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Global stability of MHD disk equilibria with sheared flows: a unified perspective BERTRAND LEFEBVRE, AMITAVA BHATTACHARJEE, FATIMA EBRAHIMI, Center for Magnetic Self-Organization, University of New Hampshire — The velocity shear-driven magneto-rotational instability (MRI) is believed to contribute to turbulence and momentum transport in accretion disks. It is one of a broader class of velocity shear-driven instabilities, in which the stable continuum is generically converted into a sequence of overstable discrete modes. Such instabilities were treated mathematically and numerically by Bondeson et al. [PoP 30, 2167 1987], who focused on fusion applications and considered primarily the effect of sheared axial flows. In order to develop a unified perspective, we first extend the plasma column equilibria studied by Bondeson et al. to include a sheared azimuthal flow. In addition to Suydam modes destabilized by the flow in the vicinity of $\mathbf{k} \cdot \mathbf{B} = \mathbf{0}$ surfaces, we find an MRI-like instability driven by the azimuthal flow. Second, we consider a Couette flow with a sheared equilibrium magnetic field as well as a small axial velocity added to the azimuthal flow. Such a generic equilibrium can have different stability properties than predicted by standard analyses, with non-axisymmetric modes linearly growing faster than axisymmetric ones. These general classes of instabilities are potentially important for MRI-generated turbulence in accretion disks and laboratory experiments.

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