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GAMMA10セントラル部における高周波波動の空間構造および非線形結合現象
Spatial structure and non-linear coupling phenomenon of high-frequency waves in the GAMMA10 central cell

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In the GAMMA10 tandem mirror, owing to mirror confinement and effective beach heating by ICRF waves, strong anisotropy of ion temperature of greater than 10 is attained. Such a strong anisotropy destabilizes Alfvén wave in the frequency range below the ion cyclotron frequency and is called Alfvén-ion-cyclotron (AIC) wave[1,2]. In the GAMMA10 central cell, main confinement region, the AIC waves are spontaneously excited in the frequency range of 5.6 – 6.0 MHz. They are emerged on that frequency range as discrete sharp peaks, contrary to the geomagnetism where single broad peak is observed. Since the wavelength of the AIC wave in GAMMA10 is in the same order as the size of the confinement region, some boundary condition should be associated with this difference.

To clarify the relationship between the discrete peaks of the AIC waves and the boundary condition in the laboratory anisotropic plasma, we have promoted the measurement of the spatial structure on high-beta GAMMA10 plasma by using a two-channel reflectometer[3]. Density fluctuations at various radial positions and axially separated two positions showed that the power distribution among the AIC waves changed much both in radial and axial directions especially in the earlier period just after the excitation. Furthermore, transformation of the AIC waves from propagating to standing waves in the earlier period was also indicated[4].

Density fluctuation measured by a reflectometer shows fruitful wave-wave coupling phenomena. The excited AIC waves interact with each other and with other ICRF waves; several ICRF waves are externally applied for ion heating. As a result, nonlinearity forms many Alfvén waves which satisfy three-wave coupling condition. Especially low-frequency waves near 100 kHz, which is excited by wave-wave coupling between the AIC waves, are important for the axial confinement of mirror field. Energetic ions are found to be axially transported by interacting with these low-frequency waves[5]. As another important feature of the wave-wave coupling, we are considering the contribution to the saturation of the stored energy in the GAMMA10 central cell; the power of heating ICRF waves may be pumped to the AIC waves and the Alfvén waves having the difference frequency. In the presentation, we will report the spatial structure of the AIC waves measured by a two-channel reflectometer and also the nonlinear wave-wave coupling phenomena observed in the inner region of the GAMMA10 central cell.

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