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OV/P-07: Fusion Prospects of Axisymmetric Magnetic Mirror Systems

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Studies of the magnetic mirrors have been started in 50s –60s of the last century. Very soon it was found out that axially symmetric mirrors suffer from the curvature-driven instabilities which results in unacceptable plasma losses. Introduction of non-axisymmetric (quadrupole) configurations with min-B magnetic field improved plasma confinement significantly. Then, plasma losses associated with less destructive kinetic instabilities become dominative. Later on, the methods of suppression of the kinetic instabilities were successfully developed and confinement was further improved. However, it was recognized that even the axial plasma losses determined by classical binary collisions appear to be too high for practical application of the mirrors. In the 70s, some ideas emerged how to reduce these losses. These ideas are briefly reviewed in [1] and in the references therein. Another advance in magnetic mirror studies was invention of axisymmetric mirrors with improved longitudinal and transverse plasma confinement. Several techniques for achieving MHD stabilization of the axisymmetric mirrors are considered in [2]. These versions of the mirror systems are of particular interest as neutron sources, fusion-fission hybrids, and pure fusion reactors. At present, two versions of the advanced magnetic mirrors, namely a gas dynamic trap (GDT) and multi mirror confinement system are studied in the Budker Institute.

References
[1] A.V. Burdakov, A.A. Ivanov, E.P. Kruglyakov, Plasma Phys. Cont. Fus., 52 124026 (2010).
[2] D.D. Ryutov, H.L. Berk, B.I. Cohen, A.W. Molvik, and T.C. Simonen, Phys. Plasmas 18, 092301 (2011).

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