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The inductive, steady-state sustainment of stable spheromaks A. C. HOSSACK, T. R. JARBOE, K. D. MORGAN, D. A. SUTHERLAND, C. J. HANSEN, C. J. EVERSON, J. M. PENNA, B. A. NELSON, University of Washington — Inductive helicity injection current drive with imposed perturbations has led to the breakthrough of spheromak sustainment while maintaining stability. Sustained spheromaks show coherent, imposed plasma motion and low plasma-generated mode activity, indicating stability. Additionally, record current gain of 3.9 has been achieved with evidence of pressure confinement. The Helicity Injected Torus - Steady Inductive (HIT-SI) experiment studies efficient, steady-state current drive for magnetic confinement plasmas using a novel experimental method which is ideal for low aspect ratio, toroidal geometries and is compatible with closed flux surfaces. Analysis of surface magnetic probes indicates large $n = 0$ and 1 toroidal Fourier mode amplitudes and little energy in higher modes. Biorthogonal decomposition shows that almost all of the $n = 1$ energy is imposed by the injectors, rather than plasma-generated. Ion Doppler spectroscopy (IDS) measurements show coherent, imposed plasma motion of +/-2.5 cm in the region inside $r \approx 10$ cm ($a = 23$ cm) and the size of the separate spheromak is consistent with that predicted by Imposed-dynamo Current Drive (IDCD). Coherent motion indicates that the spheromak is stable and a lack of plasma-generated $n = 1$ energy indicates that the maximum q is maintained below 1 for stability during sustainment.

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