Investigating Ohmic Drive Onset Dynamics In CTH Using NIMROD

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The onset of ohmic drive in the Compact Toroidal Hybrid (CTH) has been modeled with the NIMROD three dimensional MHD simulation code[1]. Initial work[2] at zero β found that magnetic islands were formed as driven current deformed the initial stellarator fields. These islands were seen to break and form stochastic regions when sufficient ohmic drive was present.

In this work, the initial zero β model has been expanded to include initial temperature and density profiles, self-consistent ohmic heating, experimentally observed loop voltage traces, and temperature dependent parallel thermal conductivity.

Early in the CTH current rise, hesitations in the driven current are observed. Three dimensional equilibrium reconstruction indicates that these hesitations occur when the edge rotational transform is near a low order rational value. These current hesitations are also accompanied by large fluctuations in Mirnov coil signals, indicating an abundance of MHD activity. In our simulations, large, symmetry-breaking islands have been observed to develop near the edge of the plasma at times similar to the observation of current hesitations in the experiment. These islands could provide a channel by which current and heat escape the plasma, stunting the plasma evolution. The importance of perpendicular thermal transport in the resolution of these islands is highlighted.

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[2] M. G. Schlutt, C. C. Hegna, C. R. Sovinec, S. F. Knowlton, and J. D. Hebert, Nucl. Fusion **52**, 103023 (2012)

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