7P83　TST-2 球状トカマク装置における低域混成波立ち上げプラズマで計測されたイオン温度応答

Ion temperature response of the lower-hybrid wave sustained plasma on TST-2

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In the TST-2 spherical tokamak device, non-inductive plasma current start-up experiment by Lowe-Hybrid waves (LHW) is conducted.　Typical plasma current is 20 kA. The LHW can couple with electrons, but not with ions due to the relation between particle velocities and wave phase velocity.　Thus, the LHW can directly heat electrons, not ions. Bulk electron temperature has a hollow profile, about 10 eV at magnetic axis and about 50 eV near last closed flux surface, and electron density is low ($< 1\times10^{18}$ m^{-3}).

Ion temperature is obtained from the Doppler broadening of a line spectrum emitted from impurity ions.　In TST-2, the emission is measured by a visible spectrometer, which has a 16 channel photomultiplier tube array and its wavelength range is about 0.3 nm. The line of C^{2+} (CIII, 464.74nm) is mainly measured.　By changing line of sights for each shot, eight radial positions could be measured. Typical ion temperature is 10 eV and profile is flat or hollow.

To investigate the effect of LHW on ion heating, power modulation experiments was conducted.　Period of modulation is 6 ms and power decrease from 50 W to 0 W every period.

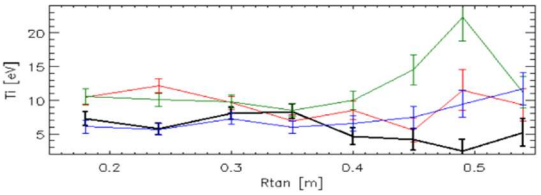

Fig1. Time development of ion temperature after LH power is ON.　Profile of 0ms, 1ms, 2ms and 3ms later are plotted black, blue, green and red respectively.

The result is shown in Fig.1.　Because emission from LHW plasma is weak, signal is analyzed by using a conditional averaged method. Ion temperature increases near plasma edge ($R = 0.25, 0.49$ m)　and does not change near magnetic axis ($R = 0.35$ m). From this result, Ion heating seems to be occurred on peripheral region.　Collision between bulk electrons and ions is too weak, because plasma density is very low ($\sim3\times10^{17}$ m^{-3}), to invoke this increment.　Collision with fast electron is further weak, so there should be other mechanisms to heat ions except for collisions,

In TST-2, Parametric Decay Instability (PDI) is often observed.　Landau damping of a wave generated by PDI is one candidate for ion heating. Investigating the correlation between ion heating and PDI is future work.