# Hysteresis in Single Helicity and Quasi-Single Helicity States in Reversed Field Pinches

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**Abstract**

We have performed 3D simulations of RFPs over a wide range of Hartman number H in search for single helicity and quasi-single helicity (QSH) states. Pure single helicity states are found only for small H, in agreement with results found by the Padua group. QSH states have a spectrum which consists of mostly one helicity with small amplitudes of other helicities. Multiple helicity (MH) states, on the other hand, have a wide spectrum. In contrast with Padua results, we find that there is a large region of hysteresis, i.e. a large range of H over which both QSH and MH states exist, and specifically, QSH states occur for much larger H than observed previously. We will show magnetic field surfaces of section for these RFP states obtained with a new field line integrator code. This code preserves the divergence free character of the magnetic field exactly by fitting the vector potential with cubic splines and differentiating the spline formula analytically. The field lines are then integrated by a volume preserving integrator which is time centered and second order accurate.