Computational modelling of quasi-single helicity states in an RFP

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Experiments have shown that RFP plasmas can self-organize to a quasi-single helicity (QSH) equilibrium with a helical axis [1,2]. These states have improved confinement and lower magnetic turbulence levels compared to a standard RFP plasma which has multiple helicities in the magnetic spectrum. These experiments all have circular, or nearly-circular cross-sections. This work explores the impact of boundary shaping on access into and out of quasi-single helicity states in reverse-field-pinch (RFP) plasmas. The VMEC code can obtain computational ideal MHD equilibria with a helical axis and a symmetric boundary [3]. In this work, we analyze the VMEC input parameters that control access to QSH states and test the impact of 2D-shaping of the boundary on RFP equilibria. Particular attention is paid to the impact that shaping has on access to quasi-single helicity states. The effect of increasing elongation and triangularity are tested systematically. Increased elongation results in lower plasma current for the same safety factor profile and a larger radial excursion of the helical axis in a QHS state. Optimization of the boundary coefficients targeting an increased radial excursion of the helical axis is undertaken. Results will be presented.

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References

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