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Fast wave excited by runaway electrons in disruptive plasma

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Kinetic instabilities in the MHz range have been observed during current quench in DIII-D disruption experiments (A. Lvovskiy et al., PPCF 60, 124003 (2018)). These instabilities are correlated with the RE loss happening at the beginning of disruption. In this work we use a MHD-kinetic code M3D-C1-K to simulate the excitation of this instability. It is found that this mode lies in the fast wave branch, which is similar to the compressional Alfvén eigenmode (CAE) and has large parallel magnetic field component. The mode frequency from the simulation has a qualitative agreement with experiments. The mode structure for different toroidal mode number was analyzed. The wave can have resonance with high energy trapped runaway electrons, which have precession frequency close to the mode frequency.

The excited mode has the potential to increase the diffusion of runaway electron and can play a role in RE mitigation, thus provides an alternative approach to dissipate RE beam during the current quench.

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