Seminar

Institute for Plasma Research

Title : Direct Measurement of Plasma Potential using Laser Heated Emissive Probes

Speaker : Dr. Payal H. Pandit
Kadi Sarva Vishwavidyalaya, Gandhinagar

Date : 04th October 2016 (Tuesday)

Time : 03.30 PM

Venue : Seminar Hall, IPR

Abstract:

Direct measurement of plasma potential Φ_{pl} is very much essential in laboratory plasmas as well as in magnetized toroidal hot plasmas. It determines the electric field, which in turn provides many useful information regarding fluctuation induced particle flux and other essential parameters related to turbulence in plasmas. Emissive probes are very useful tools for the direct measurement of plasma potential. They are not affected by the electron beams and drifts in the plasma thereby providing more reliable measurement of plasma potential.

A conventional emissive probe is a loop of metallic wire (normally tungsten) heated by an electric current. Recently Laser Heated Emissive Probes (LHEPs) are gaining more popularity over the conventional emissive probes in laboratory as well as high temperature plasmas. The advantages of LHEP are: longer life time, attainment of higher temperature without melting or evaporation and thus higher emissivity, no deformation of the probe tip in a magnetic field, no potential drop along the probe wire and faster response time. Graphite and LaB_6 are commonly used as probe tip materials for LHEP's due to their lower work function, good absorption at CO_2 laser wavelengths and better emission properties. Both materials are heated by a CW CO_2 laser of maximum 55 watt power. Complete theoretical and simulation model have been developed to understand the experimentally measured data. The rise in temperature of the probe tip, including the radiative and convective losses, as well as the reflectivity of materials (graphite and LaB_6) at 10.6μm (laser wavelength) were studied in detail. ANSYS simulation was also carried out using the finite element method. The emission current density for a range of probe temperatures has also been carried out. The emission current from the probe (both Graphite and LaB_6) with respect to the bias voltage applied to the probe has also been measured.