Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Extended MHD Stabiliy Calculations of Spheromak Equilibria[1]

E.C. HOWELL, C.R. SOVINEC, University of Wisconsin - Madison — Linear extended MHD calculations of spheromak equilibria in a cylindrical flux conserver are performed using the NIMROD code (Sovinec et al, JCP 195, 2004). A series of Grad-Sharfranov equilibria are generated with β ranging from 0.4% to 4.2%, corresponding to peak electron temperatures ranging 50 to 300 eV. These equilibria use a λ profile representative of SSPX shot 14590, which measured a peak electron temperature of 325eV (McLean et al, POP 13, 2006). Resistive MHD calculations find that the $\beta = 0.4\%$ case is unstable to resonant resistive interchange modes with $\gamma\tau_A \leq 2.3\%$. These modes transition to ideal interchange as the equilibrium pressure is increased. Growth rates as large as $\gamma\tau_A = 20\%$ are calculated for the 4.2% β case. Calculations including ion-gyroviscosity show a minimal reduction of growth rate. Effects from including the Hall and Electron pressure terms in Ohm's Law and the cross-field diamagnetic heat flux are investigated. Results of related nonlinear simulations are also presented.

[1]Work Supported by US DOE.

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Date submitted: 11 Jul 2013 Electronic form version 1.4