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直線装置 PANTA におけるイオンサイクロトロン周波数帯揺動の駆動解析
Analysis of driving mechanism of fluctuation with ion cyclotron frequency in linear plasma device PANTA.

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Waves with the frequency around Ω_i(ion cyclotron wave, ICW for simplicity hereafter) are very important for plasma physics. It is because, in the nuclear fusion, they are used for the ion cyclotron resonance heating and the measurement of fast ions. And in astrophysics, they can be used as a diagnostic for the abundance of interstellar plasmas[2]. Observations of ICW in basic experiments have been reported since 1963(see a review, e.g. [1]). Nowadays they can be observed in linear plasma device, PANTA.

The purpose of this work is the analysis of ICW in PANTA. Dispersion relations of ICW are well known in [3,4]. We assume that the fluctuation is a electromagnetic wave that propagates parallel to the magnetic field, and then we calculate the dispersion relation. For $\omega \simeq \Omega_i$, the frequency of waves with left hand polarization(*L wave*) ω_{L} and the frequency of waves with right hand polarization(*R wave*) ω_{R} are

$$\omega_L = \Omega_i(1+\omega_{pi}^2/k_z^2c^2)^{-1} \quad \text{and} \quad \omega_R = 2\Omega_i\left(\sqrt{1+4\omega_{pi}^2/k_z^2c^2}-1\right)^{-1}.$$

Fig.1 shows their dispersion relations, plotted by using typical parameters for PANTA plasmas($\omega_{pi} = 6.6\times10^8$[rad/s], $\Omega_i = 2.4\times10^5$[rad/s]). For L wave, $\omega \simeq \Omega_i$ for $k_zc/\omega_{pi} \gtrsim 4$, which corresponds to the axial mode number 4∼6. For R wave, $\omega \simeq \Omega_i$ for $0.5 \lesssim k_zc/\omega_{pi} \lesssim 1.0$, which corresponds to the axial mode number 0∼1.

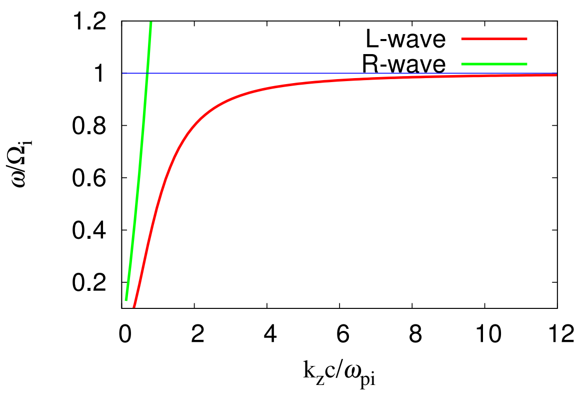

Fig 1: The dispersion relations of L and R waves($\omega_{pi} = 6.6\times10^8$[rad/s], $\Omega_i = 2.4\times10^5$[rad/s])

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