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Numerical investigation and optimization of multi-pulse CHI spheromak performance[1] J.B. O'BRYAN, C.A. ROMERO-TALAMAS, University of Maryland, Baltimore County, S. WOODRUFF, Woodruff Scientific, Inc. — Nonlinear extended-MHD computation with the NIMROD code is used to explore spheromak formation and sustainment with multi-pulse coaxial helicity injection (CHI). The goal of this research is to optimize spheromak performance in order to find candidate modes of operation for future experimental studies. We are modeling multiple specific shots from the Sustained Spheromak Physics eXperiment (SSPX) to both diagnose the parameters that affect efficiency—in particular, how the injector current and bias flux affect plasma confinement and magnetic helicity content relative to injected power—and to validate the numerical model. Preliminary results show quantitative agreement between several synthetic and experimental diagnostic measurements. The results also find—in addition to changing the magnetic topology and being the mechanism for poloidal flux amplification [E.B. Hooper et al. PPCF 2012]—the non-axisymmetric column mode decreases the decay rate of magnetic helicity relative to the injected current. Operational regimes will eventually be extended beyond those achieved in SSPX. We are also exploring the effect of the flux conserver and injector geometries on spheromak performance.

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