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NIMROD simulations and physics assessment of possible designs for a next generation Steady Inductive Helicity Injection HIT device
JAMES PENNA, KYLE MORGAN, ISAAC GRUBB, THOMAS JARBOE, University of Washington — The Helicity Injected Torus - Steady Inductive 3 (HIT-SI3) experiment forms and maintains spheromaks via Steady Inductive Helicity Injection (SIHI) using discrete injectors that inject magnetic helicity via a non-axisymmetric perturbation and drive toroidally symmetric current. Newer designs for larger SIHI-driven spheromaks incorporate a set of injectors connected to a single external manifold to allow more freedom for the toroidal structure of the applied perturbation. Simulations have been carried out using the NIMROD code to assess the effectiveness of various imposed mode structures and injector schema in driving current via Imposed Dynamo Current Drive (IDCD). The results are presented here for varying flux conserver shapes on a device approximately 1.5 times larger than the current HIT-SI3 experiment. The imposed mode structures and spectra of simulated spheromaks are analyzed in order to examine magnetic structure and stability and determine an optimal regime for IDCD sustainment in a large device. The development of scaling laws for manifold operation is also presented, and simulation results are analyzed and assessed as part of the development path for the large scale device. 1. T. Jarboe et al., "Imposed-Dynamo Current Drive (IDCD)." APS Meeting Abstracts. 2012.

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