# HIFLUX: OBLATE FRCS, DOUBLE HELICES, SPHEROMAKS AND RFPS IN ONE SYSTEM*

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Field-Reversed Configurations (FRCs) combine high $\beta$ ($\approx 1$) with favorable compact torus (CT) topology, making them very potentially attractive for magnetically confined fusion power reactors. However, FRC stability and confinement are still unclear. We are proposing HIFLUX, an experimental device to make and investigate high-flux oblate FRCs. Oblate FRCs are especially compact and can also be tilt stable,[1] yet there has been essentially no experimental investigation of these interesting and promising objects. It is extremely difficult to make FRCs by conventional techniques, because they lack toroidal magnetic field to confine the initial plasma, which must be started and grown with $\beta \approx 1$. If FRCs are to become relevant to thermonuclear fusion, they must be made and studied in the MHD regime ($s \geq 10$) and with much larger magnetic fluxes than hitherto possible.

HIFLUX will produce FRCs by merging a counterhelicity pair of spheromaks.[2] The necessary high flux spheromaks will be made by large, specialized, magnetic helicity sources, each producing a Taylor-relaxed double helix (DH). The DH accumulates helicity and flux from a primary plasma source prior to expanding into the main plasma chamber, where it relaxes into a spheromak. The long, small-diameter DH drift tube from the source reduces perturbations to the chamber and its plasma, so limitations of plasma sources integrated into the main chamber are avoided. Inductively driven RFP sources are planned for the highest flux operation, but HIFLUX would begin with conservative, magnetized hollow-electrode sources, extrapolated from a single hollow-electrode source cum short double helix that successfully produced spheromaks more than 15 years ago.[3] High-flux spheromaks can also be made in the HIFLUX chamber and studied for their own sake by injecting single or cohelicity double helices.

[1]E.V. Belova, S.C. Jardin, H. Ji, M. Yamada, R. Kulsrud, Phys. Plasmas **8** (2001) 1267.
[2]Y. Ono, A. Morita, M. Katsurai, Phys. Fluids B **5** (1993) 3691.
[3]J.C. Fernandez, *et al.*, Phys. Fluids **B1** (1989) 1254.

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