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PLASMA LONGITUDINAL VELOCITIES AT VARIOUS DENSITIES AND MAGNETIC CONFIGURATIONS IN THE OPEN MAGNETIC MIRROR TPAR SMOLA *)

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The physics of suppression of longitudinal plasma losses confined in open magnetic systems is actively studied at the BINP. Improved plasma confinement in a helical magnetic field was experimentally proven at the SMOLA device [1]. The plasma rotates in crossed [E×B] fields. In the rotating reference frame, the velocity of magnetic variations is comparable to the longitudinal flow velocity. In the confinement regime, the velocity of magnetic variations is directed along the plasma density gradient.

The plasma flow velocity is measured by Mach probes [2], where the electrodes are molybdenum coated flat quartz plates. The probes are installed at several points along the length of the transport section. The ion temperature is determined by the broadening of the Hα emission spectral line [3], the electron temperature is measured by emission probes, and the density is measured by double probes.

The dependence of longitudinal velocities on plasma density were compared experimentally in the confinement and acceleration of plasma flow regimes. In the acceleration mode, evidence was found that the longitudinal velocity in the helical field ($V \sim 1.8 \cdot 10^6$ cm/s) exceeded the longitudinal velocity in the straight field in the narrow density range.

In the plasma confinement mode, the dependence of the flow velocity on the plasma density was obtained in various magnetic configurations: axisymmetric and helical corrugations. An experimental series was also carried out with the addition of the magnetic plug at the input and output of the transport section. The greatest changes in the flow velocity were observed with an increased magnetic field at the output of the transport section [4].

The report will compare the dependences of the ratio of the flow velocity to the thermal ion velocity on the mean free path for regimes with the same mirror ratio of the axisymmetric corrugation and the average cross-sectional mirror ratio of the helical corrugation.

References

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