Study on Flow Structure Formation in a Diverging Magnetic Field with the HYPER-II Device

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Recently, ion streamline detachment from the magnetic field lines has been observed in a diverging magnetic field of an ECR plasma [1]. The detachment takes place when the non-adiabaticity parameter of ion becomes order of unity. The flow structure in the detachment region is qualitatively different from that in the magnetized region: the perpendicular electric field, which makes an azimuthal ExB rotation of plasma, is produced.

To understand the plasma flow structure formation in inhomogeneous magnetic field, we have performed the experiments with the HYPER-II device at Kyushu University in Japan. The HYPER-II device consists of two cylindrical vacuum chambers: one is the plasma production chamber with a diameter of 0.3 m and an axial length of 0.95 m and the other is the plasma diffusion chamber with a diameter of 0.76 m and the axial length of 1.3 m. The high-density plasma was produced by electron cyclotron resonance (ECR) heating with a 2.45 GHz microwave.

We have been interested in flow structure in a weaker magnetic field, and have measured the flow and electromagnetic fields in the magnetic field region from 10 G to 800 G. In the diffusion chamber, where the magnetic field strength is less than 400 G, it is expected that the non-adiabaticity parameter becomes much less that unity, and thereby, the streamline detachment may take place. The ion flow velocity is measured with the directional Langmuir probe (DLP) and the laser induced fluorescence (LIF) spectroscopy methods.

The first plasma was produced on last summer. The high density ECR plasma, which exceeds the cut-off density, has been observed in the plasma production region, and it is found that the density profile along the chamber axis is slightly weak compared with the expected profile calculated by the magnetic field scaling. In the poster session, we will show the design of the HYPER-II experiments and also show the preliminary experimental results in a diverging magnetic field.

[1] K. Terasaka et al., Phys. Plasmas **17**, 072106 (2010).