Study of the fluctuation suppressions during the potential formation in the tandem mirror GAMMA 10

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The study of turbulent fluctuations in magnetic confinement system is very important for improving the plasma confinements. Various theories predict such turbulent fluctuations lead to anomalous transport and energy loss in the transverse direction. Low frequency plasma turbulence and the resultant anomalous transport observed in various devices exhibit rather common features. The potential formation leads to radial electric field shear on turbulence suppression and transverse-loss reduction. The radial transport barrier is explained by the formation of a strong electric field shear or peaked vorticity with the direction reversal of electric field shear flow near the potential peak for the turbulence suppression.

In the tandem mirror GAMMA 10, the plasma confinement is achieved by not only a magnetic mirror configuration but also high potentials at both end regions. The main plasma confined in GAMMA 10 is produced and heated by ion cyclotron range of frequency power deposition. The axial confining potentials are produced by means of electron cyclotron heating (ECH) at the plug/barrier region. Typical plasma density, electron temperature, and ion temperature are 2×10^{12} cm^{-3}, 0.1 keV, and 5 keV, respectively.

The advance in the potential formation leads to a remarkable effects of turbulence suppression. In order to study the plasma fluctuation suppressions by the potential formation, we have used the gold neutral beam probe system (GNBP), the multi-channel microwave interferometer, and electrostatic probes. These systems can measure the plasma potential, potential fluctuation, electron density, and density fluctuation radial profiles. Before applying ECH, the drift type fluctuations were observed in the potential and density measurements. The potential and density fluctuation suppressions were clearly observed during the potential formation by the application of ECH. We study the correlation between the suppression levels of both potential and density fluctuations and the effects of produced potentials with changing the applied ECH powers. Moreover, the particle flux related values obtained by the phase difference between the potential and density fluctuations were measured by using the GNBP. We can clearly show that the radial anomalous transport induces the radial particle transport which decreases the plasma stored energy.