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EX/P6-09: Analysis of Alfvén Wave Activity in KSTAR Plasmas

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We report on evidence of neutral beam driven wave activity in KSTAR plasmas. In 2010 and 2011 campaigns KSTAR plasmas included 1MW of neutral beam heating, which provided drive for Alfvenic wave activity modes. Data from the 2010 campaign, which was fully analysed during 2011, identifies the 40kHz magnetic fluctuations as a beta-induced Alfven eignemode resonant with the q=1 surface. Evidence is multiple fold: a Fourier mode analysis identifies the mode as n=1. Electron cyclotron emission chords identify the q=1 inversion radius. These constrain equilibrium reconstruction, and permit detailed MHD calculations using the global MHD stability code MISHKA. A scan of mode frequency near the q=1 minimum of the continuum identifies a core localised n=1 mode separated from the continuum. A complementary kinetic analysis, when coupled with ion and electron temperature measurements ratios obtain from crystallography, enables calculation of the frequency evolution - which is in agreement with observations.
In 2011 a series of experiments were conducted to scope Alfvén excitation using NBI and ECRH heating as a function of field strength and plasma current. In these experiments plasmas with toroidal current up to 600kA were generated with 1.5MW of NBI heating and up to 120kW of co or counter ECRH, and the field strength varied from 1.7T to 2T. Spectral and mode number analysis of the magnetics data identifies 150-250kHz coherent activity with a toroidal mode number of n=1. Assuming a poloidal mode number of m=1, we have computed the evolution of the toroidal Alfven eigenmode (TAE) middle of the gap frequency, and compared the frequency evolution to magnetic spectrograms. While the frequency of the mode is above the Nyquist frequency, the aliased frequency tracks the observations to within 20%, providing some confidence of a TAE interpretation. Finally, we also report evidence of ion fishbone activity.

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