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Investigations on Temperature Fluctuations and Energy Transport in ETG Dominated Large Laboratory Plasma

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Extensive measurements are carried out on micro turbulence because of their possible role in causing anomalous particle and energy transport in fusion devices [1]. Outcome from past investigations suggest that the Electron Temperature Gradient (ETG) driven turbulence is considered presently as a major source of anomalous plasma transport in fusion devices, as transport by ion scale turbulence is largely understood. Direct measurement of ETG is extremely difficult in fusion devices because of its extremely small scale length ($\sim \mu m$). In this background, efforts were made in Large Volume Plasma Device (LVPD), to produce plasma suitable for carrying out investigations on ETG turbulence ($\sim mm$). Introduction of Electron Energy Filter (EEF) divides LVPD plasma into three distinct regions of Source, EEF and Target plasmas. In the core region of target plasma ($x \leq 45cm$), unambiguous, identification of ETG turbulence is successfully demonstrated [2, 3].

Simultaneous measurement of fluctuations in electron temperature ($10\% - 30\%$), plasma density ($5\% - 10\%$) and potential ($0.5\% - 2.5\%$) are carried out. Particle and energy transport are estimated from $< \tilde{n}_e \tilde{E}_\theta >$ and $< \tilde{T}_e \tilde{E}_\theta >$ correlations. It was observed that electrostatic particle transport agrees well with theoretical estimates [4] while, electromagnetic particle flux satisfies the relationship ($\Gamma_{es} \sim 10^{-5} \times \Gamma_{es}$). Strong negative correlation is observed between fluctuations of density and temperature with potential fluctuations, showing correlation coefficients, $C_{\tilde{n}_e,\tilde{\phi}} \sim -0.8$ and $C_{\tilde{T}_e,\tilde{\phi}} \sim -0.7$ respectively. This paper will present results on work carried out for energy transport due to ETG turbulence. Details on adopted diagnostic methods, for accurate measurement of temperature fluctuations will also be presented. A comparison will be made of experimentally derived energy transport with theoretically estimated values.

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