

# Seminar

---

## Institute for Plasma Research

---

**Title:** Investigation of EDF evolution and charged particle transport in  $E \times B$  plasma based negative ion sources using kinetic simulations

**Speaker:** Dr. Miral Shah  
Institute for Plasma Research, Gandhinagar

**Date:** 13<sup>th</sup> September 2023 (Wednesday)

**Time:** 10:30 AM

**Venue:** Seminar Hall, IPR

### Abstract

In an  $E \times B$  plasma-based negative ion source, a spatially varying transverse magnetic filter field (TMF) is utilized to enhance the yield of negative ions. This TMF field ranges from 1 mT to 10 mT, which leads to the magnetization of plasma electrons while leaving ions either partially magnetized or unmagnetized. Consequently, this setup results in various effects such as plasma drift, particle trapping, the formation of double layers (DL), and instabilities within the negative ion source. The presence of the TMF also significantly impacts the transport of plasma, thereby influencing the energy distribution functions (EDFs) of both electrons and ions within the plasma. However, measuring these EDFs in the presence of a strong magnetic field presents a considerable challenge.

To address this challenge, a 2D-3V Particle-in-Cell Monte Carlo Collision (PIC MCC) model is used for a detailed investigation of the spatio-temporal evolution of the EDFs, separately for electrons and ions. The electron EDF (EEDF) remains predominantly Maxwellian in its distribution. In contrast, the ion EDF (IEDF) gradually deviates from a Maxwellian distribution as measurements are taken closer to the TMF region. This study underscores the sensitivity of the IEDF to the operational conditions of the plasma source, and it is evident from the observed changes in both EDFs under varying plasma operational conditions.

---