Abstract Submitted
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Plasma driven by helical electrodes[1] CIHAN AKCAY, JOHN FINN, RICHARD NEBEL, DANIEL BARNES, NEAL MARTIN, Tibbar Plasma Technologies — We present a plasma state driven by helically symmetric electrodes (m, n) in the presence of a uniform axial magnetic field in a periodic cylinder[1], with applications as an electrical transformer or for tailoring the current profile in a tokamak or RFP. For strong drive there is a (m, n) state with mean-field current density and flat $q_0 \approx m/n = 1$ in the interior. It has large helical flows, a bi-directional parallel current density λ, and an $O-$ line encircled by all of the field lines. We show a Cowling-like theorem $\langle \eta \lambda B^2 \rangle = 0$ and discuss the relationship with magnetic helicity. The transient stage is discussed. Integration of the current density streamlines is used to quantify primary-to-secondary leakage for the transformer application. Results varying (m, n) the plasma length are presented. Sensitivity studies to (a) boundary conditions, (b) resistivity profile, and (c) electrode shape are presented. Results with finite (m, n) radial magnetic field are introduced, showing high transformer efficiencies. 3D studies of finite length plasmas are presented. [1] C. Akcay, J. M. Finn, R. A. Nebel and D. C. Barnes, "Electrostatically driven helical plasma state", Phys. Plasmas 24, 052503 (2017).

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