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PLASMA HEATING AND CONFINEMENT IN GOL-NB MULTIPLE-MIRROR TRAP *)

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The project of a new generation GDMT [1] open trap with sub-fusion plasma provides for the use of special magnetic sections to suppress longitudinal losses from the plasma confinement region. One of the variants of such sections is the classical axisymmetric multiple-mirror systems having periodic modulation of magnetic induction along the axis [2,3,4]. At a sufficiently high collisibility of $\nu^* \sim 1$ (where $\nu^* = \lambda/l$ is the ratio of the ion free path length ions to the corrugation period), a friction force arises in such a system between populations of locally trapped and transiting particles, reducing losses from the trap.

The GOL-NB device [5,6,7] was created at BINP to study the multiple-mirror confinement physics at moderate experimental scales. It includes a 2.5 m-long central gas-dynamic trap with a field in the center $B(z=0) = 0.3$ T; adjacent sections of a strong field c $B_{max} = 4.5$ T, which can be configured either in a solenoid mode or as multiple-mirror systems with 13 corrugation periods of $l = 22$ cm and corrugation depth $R_{mm} = 1.4$; as well as tanks of magnetic flux expanders that house end plasma receivers. A low-temperature starting plasma with $n \sim (1\text{-}10)\times10^{19}$ m^{-3} and $T_e \approx 7$ eV is created using an arc source located in one of the end tanks. In the experiments under discussion, plasma heating in the central trap was provided by two neutral beam injectors of 25 keV, 0.5 MW each. The duration of plasma existence is 3–5 ms that is determined by the energy supply of the magnetic system.

The report will present the results of experiments with solenoidal and multiple-mirror configurations of strong field sections. The mechanisms providing plasma stability at different stages of its existence, the process of plasma heating by neutral beams, channels of particle and energy losses, and a comparison of two magnetic configurations will be discussed.

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