

Absorption of fast waves at moderate to high ion cyclotron harmonics on

DIII-D

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Abstract. The absorption of fast Alfvén waves (FW) by ion cyclotron harmonic damping in the range of harmonics from fourth to eighth is studied theoretically and with experiments in the DIII-D tokamak. A formula for linear ion cyclotron absorption on ions with an arbitrary distribution function which is symmetric about the magnetic field is used to estimate the single-pass damping for various cases of experimental interest. It is found that damping on fast ions from neutral beam injection can be significant even at the eighth harmonic if the fast ion beta, the beam injection energy, and the background plasma density are high enough and the beam injection geometry is appropriate. The predictions are tested in several L-mode experiments in DIII-D with FW power at 60 MHz and at 116 MHz. It is found that 4th and

5th harmonic absorption of the 60 MHz power on the beam ions can be quite strong, but 8th harmonic absorption of the 116 MHz power appears to be weaker than expected under some circumstances. Possible explanations of the discrepancy are discussed.