Ion-Sound Waves in UHF Discharge Plasma Injected in Open Magnetic Trap

S. Nanobashvili[1], Z. Beria[1], G. Gelashvili[1], G. Gogiashvili[1], I. Nanobashvili[1], G. Tavkhelidze[1], I. Tsevelidze[1], G. Van Oost[2,3,4]

[1]*Andronikashvili Institute of Physics of the Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia*

[2]*Department of Applied Physics, Ghent University, Ghent, Belgium*

[3] *National Research Nuclear University "MEPHI", Moscow, Russia*

[4]*National Research University "Moscow Power Engineering Institute", Moscow, Russia*

Different methods of filling open magnetic trap with plasma are used in various experiments. Contactless methods are used most frequently and lately ultra-high frequency (UHF) methods of plasma accumulation in a trap were most widely applied. As a rule, plasma formation takes place in the trap itself in the electron cyclotron resonance (ECR) regime. However, this method has various disadvantages. In particular, the range of magnetic field variation in the trap is strictly limited by the existence of an UHF discharge in the magnetic field. Together with a change of magnetic field, discharge regime and plasma parameters change. The most important disadvantage is that the "hot" region of UHF wave absorption in the plasma is in the trap itself, which is often undesirable. Therefore, the application of an independent plasma source with controllable parameters located far from the trap and from which the "target" plasma is injected in the trap is of great interest.

The present work deals with this new application. The independent stationary UHF plasma source and its characteristics are described. The possibility of filling an open magnetic trap with uniform field by plasma injected from the source as well as the properties of plasma and its low frequency (LF) oscillation characteristics in the trap are investigated.

Experiments showed that plasma which is formed in an independent stationary UHF source in the ECR regime for pressure $\boldsymbol{p} < 1 \cdot 10^{-3}$ Torr, magnetic field in the trap $\boldsymbol{H_t} > 400$ Oe and distance between the plasma source and solenoid $\ell < 80$ cm, fills the trap very efficiently. As a result, plasma with controllable density within the range $10^8 \div 10^{12}$ cm^{-3} and temperature $2 \div 3$ eV is accumulated in the trap. Near the UHF plasma source and also in the trap first, second and third harmonics of the ion sound wave together with ion cyclotron oscillations are reliably detected.