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Toroidal Simulations of Sawteeth with Diamagnetic Effects MATTHEW BEIDLER, PAUL CASSAK, West Virginia University, STEPHEN JARDIN, Princeton Plasma Physics Laboratory — The sawtooth crash in tokamaks limits the core temperature, adversely impacts confinement, and seeds disruptions. Adequate knowledge of the physics governing the sawtooth crash and a predictive capability of its ramifications has been elusive, including an understanding of incomplete reconnection, i.e., why sawteeth often cease prematurely before processing all available magnetic flux. There is an indication that diamagnetic suppression could play an important role in this phenomenon. While computational tools to study toroidal plasmas have existed for some time, extended-MHD physics have only recently been integrated. Interestingly, incomplete reconnection has been observed in simulations when diamagnetic effects are present [1]. In the current study, we employ the three-dimensional, extended-MHD code M3D-C1 [2] to study the sawtooth crash in a toroidal geometry. In particular, we describe how magnetic reconnection at the q=1 rational surface evolves when self-consistently increasing diamagnetic effects are present. We also explore how the termination of reconnection may lead to core-relaxing ideal-MHD instabilities.

[1] J. A. Breslau, S. C. Jardin, and W. Park, Phys. Plasmas 14, 056105 (2007).
[2] N. M. Ferraro and S. C. Jardin, J. Comp. Phys. 228, 7742-7770 (2009).

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