Potential Fluctuation Study from the Core Plasma to End Region in the GAMMA 10 Tandem Mirror

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Introduction

Correlation between the drift type fluctuation and anomalous radial transport was observed in GAMMA 10 and these fluctuations were suppressed by electron cyclotron heating (ECH) driven radial electric field. In divertor experiments, the correlations between core plasma and the end/edge plasma have to be studied.

We have developed new diagnostics, which are a simultaneous two points measuring gold neutral beam probe (GNBP) for measuring the radial electric field and potential fluctuation and a high speed end plate potential fluctuation measurement system.

- The coherency of the potential fluctuations between the core plasma by GNBP and that of the end plate measurement was studied.

Experimental apparatus

GAMMA 10 tandem mirror

Experiments

- Diamagnetism and line density
- Two point potential measurements
- End plate potential
- Ion sensitive probe current
- End loss ion analyzer current
- Radial profiles of electron density and temperature

The plasma is heated and maintained with applying ICCH wave from t = 51 to 240 ms and the confinement potential is produced by applying ECH with power of 100 kW and P/B with power of 400 kW from t = 151 to 181 ms. The temporal evolution of two positions' potentials were measured by GNBP with a single plasma shot, and we changed the measuring position shot-by-shot. End plate potential is measured at the end plate. The central potential and end plate potential quickly increased during the P/B-ECH period.

Potential fluctuation spectra

- Radial potential profiles without and with ECH measured by new GNBP as shown in the figure (a). The two point potential measurements made us to obtain the electric field radial profile. With ECH, the radial profile of the potential and electric field significantly changed from those without ECH.

- Drift type fluctuations are observed at frequency about 10 kHz without ECH and they are suppressed with ECH.

- Radial potential fluctuations are plotted using single point data and two point measurements in one data set. Observed radial electric field include error of less than 15 V/cm. The potential fluctuations with the frequency of about 10 kHz and mode number of 3 which correspond to the diamagnetic drift type fluctuation are suppressed during the P/B-ECH period.

Summary

We successfully developed new diagnostics to investigate for the drift type fluctuations and anomalous radial transport and the fluctuations suppressed by ECH, which are a simultaneous two points measuring GNBP and a high speed end plate potential fluctuation measurement system. The radial electric field and its fluctuation successfully obtained by using simultaneous two point measurements. The coherency of the drift type potential fluctuations between the core plasma by GNBP and that of the end plate measurement was clearly observed. The application of ECH, the potential fluctuation is suppressed and the axial and radial particle confinement improved.

We have obtained the strong tools for investigating the correlation of the radial electric field and the potential fluctuations between core and edge plasmas.

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