

Development of Mach Probe for the Ion flow measurement in the Helicon

Plasma Thruster system

Mariamammal Megalingam*, Renu Bahl, Narender Singh, Mritunjay Kumar, Ramesh Kumar

Buddu, Prabal Kumar Chattopadhyay

Institute for Plasma Research- Gandhinagar, Gujarat -382428 India

mari.mahee91@gmail.com (speaker):

Plasma Flow has been observed in space and ionosphere. Accurate measurement of plasma flow can give a better insight in understanding of many phenomenon e.g., Interaction of satellites moving through stationary space plasmas, magneto-hydro-dynamic phenomena observed in space and fusion plasmas, various wall material studies etc. Institute for Plasma research, Gandhinagar (IPR) has developed a Helicon plasma device to study helicon plasma characteristics, evolution and wave plasma coupling etc. Recently a Helicon Plasma Thruster (HPT) has been set up to extend these studies to space related technological applications. As Plasma flow velocity plays a vital role in thrust evolution as well as its understanding, IPR initiated development of different types of Mach probe, a proven tool to measure plasma flow velocity in magnetized and unmagnetized plasma. Present experiment has been performed in the helicon plasma thruster device which has a special feature of magnetic nozzle whose gradient can be controlled with the

combined field of permanent magnet (~1200 G) and electromagnet to create a plasma flow. Further the experiment is carried out in the various uniform magnetic field configuration from RF power (500 W) to high RF power (~4KW) and therefore Mach probe and Dog-Leg Langmuir probe size and shape has been selected to fit in the requirements. The axial scanning of the plasma has been carried out using designed Mach probes from 500 W to 4KW and upto 1600 G magnetic field. Mach numbers and Plasma flow velocity has been measured and it is observed that it lies in sub-sonic to super-sonic plasma flow regime. Other plasma parameters such as plasma density, electron temperature has been measured using dog-leg Langmuir probe. The details of the work done will be presented.