Seminar

Institute for Plasma Research

Title : Plasma Parameter Control using Multi-Grid Biasing System in a Double Plasma Device

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Date : 10th January 2019 (Thursday)

Time : 11.30 AM

Venue : Committee Room 3, (New Building), IPR

Abstract :

A double plasma device (DPD) is developed to investigate control on radial plasma parameters. The plasma column is divided into two regions of source and target plasmas, separated by a control grid, mounted between the two plasma regions. Control on radial profiles of plasma parameters viz., electron temperature, plasma density, and electric field are key to understand plasma transport, and plasma turbulence [1, 2, 3]. Plasma is produced in DPD using a multi- filamentary cathode arranged in the grounded source plasma chamber and plasma is allowed to diffuse into the floating target chamber. Initial investigations are carried out to optimize the discharge parameters and establish double plasma configuration with and without the control grid.

Further, detailed investigations are carried out on control of plasma parameters at radial center of target plasma in presence of biased grid for identifying the role of grid bias, transparency, and Debye length on target plasma parameters. In the optimized limit of grid bias, electron temperature is reduced by ~ 35% with its value changing from 7.2 eV to 4.9 eV. Variation in grid transparency is realized by varying the Debye length. It was observed that a better control in electron temperature is observed when the ratio of source to target plasma density is maximum. For realizing a control on radial variation of plasma parameters, an arrangement consisting of four (G1-G4) electrically isolated, concentric, variable sized, annular grids is installed in place of single grid arrangement. Results obtained for optimized grid biasing configuration i.e., by keeping (G1, G2) floating and (G3, G4) = +10V suggests that large scale length variation in electron temperature (LTe=15cm & 7cm) and plasma density (Ln=45cm & 4 cm) is realized for plasma region between $r \leq$ 0-4 cm and $4< r \leq 10$ cm respectively. The observed results may be explored for carrying out investigations in electron temperature gradient (ETG) driven turbulence investigations.

References:

[1] R. J. Taylor, K. R. MacKenzie, and H. Ikezi, Review of Scientific Instruments **43**, 1675 (1972);
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[3] K. H. Bai, J. I. Hong, S. J. You, and H. Y. Chang, Phys. Plasmas **8**, 4246 (2001).
[4] S. K. Singh, P. K. Srivastava, L. M. Awasthi, S. K. Mattoo, Rev. Sci. Instrum. **85**, 033507 (2014).