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Stability of an axisymmetric, non-paraxial mirror and its applications for a fusion neutron source[1] ROGER WALEFFE, ETHAN PETERSON, VLADIMIR MIRNOV, CARY FOREST, Univ of Wisconsin, Madison — Interchange stability analysis is underway for the design and development of an axisymmetric, non-paraxial (spherical) mirror. Such a system takes advantage of favorable magnetic field line curvature to stabilize the m = 1 flute mode, corresponding to a radial displacement of the plasma as a whole. Our results indicate the presence of a stability ring at intermediate values of magnetic flux inside the separatrix. As a result, any pressure distribution inside such a region is also stable. Optimizations for maximum stable volume peak where $B_{Helmholtz}/B_{Mirror} = 0.1$ at the origin, independent of cylindrical Z location or mirror coil shape. An eigenvalue solver in the ballooning approximation has been developed and applied to the spherical mirror equilibria: it exhibits stability with respect to high-m modes for inner portions of the plasma volume. The stability limit is seen to decrease with increasing plasma beta and is heavily dependent on the pressure profile. Inherent MHD stability, coupled with high-temperature superconducting technology provides a promising path forward for the resurgence of axisymmetric mirrors. Work is ongoing to model a standalone high-field spherical mirror as a fusion neutron source using the GENRAY ray tracing and CQL3D wave deposition codes.

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