

# Physics 928 — Introduction to Plasma Physics

Spring 2015

## Meeting Time

Official time: 12:30 – 1:45 PM, Tuesday & Thursday, Jorgensen Hall, Room 245

## Instructor

Brad Shadwick, 310N Jorgensen Hall, 472-3578, [shadwick@unl.edu](mailto:shadwick@unl.edu)  
Office Hours: Drop by or by appointment.

## Text

Required text: Hans L. Pécseli *Waves and Oscillations in Plasmas*. Available [electronically](#) from the UNL library. Reading assignments from the text and other sources will be posted on BlackBoard as required; please complete the readings **before** class.

## Prerequisites

Physics 911 & 913. We will draw extensively on the concepts from Mechanics and Electromagnetism.

## Course Outline

This course will cover basic plasma physics and an introduction to laser-plasma interactions for accelerator applications. We will not discuss magnetic fusion or plasma processing.

Topics to be covered (tentative):

### I. Basic Plasma Physics

- 1) Nature of Plasmas
- 2) Relativistic Particle Dynamics
- 3) Fluid Models
- 4) Waves & Dispersion Relations
- 5) Kinetic Plasmas

### II. Laser-Plasma Interactions

- 1) Single-Particle Dynamics
- 2) Wakefield Generation
- 3) Wave Breaking
- 4) Particle Trapping
- 5) Laser Guiding
- 6) Accelerator Applications
- 7) Raman Processes

## Homework

Mastering the concepts covered in this course requires solving problems. The importance of doing and fully understanding the homework problems cannot be over emphasized. Homework will be throughout the semester and will be due approximately one week later. While discussing homework problems with other students is encouraged, the work you turn must be yours alone. In your solutions, you **must state** all sources (people, web sites, books, *etc.*) from which you obtained part or all of a solution.

## Simulation Labs

A number of homework problems will involve using various computer codes to perform numerical simulations of a range of plasma phenomena. The codes will be available on the workstations in Jorgensen Hall, Room 211.

## Exams

There will be one mid-term exam, tentatively scheduled for Wednesday, February 25 from 7:00 to 9:00 PM. A comprehensive two hour final exam is officially scheduled for 10:00 AM on Friday, May 8, 2015.

## Grading (approximate)

- 1/3 Final exam
- 1/3 Mid-term exam
- 1/3 Homework

## Web Pages

Course materials will be available through the Blackboard system.

## Makeup Lecture Time

The instructor will likely need to miss a class from time to time. Makeup lectures will be scheduled accordingly.

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.