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Spheromak Formation and Toroidal Mode Activity in HIT-SI
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A spheromak is formed and sustained for the first time using Steady Inductive Helicity Injection (SIHI). A steady state spheromak with n=0 symmetry is formed and sustained through non-linear relaxation from the two inductive injectors, which provide a magnetic structure with n=1 symmetry. A spheromak with approximately 34 kA of toroidal current is achieved using injector current amplitudes of 20 kA. Internal magnetic probe data agree remarkably well with the plasma being in the 3D Taylor state. The Taylor state model predicts a separatrix between the injector fields and the spheromak core at a threshold that has been greatly exceeded in the experiment. The spheromak often undergoes a reversal of the n=0 toroidal current while the magnitude of an n=2 mode peaks. After the reversal, the toroidal current is equal or greater in magnitude than before and the magnetic helicity handedness is unchanged. Spheromak discharges often terminate with a growing n=1 locked mode. Comparisons will be presented between experimental data and predictions from the 3D Taylor state model for the n=0, n=1, and n=2 Taylor states.

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