



Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Modeling and experiments for investigating the magnetically guided flow of an electron cyclotron resonance (ECR) generated plasma
Project Summary (Minimum 500 and maximum 2000 characters)	Plasma generated by an electron cyclotron resonance (ECR) based source tends to attain a high electron temperature while the ions remain at the room temperature. These two species are found to flow out of the source region following the inherent magnetic field lines of the ECR source while retaining the quasi-neutral nature of plasma. Due to the moderately strong ECR magnetic field that penetrates into the expansion chamber, the plasma dynamics is governed by the associated diverging magnetic field lines. Hence, to understand the plasma flow in the expansion chamber of varied dimensions one needs to have a multi-dimensional theoretical model capturing the underlying physics. Owing to the dimensions of the expansion chamber, it is natural to use a multi-fluid approach to model the magnetized plasma dynamics. However, the complexity of the model equations makes it quite demanding to solve them numerically in their original form. One can simplify the model equations by assuming the plasma to be in a steady state and by transforming them into a magnetic coordinate system. This results in a relatively simplified set of equations which can be easily integrated in the magnetic coordinate system to obtain plasma flow profiles. The model predictions of the flow profiles, the energy flux, and the plasma thrust will be compared with the experimentally measured values.

Ph.D. Supervisors* (Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)			
Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1*	Vikrant Saxena	Department of Physics, Indian Institute of Technology Delhi	vsaxena@physics.iitd.ac.in
Supervisor 2	Ramesh Narayanan	Department of Energy Science and Engineering, Indian Institute of Technology Delhi	rams@dese.iitd.ac.in

*Supervisor 1 must be from IIT, Delhi.
+All cells in this table are mandatory fields that need to be filled by faculty for consideration of proposal.
\$The date of superannuation of supervisors should be at least three years from the date of registration of selected candidates.

Project requirements (Student qualifications, experience required, etc) *The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)
- M.Sc. Physics / B.Tech. In Engineering Physics - Knowledge of programming in Fortran + Matlab/Python

Source of fellowship/funding and project number (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)
Candidate with his/her own fellowship (preferable). If not, then Institute Fellowship (FIA) can be considered.

Role of Faculty Members involved:	
Supervisor-1	Prof. Vikrant Saxena (Physics, IIT Delhi) will mentor the student in: - Fluid modeling of plasmas, development of model equations. - Numerical methodology to solve the equations - Analysis and representation of numerically obtained data
Supervisor-2	Prof. Ramesh Narayanan (DESE, IIT Delhi) will mentor the student in - Understanding the experimental procedure of collecting data - Understanding experimental parameters/boundary conditions - Comparing the theoretical results with experimental observations

Note :-

1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Full-time Institute Assistantship (Category-wise) (FIA)" for selecting the students in SIRe.
2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SIRe student.
3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.
4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.
5. A candidate applying with a valid JRF/INSPIRE/any national level fellowship should have at least two-year validity from the date of joining the Ph.D. program.
6. The third supervisor's name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.
7. If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.