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Reversed Shear Alfvén Eigenmodes in Alcator C-Mod During ICRF Minority Heating and relationship to Sawtooth Crash Phenomena

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Recent Alcator C-Mod experiments focusing on Alfvén eigenmodes in the current flattop phase of the discharge have discovered reversed shear Alfvén eigenmodes (RSAEs) between sawtooth crashes [1]. The phase contrast imaging (PCI) diagnostic [2] is the primary tool for these studies. Having high sensitivity to small perturbations of the electron density, having fast time response and simultaneous broad radial coverage, the PCI system on Alcator C-Mod is able to detect core-localized RSAEs even if only weakly excited. The output signal from the PCI system is an image of the line integral of the electron density perturbations along the beam path, decomposed into 32 elements in the coordinate parallel to the major radius. Images from PCI are compared to numerical results from the ideal MHD code NOVA [3] through the use of a "synthetic diagnostic" analysis. The presence of RSAEs near the q=1 surface suggests that a reversed shear q profile (hollow current density profile) exists during sawteeth. This observation has motivated the modeling of current diffusion following a sawtooth crash which has shown the development of a hollow current density profile for certain initial conditions. These results mark an important contribution to the understanding of current relaxation during sawteeth.

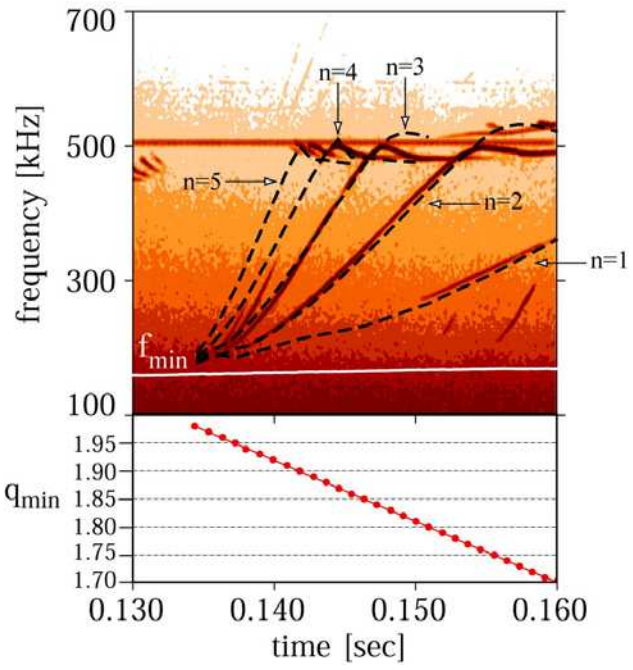

Figure 1: PCI spectrogram from the current ramp phase with NOVA modeling overlaid in black dashed traces. Toroidal mode numbers are inferred from the rate of chirping as described in Eq. (1).

The RSAEs are localized near the minimum of the q profile (q_{min}), where the magnetic shear, s = (r/q) (dq/dr), is small