HYBRID MODEL OF DIAMAGNETIC BUBBLE EQUILIBRIUM IN OPEN TRAP [[1]](#footnote-1)\*)

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The diamagnetic confinement mode (diamagnetic “bubble”) [1] is designed to significantly increase the plasma confinement time in open axisymmetric gas-dynamic traps (GDT). The idea is to form a high-pressure plasma “bubble” with  in the central region of the trap. Inside the bubble, the magnetic field is close to zero, since it is almost completely displaced by the plasma. Estimates show that this results in a significant increase in mirror ratio and an effective improvement of the confinement.

Previously, a one-dimensional MHD model of the bubble equilibrium was constructed in the cylindrical approximation for the case of the isotropic plasma and constant temperature [1]. Further, in [2], this model was generalized to the two-dimensional case and now takes into account the effects of non-paraxiality associated with the tension of the field lines. Nevertheless, inside the bubble, the magnetic field is close to zero, which means that the hydrodynamic approximation may be violated, and the kinetic effects should be taken into account. Fully kinetic model of the bubble equilibrium with the distribution function isotropic in the transverse plane is presented in [3]. The dynamics of individual particles in the diamagnetic trap is considered in [4]. Complete computer simulations of a diamagnetic bubble are also underway at the moment [5-7].

This work is devoted to the construction of a hybrid model of the diamagnetic bubble equilibrium in an axisymmetric open trap in the cylindrical approximation. We assume the plasma to consist of two components: (1) hot ions, high-energy particles, which we describe in terms of kinetic theory; (2) cold equilibrium background plasma, which is described using MHD. As a result of numerical simulation, bubble-type equilibrium solutions are obtained in a wide range of parameters; in particular, plasma equilibria of the GDMT [8] in the diamagnetic confinement mode are calculated.

References

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