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ダイポールプラズマにおける0波入射による電子バーンスタイン波励起実験
Excitation Experiment of Electron Bernstein Waves via O-mode Injection in Dipole Plasmas

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1. Introduction

The Mini-RT is an internal coil device that was constructed to confine high beta plasma by a magnetic field similar to that of a planet. In this device, so-called overdense plasmas have been observed with levitation of an internal superconducting magnetic coil [1], and heating with Electron Bernstein Waves (EBWs) is expected.

EBW heating is expected to be one of the most promising methods for generating and heating high-density plasmas. Inserting antennas enables the direct investigation of waves in the plasma, and revealed wave characteristics of the Electron Cyclotron Range of Frequencies (ECRF) corresponding to EBW in FX-SX-B mode conversion in Mini-RT [2].

We have an interest other excitation scenario of EBW. Here, to examine O-X-B mode conversion in Mini-RT experiments, we are attempting to investigate the propagation of waves in the ECRF in overdense plasmas, sifting the initial injection angle of diagnostic microwaves.

2. Experimental Setup

In the Mini-RT device, waves at frequencies lower than 2.45 GHz are injected to diagnose wave propagation in overdense plasmas; the plasma produced by 2.45 GHz microwaves acts as an overdense plasma with respect to lower frequency diagnostic microwaves. In this study, diagnostic O-waves at 1GHz and 10W are injected from low field side, and the angle between wave number vector k and the external magnetic field can be altered by changing position and angle of element of excitation antenna. To examine the mode conversion of waves in the internal coil device, electromagnetic and electrostatic components are measured with interferometry system by probing antennas inserted directly into plasmas. Figure 1 shows a schematic diagram of the diagnostics.

3. Experimental Results

Figure 2 shows the radial electric field and the region inside the major radius R<285mm is the overdense region for diagnostic microwaves. The estimated optimum injection angle θ_{opt} = 64.7°. As shown in Fig. 2, a short wavelength mode (λ = 20 mm) is observed at only the initial injection angel θ = 66.5°, while in other injection angle (ex. in Fig. 2 θ = 71.0°) this short wavelength mode waves are not observed. In addition, a reversal of the phase gradient around the UHR in θ = 66.5° is confirmed. This indicates a change in the direction of the phase velocity.

These results suggest that EBWs were mode converted from electromagnetic waves at the UHR.

References

[1] T. Goto *et al.*: Jpn. J. Appl. Phys. **45** (2006) 5917.

[2] K. Uchijima *et al.*: Plasma and Fusion Res. **6** (2011) 401122.

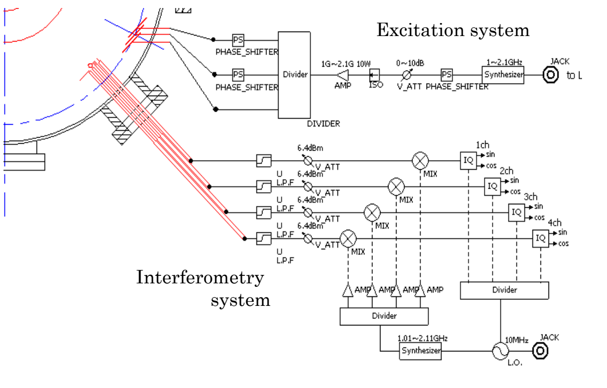

Fig. 1 Measurement system

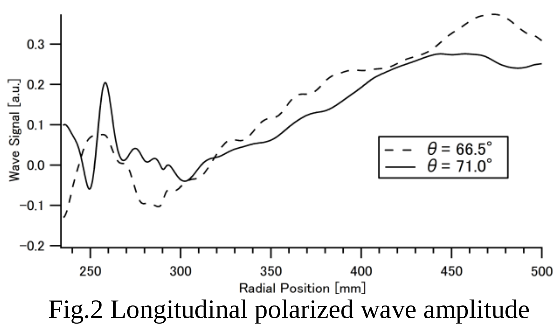

Fig.2 Longitudinal polarized wave amplitude