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**Session GP1 - Poster Session IV.**

*POSTER session, Tuesday afternoon, October 28  
Fran Hill Southeast Exhibit Hall, ACC*

**[GP1.106] Nonlinear Dynamics of the Sawtooth Instability and its Diamagnetic Stabilization: Results from a Toroidal Hall MHD Simulation**

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The nonlinear dynamics of the sawtooth instability is studied with a fully compressible Hall MHD pseudospectral code. In the radial direction, we employ a finite-difference scheme with fourth-order accuracy while Fourier expansions are used in the poloidal and toroidal coordinates. A fourth-order Runge-Kutta scheme is used for time-advancement. The initial q-profile of the simulation is the same as one used by Aydemir [Phys. Fluids B 4, 3469 (1992)] who obtained explosive nonlinear growth from reduced two-fluid equations. In our simulation, the pressure profile in the initial equilibrium is determined by the constraint of force balance which produces diamagnetic flows not seen in Aydemir's simulation. In the context of Hall MHD, these flows cause a separation of the stagnation point of the flow from the X-point of the reconnecting field, thwarting the near-explosive growth seen by Aydemir. The full Hall MHD simulations are shown to produce sheared flow and pressure dynamics not seen in previous resistive MHD or reduced two-fluid simulations of the sawtooth instability. Conditions under which the sawtooth crash can be expected to occur, overcoming the effect of diamagnetic stabilization, are delineated. Implications for observations of sawtooth-free observations in tokamaks with  $q < 1$  will be discussed.

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