# Investigation of Wave-Plasma Interactions and Plasma Heating at Ion Cyclotron Frequencies


## *Abstract*

The interaction between electromagnetic (EM) waves and plasma plays a crucial role in heating magnetically confined plasmas, particularly in the ion cyclotron (IC) frequency range. In this frequency regime, externally launched EM waves couple to the plasma and propagate primarily as fast magneto-sonic waves, commonly referred to as "fast waves." When the polarization of the rotating electric field in these fast waves aligns favorably with the gyrating motion of ions and matches their cyclotron frequency, the wave energy is effectively absorbed by the ions. This frequency is known as the ion cyclotron resonance frequency (ICRF), and the spatial location where this absorption takes place within a tokamak plasma is termed the ion cyclotron resonance layer.

Scope of Work:

As part of this project, the student will be expected to perform technical and computational work in Ion Cyclotron Resonance Heating (ICRH) of magnetically confined plasmas. This will involve studying the fundamental principles of excitation of fast magneto-sonic waves in a plasma environment & its Coupling.

Computational Studies and Methodology:

The student will be use numerical tools for wave-plasma interaction studies. These including wave coupling, propagation and absorption.

Expected Outcomes:

Study of ICRH optimization scenarios in tokamaks.


## Academic Project Requirements:

**1) Required No. of student(s) for academic project: 1**

**2) Name of course with branch/discipline: B.E./B.Tech. Mechanical Engineering**

**3) Academic Project duration:**

**(a) Total academic project duration: 10 Weeks**
**(b) Student's presence at IPR for academic project work: 5 Full working Days per week**


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