

NUCL 597 (Beam-on-Target Interactions with Materials for Energy & Industrial Applications)

Contact Info:

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A. Justification for the Course:

This NUCL 597 course is 3 credit hours-course and targets graduate students preferably those who have knowledge of Nucl 420 or Nucl 520 courses but not mandatory. This course may built on the knowledge gained in those courses or other related courses and how to apply fundamental and basic knowledge in solving current challenging problems in beam-target interactions with materials for energy, space, and industrial applications. This will allow and encourage motivated students on conducting high end research projects either theoretically or experimentally that of significant impact on advancing and improving materials performance and lifetime in nuclear reactors or space/industrial applications.

B. Course Objectives and Learning Outcomes and Method of Evaluation or Assessment:

The course objective is to enhance the knowledge of students in selected advanced topics in beam target interactions. This course may be composed of lectures, research projects, assignment papers, and discussion participation in related subjects to beam irradiation and evolution of materials. Each student will be also assigned a specific research topic to do extensive literature review of current state of the art problems, perform independent analysis, possibly conduct experiments depending on the subject chosen, propose solutions of this problem, make presentations and comprehensive research paper.

Course Grading: Each student will be evaluated and graded based on his/her research project outcome, class presentations, critique of assigned published papers, course participation in evaluating other projects, obtained experimental data, answer questions, and final project research outcome and reports that can be published in related scientific journals.

Methods of instruction may include several lectures, students review and critique of published related papers, presentations, and class discussions. In some projects, laboratory experiments may be required to enhance the project knowledge outcome. This integrated learning method will help enhance the critical thinking of the students as well as communication skills and ethics in conducting advanced research. Many of the discussions and research will include one-to-one interaction with each student with the course instructor.

C. Prerequisite(s):

Preferably Nucl 420 or Nucl 520 but not mandatory (or other related/similar courses). The instructor will assign specific materials for each student to review and work with the instructor to explain the required research for completing the projects.

D. Course Instructor(s):

Ahmed Hassanein, Paul L. Wattelet Distinguished Professor
Director of Center for Materials Under Extreme Environment (CMUXE)
POTR Engineering Building (376C)

E. Course Outline:

The course will help the students on several subjects and research projects related to the following effects in beam-target interactions that include some of the following topics:

- (1) Laser beams Interaction with materials
- (2) Ion beams Interactions with materials
- (3) Electron beams interaction with materials
- (4) Ion/Photon/Electron Transport and Range Calculations
- (5) Surface Damage and Materials Evolution
- (6) Materials Erosion and Degradation
- (7) Plasma-Material Interactions
- (8) Conduct Experiments on various Lasers and Ion Beams Interaction with Materials
- (9) Benchmarking Theoretical Models with Experimental Data

F. Reading List (including course text):

The instructor may provide some of his own notes, recommend current and recently published materials related to each student's project, assign research papers to critique, and may identify text books/published quality papers suitable for the selected projects of each student.

Academic Integrity

Purdue honors pledge: "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

<https://www.purdue.edu/provost/teachinglearning/honor-pledge.html>

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

Course materials on Brightspace considered to be derivative works and cannot be distributed without my express written permission.

Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

Mental Health Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#). Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructor via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Emergency Preparedness face-to-face

Review the Emergency Preparedness website for emergency preparedness information:
https://www.purdue.edu/ehps/emergency_preparedness/