studies of ecr discharge in the field of a solenoid supported by powerful millimeter-range gyrotron radiation

Shaposhnikov R.A., Skalyga V.A., Golubev S.V. and Izotov I.V.

Institute of Applied Physics, Russian Academy of Sciences, Nizhni Novgorod, Russia, shaposhnikov-roma@mail.ru

Nowadays one of the widespread types of ion sources is systems with heating of plasma by microwave radiation in a magnetic field under the conditions of the electron cyclotron resonance (ECR). In a purpose to obtain high values of ion beam currents there is a need of high plasma density. Due to this fact one of the main directions of development of ECR ion sources is to increase the frequency and power of microwave heating.

In modern systems gyrotron is increasingly used as a source of microwave radiation. Earlier in the IAP RAS it has been demonstrated that the use of gyrotron radiation to heat the plasma in simple magnetic traps produces beams of light and multiply charged ions with record current.

However, the disadvantage of such systems is that they are favorable for development of magneto-hydrodynamic instabilities, and because of that there is a need to suppress them. Due to this fact there is a complication of the design of installation which leads to additional technological complexity and material costs.

So there was proposed to explore the prospects of creating a source of hydrogen ions on the basis of ECR discharge in a solenoid supported by powerful gyrotron radiation. Opposed to simply mirror trap this system is MHD stable, a high power of microwave radiation allows to maintain an electron temperature on a sufficient level for high efficiency of ionization of light gas.

The paper presents the first results of research of gas of the ECR breakdown in such circumstances and there is an analysis of the prospects for the use of such plasma to form the ion beam.