

Spheromak merging and FRC formation studies at SSX-FRC

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We report the results of coaxial co- and counter-helicity spheromak merging studies at the Swarthmore Spheromak Experiment (SSX). The present configuration of SSX is optimized to study FRC formation and stability by complete counter-helicity spheromak merging. In forthcoming experiments the merging will be magnetically restricted with a pair of midplane coils to determine how the stability of the resulting magnetic configuration, a doublet-CT, depends upon the quantity of toroidal flux annihilated from the initial spheromaks.

The diagnostic set at SSX, featuring the capability of measuring up to 600 magnetic field components at 800-ns time resolution, permits detailed studies of the dynamic three-dimensional magnetic structures resulting from these merging experiments. A compact array of magnetic probes has been used for local reconnection measurements, while a distributed array of probes has been used to examine global magnetic structure. Counter-helicity merging produces an FRC that persists for many Alfvén times before an instability grows at a rate much slower than ideal. The oppositely directed toroidal field of the initial spheromaks does not completely annihilate. Co-helicity merging produces a single elongated spheromak that evolves on similar time scales and tilts. In addition to the magnetic activity, plasma flows and heating are being studied with a new mach probe and soft x-ray detector.