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Line-tied MHD modes: effect of plasma pressure, axial boundary condition and axial flow FRANCESCO ARCUDI, Politecnico di Torino, GIAN LUCA DELZANNO, JOHN M. FINN, Los Alamos National Laboratory — Recent 3D nonlinear magnetohydrodynamic (MHD) simulations of astrophysical jets [1] showed a narrow jet-like region with very tightly wound magnetic fields, very suggestive of jet observations. These results were unexpected because such tightly wound magnetic fields should be violently MHD unstable. In order to make direct contact with the simulations of Ref. [1], we present a linear stability study in resistive MHD in cylindrical geometry. In this work, stability is studied including axial flows and finite plasma pressure. We also changed the axial boundary conditions to model those typical of astrophysical jets and laboratory experiments, using line-tying at one end of the field lines and non-line-tied boundary conditions at the other end [2]. The numerical results show that pressure strongly shifts the marginal stability threshold relative to the Kruskal-Shafranov threshold and a monotonically increasing pressure profile stabilizes the plasma. On the other hand, non-line-tied boundary conditions have little effect on marginal stability for typical parameters. All the results are supported by analytical studies based on reduced ideal MHD. [1] H. Li, G. Lapenta, J. M. Finn, S. Li, and S. A. Colgate, Astrophys. J. 643, 92 (2006). [2] D. D. Ryutov, I. Furno, T. P. Intrator, S. Abbate, and T. Madziwa-Nussinov, Phys. Plasmas 13, 032105 (2006).

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