

Seminar

Institute for Plasma Research

Title: Advancing Efficiency in Electron Cyclotron Resonance Ion Sources for Enhanced Ion Acceleration

Speaker: Dr. Ram Swaroop
Central University of Punjab

Date: 15th December 2023 (Friday)

Time: 03:30 PM

Venue: Seminar Hall, IPR

Abstract

This research endeavours to propel the frontiers of accelerator technology by addressing the inherent challenges in Electron Cyclotron Resonance (ECR) ion sources. The study primarily focuses on enhancing the efficiency of ECR ion sources, crucial components in ion accelerator systems, to achieve more precise and effective ion acceleration. The investigation spans a multidisciplinary approach, integrating electromagnetic modelling, waveguide section analysis, and meticulous optimization techniques. By delving into the intricate plasma parameters and precise diagnostics of ECR ion sources, the research aims to unravel the scientific principles governing ion accelerator systems. The specific objectives include the development and optimization of Radiofrequency (RF) cavities tailored for ECR ion sources. This involves a comprehensive exploration of electromagnetic properties, waveguide structures, and innovative optimization strategies to maximize the performance of these critical components. Furthermore, the project encompasses practical applications, involving the irradiation of sample materials using the optimized ECR ion source. Through extensive experiments and systematic analysis, the study aims to understand and mitigate the impact of ion beams on a variety of materials, thereby contributing to the broader field of materials science. The outcomes of this research are anticipated to not only advance the efficiency of ECR ion sources but also to contribute valuable insights to the broader realm of accelerator technology. The dissemination of findings through presentations at conferences and publications in esteemed journals is integral to the project, fostering collaboration and knowledge-sharing within the scientific community [1-3 & a-f].

Key words: Plasma Cavity, Magnetic field, Waveguide sections, Microwave coupling, Extraction system.

References

1. Swaroop. R, Kumar. N, Sabavath .G, Choudhary V. S, Jewariya .Y and Rodrigues .G (2023) Design and simulation of 2450 MHz microwave cavity for resonance and off-resonance plasma diagnosis in-situ plasma irradiation facility. Journal of Instrumentation (18) P02010.
2. Swaroop, R., Kumar, N., Rodrigues, G., Kanjilal, D., Banerjee, I., & Mahapatra, S. K. (2021). Design and development of a compact ion implanter and plasma diagnosis facility based on a 2.45 GHz microwave ion source. Review of Scientific Instruments, 92(5), 053306.
3. Swaroop, R., Rani, P., Jamwal, G., Sabavath, G., Kumar, H., & Jewariya, Y. (2022). Enhancing the electrochemical performance of TiO₂ based material using microwave air plasma treatment with an ECR cavity. Frontiers in Chemistry, 10.

Conferences and Seminars

1. Indo European Seminar on Nuclear & High Energy Physics, Department of Physics, Central University of Punjab Bathinda 151001. 7 February 2019.
2. 3Rd international conference on Modern mathematical methods and high performance of computing in science and technology (M3HPCST-2020). January 9-11,2020.
3. SCHOOL ON “ECR ION SOURCE TECHNOLOGY: OPPORTUNITIES AND FUTURE CHALLENGES. organized by Inter-University Accelerator Centre, New Delhi, India. 5-6 November 2020.
4. Department of Physics Savitribai Phule Pune University Raman Memorial Conference (RMC) -2021 27th Raman Memorial Conference (RM 2021) held on 4-5 March 2021 at the Department of Physics, Savitribai Phule Pune University.
5. Modelling of a Resonant Cavity based on a 2.45 GHz Microwave Ion Source. 25th International Workshop on Electron Cyclotron Resonance Ion Sources 2022 (ECRIS2022). 12-14, October 2022, Institute for Plasma Research, Gandhinagar, India.
6. Investigation of Argon plasma in the presence & absence of magnetic fields. Workshop on Electron Cyclotron Resonance Ion Sources 2022 (ECRIS-2022). 12-14, October 2022, Institute for Plasma Research, Gandhinagar, India.