PLASMAS AND FUSION

Introduction

The guidelines outlined in this document are intended to supplement the general information on graduate programs provided by Nuclear Engineering and Radiological Sciences (NERS), the College of Engineering, and the Rackham School of Graduate Studies.

Master's and Doctoral Degree Requirements

See the Rackham School of Graduate Studies Academic Policies website for graduation requirements information at: http://www.rackham.umich.edu/policies/academic_policies/. Also, see the supplementary Master's and Ph.D. Graduation Requirements and corresponding checklists for Nuclear Engineering and Radiological Sciences. All checklists should be reviewed in the term prior to graduation for the master's degree or in the term in which candidacy is achieved for the doctoral program.

Graduate Advising

Students will be assigned an advisor when they first join the graduate program. However, this assignment is tentative, and students should not be reluctant to change advisors once they have come to understand how their interests mesh with those of the various faculty members in the department. For students carrying out graduate research, the research supervisor is also their academic advisor. Before registering for a future term, the student must discuss courses with the advisor.

Plasmas and Fusion Research

This guide is intended for graduate students in Nuclear Engineering and Radiological Sciences who are interested in coursework and research in plasmas and fusion. The plasmas option is primarily designed for students who wish to continue training in this field through the Ph.D. level. The purpose of this document is to aid you in selecting a sequence of courses of both intermediate and long-term value. Some topics of research include:

- High Power Microwave Sources Driven by Long-Pulse, Intense, Relativistic, Electron Beams
- Plasma-based space propulsion
- Relativistic plasmas
- Laser plasma particle Accelerators
- Laser plasma interactions
- Z-pinch Plasma Science
- Theoretical Plasma Physics
- Plasma-Assisted Materials Processing
- Atmospheric pressure nonthermal plasmas for environmental mitigation
- Plasma medicine
- Aerospace related plasmas related to boundary layer dynamics and control
- Lasers, lighting sources, displays
- Compact laser-driven radiation sources
- Computational modeling of Inertial Fusion Plasmas

Departmental Curriculum Guidelines

A sample course program is outlined below. It is emphasized that this is a suggested curriculum and not a set of rigid requirements. It is meant primarily as a *guide* to students and advisors during the earlier phases of the student's graduate career. Required courses for Ph.D. candidacy are:

NERS 471	Introduction to Plasmas
NERS 515	Nuclear Measurements Laboratory
NERS 571	Intermediate Plasma Physics I
NERS 572	Intermediate Plasma Physics II
NERS 575	Plasma Generation and Diagnostics Lab
	Graduate level mathematics

There are a number of 400 and 500 level courses offered by other departments relevant to some aspect of fusion reactor engineering. Students are encouraged to review current course listings in the College of Engineering and Graduate School bulletins and consult with Nuclear Engineering and Radiological Sciences staff on appropriate course offerings.

1st Fall Term		**1st Fall Term Suggested Electives**	
NERS 471 or NERS 571	Introduction to Plasmas Intermediate Plasma Physics I	NERS 576	Charged Particle Accelerators & Beams
NERS 441 or NERS 543	Nuclear Reactor Theory I Nuclear Reactor Theory II	NERS 673	Electrons and Coherent Radiation
NERS 515	Nuclear Measurements Laboratory	NERS 674	High Intensity Laser Plasma Interaction
		NERS 573	Plasma Engineering

1st Winter Term		**1st Winter Term Suggested Electives**	
NERS 575	Plasma Generation and Diagnostics Lab	NERS 472	Fusion Reactor Technology
NERS 572 or NERS 578 (EECS 517)	Intermediate Plasma Physics II Physical Processes in Plasmas	NERS 673	Electron and Coherent Radiation
EECS 530 or Phys 405- Intemediate Electricity and Magnetism	Electromagnetic Theory	NERS 578 (EECS 517)	Physical Processes in Plasmas
	Elective	NERS 573	Plasma Engineering
		NERS 590	Comp Plasma Physics

2nd Fall Term		2nd Fall Term Suggested Electives	
NERS 571	Intermediate Plasma Physics I	NERS 576	Principles of Charged Particle Accelerators
NERS 521	Radiation Effects in Nuclear MaterialsRadiation Materials Science I	NERS 673	Electrons and Coherent Radiation
Math 556 or Math 571	Methods of Applied Mathematics Numerical Methods Sci. Computing	NERS 674	High Intensity Laser Plasma Interactions

2nd Winter Term		2nd Winter Term Suggested Electives	
NERS 572	Intermediate Plasma Physics II	NERS 578 (EECS 517)	Physical Processes in Plasmas
Math 557 or Math 572	Methods of Applied Math II Numerical Meth for Sci. Computing II	NERS 573	Plasma Engineering
	Elective	NERS 590	Comp Plasma Physics

Ph.D. Candidacy Exam

The written candidacy exam in the plasmas and fusion area covers plasma courses through the 500 level.

Primary Faculty in the Plasmas and Fusion Option and their Specialties

John E. Foster	Professor, Nuclear Engineering and Radiological Sciences
Ronald M. Gilgenbach	Professor and Chair, Nuclear Engineering and Radiological Sciences Director, Plasma, Pulsed Power and Microwave Lab
Karl M. Krushelnick	Professor, Nuclear Engineering and Radiological Sciences Professor, Electrical Engineering and Computer Science Professor, Physics Director of the Center for Ultrafast Optical Sciences
Mark J. Kushner	Professor, Nuclear Engineering and Radiological Sciences Professor, Electrical Engineering and Computer Science
Y.Y. Lau	Professor, Nuclear Engineering and Radiological Sciences
Ryan D. McBride	Associate Professor, Nuclear Engineering and Radiological Sciences