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Does Flow Stabilize or Destabilize MHD Instabilities? ALEXEI KOUZNETSOV, JEFFREY FREIDBERG, JAY KESNER, MIT — It is well known that a static (i.e.$\mathbf{v} = 0$) closed field line configuration, such as a levitated dipole, or hard-core Z-pinch, can be stabilized against ideal MHD interchange modes when the pressure gradient is sufficiently weak. The stabilizing effect is provided by plasma compressibility. However, many laboratory plasmas exhibit a sheared velocity flow, (i.e.$\mathbf{n} \cdot \nabla \mathbf{v} \neq 0$), and this flow may affect the marginal stability boundary. The present work addresses this issue by an analysis of the effect of axially sheared flow on ideal MHD stability in a hard-core Z-pinch, which is a cylindrical model for the levitated dipole configuration. Specifically, the goal is to learn whether sheared flow is favorable, unfavorable, or neutral with respect to MHD stability. Analytic calculations of marginal stability for several idealistic velocity profiles show that all three options are possible depending on the shape of the shear profile. This variability reflects the competition between the destabilizing Kelvin-Hemholtz effect and the fact that shear makes it more difficult for short wavelength interchange perturbations to form. Numerical calculation are also presented for more realistic experimental profiles and compared with the results for the idealized analytic profiles.

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