

Fluctuation suppression by the potential formation in GAMMA 10/PDX plasma

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In the hot ion mode experiments of the tandem mirror GAMMA 10/PDX plasma, the suppression of drift-type fluctuation, which rotate in the direction of the electron diamagnetic drift, has been observed when the axial confinement potential is formed by the electron cyclotron heating (ECH) at the barrier (B) and plug (P) cells. The flute-type fluctuation of which rotation direction is the same as ion diamagnetic rotation direction was also suppressed with application of both B/P-ECH for the first time. The suppression seems to be caused by $E \times B$ drift shear, which is common in magnetically confined fusion plasmas.

Fluctuation study is one of the most important issues in magnetically confined fusion plasmas, because the fluctuations due to the instabilities cause the anomalous transports. The drift-type fluctuation arises due to the existence of density and temperature gradients. The radial electric field E causes an $E \times B$ plasma rotation in the direction of the ion diamagnetic rotation, which may enhance instabilities such as rotational flute modes, and degrade radial confinement. In the tandem mirror GAMMA 10/PDX, the main plasma is produced and heated by ion cyclotron range of frequency (ICRF) waves, and an electrostatic potential for improving an axial confinement is created by applying electron cyclotron resonance heating (ECH) in the end mirrors of barrier/plug (B/P) cells. The plasma confinement is improved not only by a magnetic mirror configuration but also by high potentials at both end mirrors. The typical electron density, electron and ion temperatures are about $2 \times 10^{18} \text{ m}^{-3}$, 0.1 keV and 5 keV, respectively. We often observed flute-type fluctuations and they seem to be related to $E \times B$ drift. In order to clarify the $E \times B$ drift effects on flute-type fluctuations, we optimized the diameters of iris-limiters, fueling gas pressures, and ICRF heating powers to produce the rotational flute-type fluctuation before B/P-ECH. The central potential quickly increased and the observed fluctuations on the line density and potential were clearly suppressed by the application of B/P-ECH. Potential and density fluctuations suppressions with the application of B/P-ECH were clearly observed at each radial position. Low frequency flute-type fluctuations in the density and potential were suppressed with applying B/P-ECH for the first time.

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