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PLASMA CONFINEMENT IN A MULTIPLE-MIRROR TRAP WITH AXISYMMETRIC AND HELICAL MAGNETIC CONFIGURATION *)

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Multiple-mirror suppression of the axial losses of the thermalized plasma component is one of the possible ways to increase particle and energy confinement time in the open trap. This method is proposed for improved plasma confinement for the next-step open trap GDMT [1]. The momentum transfer from a periodic magnetic field to the plasma can be increased if the magnetic mirrors move in the direction opposite the flow at a speed comparable to the flow velocity. Recently, it was proposed to create moving multiple mirrors by the rotation of the plasma in a magnetic field with helical symmetry [2]. The exponential dependence of the confinement efficiency on the length of the helical field section and the radial pinching of the plasma were predicted [3]. Both of these effects increase the effectiveness of this method compared to the classical multiple-mirror scheme.

Multiple-mirror confinement requires the momentum exchange between the trapped and passing populations. In a hot plasma, the frequency of Coulomb scattering is insufficient, so any anomalous scattering of the particles leads to improved confinement. In the helical system the population of the trapped particles, moving at the speed of magnetic perturbations, is an additional source of energy for the oscillations causing scattering itself. In addition, a combination of periodic fields with different symmetries was proposed for additional particle scattering [4].

The concept of helical confinement is being tested at SMOLA device in Budker INP. A detailed description of the device is given in [5]. Previously, the possibility of the plasma flow suppression by the helical magnetic mirror was demonstrated. The experimental scaling matches the theory. 1.6-fold increase in plasma density in the confinement region was observed [6, 7].

The report presents the results of a direct experimental comparison of the plasma flow suppression by the multiple-mirror section with axial and helical symmetry, as well as with their combination at various experimental parameters.

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