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Observation of a nonaxisymmetric MHD self-organized state¹

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A nonaxisymmetric stable magnetohydrodynamic (MHD) equilibrium within a prolate cylindrical conducting boundary has been produced experimentally at SSX (Swarthmore Spheromak Experiment). It has $m = 1$ toroidal symmetry, helical distortion, and flat λ profile. Each of these observed characteristics are in agreement with the magnetically relaxed minimum magnetic energy Taylor state. The Taylor state is computed using the methods described by A. Bondeson *et al.*, Phys. Fluids **24**, 1682 (1981) and by J. M. Finn *et al.*, Phys. Fluids **24**, 1336 (1981) and is compared in detail to the measured internal magnetic structure. The lifetime of this nonaxisymmetric CT is comparable to or greater than that of the axisymmetric CTs produced at SSX, thus suggesting good confinement. Despite varied initial conditions determined by two helicity injectors on the SSX device, this same equilibrium consistently emerges as the final state. These results therefore describe a new example of self-organization in an MHD plasma.

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