SPATIAL AND FREQUENCY STRUCTURE OF OSCILLATIONS IN SMOLA THE OPEN HELICAL TRAP [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.030

1Inzhevatkina A.A., 1Sudnikov A.V., 1Tolkachev M.S., 2Ustyuzhanin V.O., 1Chernoshtanov I.S.

1Budker Institute of Nuclear Physics, Novosibirsk, Russia, M.S.Tolkachev@inp.nsk.su
2Novosibirsk State University, Novosibirsk, Russia

To grow the plasma parameters in open traps to thermonuclear ones, it is necessary to suppress particle losses along the magnetic field lines. The helical confinement method proposed for this purpose in the INP SB RAS [1] is currently undergoing experimental testing at the SMOLA device [2]. The idea of the method is to place a rotating plasma in a helical magnetic field. In the plasma reference frame, the maxima of the magnetic field will move. As a result, the trapped particles form a reverse flow of ions are directed to the confinement area. The scaling of confinement efficiency obtained in the experimental results [3] is consistent with theoretical [4] estimates.

Effective confinement in multiple-mirror systems is achieved if the free path of ions is equal to the length of one cell. In hot thermonuclear plasma, this condition is not fulfilled when only Coulomb collisions are taken into account. However, the results of experiments at the GOL-3 installation showed that when the bounce instability develops in the plasma, anomalous collisionality occurs, and the energy lifetime of the plasma increases [5]. In the SMOLA device, the flows of trapped and flowing particles are oppositely directed, which contributes to the development of oscillations and can lead to the occurrence of anomalous collisionality. The study of these processes will make it possible to find out whether they are capable of providing the necessary free path length in the helical end sections of open traps with subthermonuclear plasma.

The report presents the spatial and temporal characteristics of plasma potential fluctuations, which are recorded by emission probes. The oscillations were studied in different directions of the longitudinal motion of magnetic disturbances, as well as in the mode without a helical field. The analysis of the oscillation characteristics dependences on experimental parameters, such as the intensity of the leading magnetic field, the value of the field corrugation, expressed in the average of the mirror ratio along the force lines over cross-section of the transport section, plasma density, etc., is given. The issue of observed oscillations the interrelationship with anomalous collisionality is discussed.

References

1. Beklemishev A.D., Helicoidal system for axial plasma pumping in linear traps, Fusion Sci. Technol. 63 (1T), 355–357 (2013).
2. Sudnikov A.V. et al., SMOLA device for helical mirror concept exploration, Fusion Eng. Des. 122, 86-93 (2017).
3. Sudnikov A.V. et al., Plasma flow suppression by the linear helical mirror system, J. Plasma Phys. 88, 905880102 (2021).
4. Beklemishev A.D., Radial and axial transport in trap sections with helical corrugation, AIP Conference Proceedings 2016 1771, 040006 (2016).
5. Koidan V.S. et al., Progress on the multimirror trap GOL-3, Fusion Sci. Technol. 47, 35-42 (2005).
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/BI-Tolkachev.docx) [↑](#footnote-ref-1)