Study of Turbulent Particle Transport in ETG Dominated Plasma of LVPD

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In present work we are studied plasma particle flux due to correlated fluctuation of plasma density and potential fluctuation in the background of target plasma of Large Volume Plasma Device (LVPD). The target plasma of LVPD have been characterized as ETG dominated region, by introducing an Electron Energy Filter (EEF). Radial profiles of turbulent particle flux and density - potential cross phase has been measured. It is observed that the net electrostatic flux is negative and is directed radially inward. Turbulent particle flux is predominantly electrostatic in spite of electromagnetic nature of excited turbulence . . The experimental cross phase angle and flux has been compared radially with theoretical counterparts resulting due to the non-adiabatic ion response because of the resonant interaction of the ions with the ETG mode, agrees well within 20%.

1. Introduction

Understanding turbulent plasma transport in magnetized plasma is a subject matter of great significance from the perspective of understanding plasma loss in fusion devices. Although, significant progress has been made in understanding physics of ion thermal transport over the past decade but various aspects of turbulent transport in electron and particle channel remains to be elucidated[1-2].

In this background, Large Volume Plasma Device (LVPD) ($length = 3\,m, dia. = 2\,m$) has successfully demonstrated unambiguous excitation of ETG turbulence, where plasma profiles characterized as $\nabla T_e \neq 0, \nabla n_e \approx 0, \nabla \phi_p \approx 0$ and $\eta_e = \frac{L_n}{L_{T_e}} > \frac{2}{3}$ by introducing an Electron Energy Filter (EEF)[3]. Radial profiles of turbulent particle flux (Γ) and density - potential cross phase,($\theta_{n-\phi}$) has been measured. It is observed that the net electrostatic flux is negative ($\Gamma_{es} \approx -10^{18} m^{-2} - s^{-1}$) and is directed radially inward. Turbulent particle flux is predominantly electrostatic in spite of nature of excited turbulence is electromagnetic ($\beta \approx 0.4$).

The particle flux maximizes when EEF is ON suggesting that the flux is due to ETG driven turbulence. Theoretically, net particle flux results when phase difference is, this agrees well with our observation. Turbulence intensity maximizes roughly at the location where particle flux maximizes.

The experimental cross phase angle and flux has been compared radially with theoretical counterparts resulting due to the non-adiabatic ion response because of the resonant interaction of the ions with the ETG mode, $k_\perp V_{thi} \sim \omega$, agrees well within 20%. Theoretical standpoint suggests that thermo-diffusive turbulent flux radially inward in the background of ETG [4]. Comparison of experimental results with theoretical model suggesting it as a thermo diffusive turbulent particle flux will be present in this conference.

2. References

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