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Can helical RFP states be explained by simple linear tearing mode theory? JEFFREY FREIDBERG, Plasma Science and Fusion Center, Massachusetts Institute of Technology, LUCA GUAZZOTTO, University of Rochester — One very interesting experimental observation in recent years is the transition of an RFP plasma from a cylindrically symmetric state to a helically symmetric state which occurs above a critical value of plasma current. Helical RFP states form even though the boundary conditions are cylindrically symmetric. We focuse on understanding the basic physics that leads to the formation of such states. Specifically, we pursue a "minimal model," containing the minimum amount of physics necessary to explain the transition, even if only semi-quantitatively. Since it is believed that helical states form as saturated tearing modes, we need to include tearing stability in our model. We do not have the goal to explain helical states by a nonlinear analysis of tearing mode saturation. Rather, we try to obtain, by a combination of analytical linear stability theory and simple numerical calculations, a plausible trajectory in the $F-\Theta$ space for the slowly varying RFP equilibrium profiles that will ultimately bring the system to the onset of a dominant unstable tearing mode. Other critical elements in our model are stability analysis of ideal modes, the presence of an ideal wall and most importantly, the goal to obtain an unstable tearing mode with the same helicity as experiments.

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