Abstract Submitted
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Extend MHD Simulations of Spheromaks[1] E.C. HOWELL, C.R. SOVINEC, University of Wisconsin-Madison — Nonlinear extended MHD simulations of decaying spheromaks are studied using the NIMROD code (JCP 195, 2004). Earlier work shows substantial agreement between resistive MHD simulations and experimental measurements of the Sustained Spheromak Physics Experiment (SSPX), except that simulations under-predict the peak observed electron temperature by as much as 40%. This work investigates the confinement predicted by three extended models. The first model has a resistive MHD Ohm's law but evolves separate electron and ion temperatures. The second model has a single species temperature evolution but includes ion gyroviscosity and a 2-fluid Ohm's law. The third combined model has ion gyroviscosity, a 2-fluid Ohm's law, and separate temperature evolutions. The combined model predicts the hottest electron temperature of 84eV, but undergoes a large cyclical instability that cools the plasma below 50eV. The resistive MHD model that evolves separate temperatures peaks at 72eV. The model using the 2-fluid Ohm's law with single-temperature evolution undergoes a large instability early in the sustainment phase that transitions the q-profile from a standard spheromak profile to a monotonically decreasing profile, and temperature is limited to 65eV.

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