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Observation of Alfven eigenmodes triggered by static resonant magnetic perturbations in EAST ohmic heating plasma

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A Toroidaicity-induced Alfven Eigenmode(TAE) triggered by static resonant magnetic perturbations(RMP) has been observed in EAST ohmic heating plasma for the first time. Two modes with different frequencies appear at the same time as shown in figure 1, when the amplitude of a static n=2 RMP exceeds a threshold value, at which field penetration of the n=2 RMP happens. The mode with higher frequency is propagate in the electron diamagnetic direction. This mode depends linearly on the Alfven frequency and have toroidal mode number of n=1 and 2. This mode is located near the plasma edge, which agrees well with the calculation on of TAE gap by GTAW code[1]. The TAE mode is more sensitive to plasma density and disappears in high density discharge. The lower frequency mode has characters like Beta induce Alfven Eigenmodes(BAE) or Geodesic Acoustic Mode(GAM).

Since our experiment is conducted in ohmic discharge, fast ion is not possible to exist, fast electron should be the drive source for these Alfven Eigenmodes(AEs). There is no disruption in our experiment, so the fast electron might be produced by the interaction between plasma and the static magnetic island which is formed after the n=2 RMP penetration.

AEs could interact with energetic particles in fusion plasma thus degrade the self-maintenance of fusion reaction[2]. So it is very import to study the properties of AEs for better fusion plasma control. The experiment results in EAST suggest that we might be able to use RMP as an active tool to study the AEs in ITER and other magnetic fusion devices in the future.

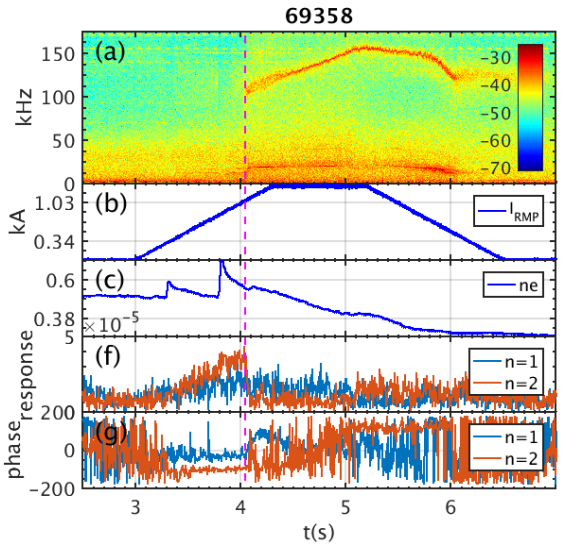

Fig1. Shot 69358 Alfven eigenmodes observation, fig(a) is the power spectrum of Mirnov probe signal, fig(b) is current of RMP coil, fig(c) is plasma density, fig(d) is measured plasma response with different toroidal mode number n, fig(e) is measured plasma response phase with different toroidal mode number n.

References:
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