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The curious disappearance of MHD compressibility stabilization in closed line systems ANTOINE CERFON, JEFFREY FREIDBERG, Massachusetts Institute of Technology — Ideal MHD theory shows that in a closed field line configuration interchange modes are stabilized for sufficiently gradual pressure profiles. The stabilizing effect is provided by plasma compressibility. More sophisticated models which treat the ions with the more realistic drift kinetic equation also exhibit compressibility stabilization for MHD modes, although in a modified form. The present work reexamines the MHD compressibility stabilization problem using a fluid model for electrons but with a full Vlasov treatment for the ions. There are two main results to report. (1) An exact quadratic energy integral is derived that is valid for arbitrary 3-D static MHD equilibria, for either ergodic or closed field line configurations. This relationship shows that at marginal stability the compressibility stabilization term vanishes identically–there is no compressibility stabilization! The energy integral represents a generalization of an earlier Vlasov-fluid model result which was valid only for ergodic systems whose marginal stability is inherently incompressible. The new result includes both the kinetic ion and fluid electron compressibility effects and it is thus curious that the compressibility stabilization vanishes. (2) The second result is a derivation of the actual dispersion relation for a linear hard-core Z-pinch. It is shown that resonant particles are responsible for the vanishing of compressibility stabilization.

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