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Alfvénic plasma flow during spheromak preformation stage[1]
DEEPAK KUMAR, PAUL BELLAN, California Institute of Technology — Spheromak formation consists of a series of dynamic steps whereby highly localized plasma near the electrodes evolves towards a Taylor state equilibrium. The dynamical evolution stage is often modeled as a series of equilibrium states. However, the experiments at the Caltech Spheromak facility have revealed that non-equilibrium Alfvénic flows are driven during these preliminary stages by unbalanced $\vec{J} \times \vec{B}$ forces. The flow velocity was measured using time of flight measurements using a novel He-Ne density interferometer with low phase ambiguity $\sim 1^{\circ}$(D. Kumar and P. M. Bellan, Rev. Sci. Instrum. **77**, 083503 (2006)). The flow velocities depend on the gas species inertia and lead to a collimated plasma jet with $\beta \sim 1$(P. M. Bellan, Phys. Plasmas **10** Pt2, 1999 (2003)). Experiments are underway to characterize how the flow velocity depends on the initial neutral gas density profile. Under some conditions, a layer of neutral gas with density $\sim 10^{23}/\mathrm{m}^3$ and thickness ~ 1 cm is observed to move in front of the plasma jet. The neutral gas density in the layer was estimated using the Gladstone-Dale relation(F. J. Weinberg, Optics of flames (1963)).

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