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4P62 - Electrostatic gyrokinetic simulations of sheared Z-pinch

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Z-pinch is known to be unstable due to MHD kink ($m = 1$) and sausage ($m = 0$) modes [1]. Recent experiments demonstrated that these modes can be stabilized by a radially sheared axial flow [2]. Typical MHD models are usually unable to adequately describe evolution of short wave length modes as they ignore finite ion gyroradius ρ_i effects. Gyrokinetic simulations of the $m = 0$ mode performed in the present paper provide a growth rate as a function of the shear amplitude and axial mode number k. The mode stabilization by a sheared flow is observed in the simulations. The simulations are carried out with high order finite volume COGENT code and are analyzed for the parameters characteristic of the FuZE experiment [2]. For the case of a Bennett equilibrium, high k modes are shown to require less shear amplitude for stabilization than $k\rho_i \approx 1$ modes. In addition, a local analytical linear analysis is performed and shown to be in agreement with simulation results.

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1. B. B. Kadomtsev, Sov. Phys. JETP 10, 780 (1960).
2. H. McLean, U. Shumlak, and B. Nelson, 2016 Exploratory Plasma and Fusion Workshop, Aubunr, Alabama, 2016.

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