Measurement of electron energy distribution function in rotating magnetic field plasma source

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Rotating Magnetic Field (RMF) is one of the methods for creating Field Reversed Configuration (FRC). By applying transverse magnetic field rotating in azimuthal direction with frequency much higher than ion cyclotron frequency and much lower than electron frequency, only electron can keep up with the variation of magnetic field, and electron current is driven. This net toroidal plasma current creates poloidal magnetic field and finally forms FRC's closed magnetic surfaces surrounded by open magnetic field created by external coils.

Since RMF can maintain stable plasma and drive current without electrode, it is expected as a plasma source in neutral beam injection (NBI), plasma propulsion and so on. In the field of plasma propulsion, study on RMF as an acceleration method has already begun [1]. As s plasma source for NBI, it is important to create high density plasma with small loss. In order to utilize RMF as a plasma source, measurement of various plasma parameters is required. In this study, we focus on electron energy distribution function (EEDF). EEDF on other electrodeless plasmas such as radio frequency (RF) plasma has been intensively studied, but EEDF on RMF plasma has not been studied very well.

EEDF on plasma produced and driven by RMF is measured by using Langmuir probe inserted into the plasma. Oscillating high voltage is applied between probe tip and device chamber by an oscillator and an amplifier. EEDF is calculated from relationship between probe voltage and current using Druyvesteyn method. Optimum RMF condition for a plasma source will be evaluated by changing discharge conditions such as gas pressure, input power, and applied static magnetic field.

[1] T. Furukawa *et al.*, Phys. Plasmas **24**, (2017) 043505.