super-Alfvénic NBI in the MAST and START spherical tokamaks [1, 2]. These instabilities are seen either as fixed-frequency TAE-perturbations that follow the Alfvén scaling, $\omega_{TAE} \propto B_0 / q\sqrt{n_i}$, or as 'chirping' mode perturbations with frequencies that sweep faster in time than the equilibrium parameters change. Analysis of the experimental data for both MAST and START indicates that the Alfvén instabilities weaken in both the mode amplitude and in the number of unstable modes as the pressure of the thermal plasma increases. Interpretation of this data is given in terms of increased thermal ion Landau damping and the high-pressure effect on TAE existence.

In some discharges NBI excites modes that start from the TAE frequency range and sweep in both up and down directions. These modes are interpreted as 'hole-clump' long-living nonlinear fluctuations of the fast ion distribution function first found in Berk-Breizman-Petviashvili paper [3]. Modelling of the up-down sweeping modes on MAST with the particle-following HAGIS code [4] is discussed.

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