Japan Geoscience Union Meeting 2014
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PEM34-P01 Room:503 Time:May 1 18:15-19:30

High beta plasma production and their diagnostics in magnetosphere RT-1 device

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The magnetosphere plasma device is one of new concepts for nuclear fusion devices. A ring trap 1(RT-1) realizes the concept as a laboratory magnetosphere using a superconducting magnet levitated in a vacuum vessel, which produces a dipole magnetic field. We study the characteristics of confined plasmas in RT-1. In recent experiments, the RT-1 experiment has demonstrated the self-organization of a plasma clump with a steep density gradient; a peaked density distribution is spontaneously created through "up-hill diffusion".

The operation regime of RT-1 is extended into the electron density from 10^{17} to 10^{18} m^{-3} by optimizing the electron cyclotron heating (ECH) system. The line integrated density measured by an interferometer achieved 6.2x$10^{17}m^{-3}$ and diamagnetic flux 5.6 mWb. It is considered that the beta value (the ratio of plasma pressure to magnetic pressure) exceeds 100%. In such situation, a millimeter wave reflectometer is implemented to measure the density peaking and spatial structure. We observed the initial results and started the analysis of acquired signals.

When we use the electron heating by ECH system, the ion remains cold due to a collisionless situation. Therefore we installed three turn antenna into RT-1 to heat ions by a slow wave (ion cyclotron heating: ICH) in a MHz range. In the case of ~$10^{18}m^{-3}$ as a target plasma of ICH by only use of ECH, the heating efficiency of ICH increases, and then leads to the increase of ion temperature. The effect has been observed by an electrostatic energy analyzer, which located at the plasma edge of RT-1.

We designed an ion probe to diagnose energies and pitch angles of ions in ICH experiments of RT-1. The principle of the ion probe is the same as that of fast ion loss measurement in a fusion machine, and is applied to the ion diagnostic in RT-1 plasmas. A scintillator is mounted inside the probe head with a pin hole. Ions with gyro motion enter into the probe head, and then hit the scintillator. We can know the energies and pitch angle simultaneously from the scintillation image.

We report the extension of plasma parameters by ECH optimization, progress on the installation of ion probe, and future perspective.

References
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Keywords: plasma, magnetosphere, plasma diagnostics, plasma heating

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Hybrid simulations of the interaction between the solar wind and the ion scale magnetosphere

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The interaction between the solar wind and the ion scale magnetosphere with a dipole magnetic field is investigated by a three-dimensional hybrid simulation. In the present study, the ion scale magnetosphere has a dayside stand-off distance which is several to a hundred times larger than the ion Larmor radius of the solar wind proton in the magnetic field strength at the dayside magnetopause boundary. The hybrid simulation treats the ions as kinetic super particles via particle-in-cell method and the electrons as a massless fluid. In the interaction between the solar wind and the magnetosphere, the interplanetary magnetic field (IMF) condition controls not only the reconnection regions but also the subsolar sheath flow due to the ion kinetic effects. Those influence the structures of the bow shock and the magnetopause boundary layer. We will also discuss the momentum transfer process from the solar wind into the magnetosphere and to the magnetized object.

Keywords: Ion scale magnetosphere, Interaction between solar wind and mini-magnetosphere, 3D hybrid simulation