

PHYS:7729

Plasma Physics II

Spring 2025

Instructor:	Gregory Howes
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Office Hours:	1:45–2:45pm T, 9:45am–11:45am W, or by appointment
Department:	Physics & Astronomy, 203 Van Allen Hall, Prof. Mary Hall Reno, Chair
Catalog Description:	Continuation of PHYS:4731; cold plasma waves, MHD stability, kinetic theory of plasmas, including Landau damping and velocity space instabilities; nonlinear evolution.
Meeting:	Tuesday and Thursday, 12:30–1:45pm, 172 Van Allen Hall
Textbook:	Required: D. A. Gurnett & A. Bhattacharjee, <i>Introduction to Plasma Physics with Space and Laboratory Applications</i> Optional: T. J. M. Boyd & J. J. Sanderson, <i>The Physics of Plasmas</i>
Web Page:	http://www.physics.uiowa.edu/~ghowes/teach/phys7729/index.html
Exams	Two Midterm Exams: Thursday, Feb 27th and Thursday, Apr 17th Final Exam: TBD
Grading:	Homework: 20% Two Midterm Exams: 20% each Final Exam: 40%
Topics:	1. Cold plasma waves 2. MHD Stability 3. Kinetic Theory and Landau Damping 4. Kinetic Stability 5. Quasilinear Theory 6. A Selection of Special Topics: Lab Plasmas, Dimensional Analysis, etc.
Reference books:	R.D. Hazeltine and F.L. Waelbroeck, <i>The Framework of Plasma Physics</i> N.A. Krall and A.W. Trivelpiece, <i>Principles of Plasma Physics</i> D.R. Nicholson, <i>Introduction to Plasma Theory</i>

Homework: Homework will be assigned on a regular basis with a time allotment corresponding to the level of difficulty. Longer assignments will be weighted more heavily in the homework score. Late homework will not be accepted. You are encouraged to work together in groups on the homework, but each student must write his or her own solutions; you may discuss how to solve the problem together, but you may not copy another student's solution. Homework must be turned in at the beginning of the class meeting on the day the homework is due.

Solutions: Solutions for the homework assignments and midterm exams will be available only to enrolled students through the ICON course website under the "Files" section.

Exams: There will be two in-class midterm exams, with tentative dates given on the front page of this syllabus, and one in-class final examination to be scheduled by the registrar and announced mid-semester. You may use a Formula Summary Sheet (see below) for each exam.

**Formula Summary
Sheets:**

All exams are closed book and closed notes. For each exam, you are allowed to prepare a Formula Summary Sheet to use during the exam. You are also free to use the NRL Plasma Formulary. For each midterm exam, your Formula Summary Sheet may use two sides of 8.5 inch by 11 inch paper. You may also reference the Formula Summary Sheets from previous exams (which do not count against the two-side limit). For the final, in addition to the four sides of Formula Summary Sheets from the two midterm exams, you may include one additional side of 8.5 inch by 11 inch paper (for a total of 5 sides of paper).

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Plasma Physics II Schedule

Spring 2025

Week	Weekly Reading	Class Meeting	Date	Lecture Notes	HW/Exams
1	GB Chap. 4, Sec. 4.1–4.4 (p.87–137) BS Chap. 6, Sec. 6.1–6.3 (p.197–227)	1	1/21	Lecture #1	
		2	1/23	Lecture #2	
2	GB Chap. 4, Sec. 4.5 (p.137–141) BS Chap. 11, Sec. 11.1–11.2 (p.425–433)	3	1/28	Lecture #3	
		4	1/30	Lecture #4	
3	Prepare for and deliver Cold Plasma Wave Presentations	5	2/4	Lecture #5	HW#1 due 2/4–2/6
		6	2/6	Lecture #6	
4	GB Chap. 7, Sec. 7.3 (p.239–260) BS Chap. 4, Sec. 4.5–4.7 (p.108–130)	7	2/11	Lecture #7	HW#2 due 2/13
		8	2/13	Lecture #8	
5	None	9	2/18	Lecture #9	HW#3 due 2/20
		10	2/20	Lecture #10	
6	Review Lectures #1–10 Review HW #1–3	11	2/25	Midterm #1 Review	Midterm Exam #1
		12	2/27	No Lecture	
7	GB Chap. 9, Sec. 9.1–9.1.1 (p.319–323) GB Chap. 9, Sec. 9.2 (p.328–346) BS Chap. 7, Sec. 7.1–7.3 (p.252–268)	13	3/4	Lecture #11	
		14	3/6	Lecture #12	
8	GB Chap. 9, Sec. 9.3–9.4 (p.346–356)	15	3/11	Lecture #13	HW#4 due 3/13
		16	3/13	Lecture #14	
Spring Break					
9	GB Chap. 9, Sec. 9.1.2 (p.323–328) GB Chap. 9, Sec. 9.5 (p.356–370) BS Chap. 7, Sec. 7.4–7.5 (p.268–277)	17	3/25	Lecture #15	HW#5 due 3/27
		18	3/27	Lecture #16	
10	GB Chap. 11, Sec. 11.1 (p.428–441) BS Chap. 10, Sec. 10.1–10.2 (p.376–388)	19	4/1	Lecture #17	HW#6 due 4/3
		20	4/3	Lecture #18	
11	GB Chap. 2, Sec. 2.2 (p.6–9) BS Chap. 11, Sec. 11.7 (p.453–458)	21	4/8	Lecture #19	HW#7 due 4/10
		22	4/10	Lecture #20	
12	Review Lectures #11–20 Review HW #4–7	23	4/15	Midterm #2 Review	Midterm #2
		24	4/17	No Lecture	
13	Read Barenblatt (2003), p.1–26 Read Taylor (1950a) and (1950b)	25	4/22	Lecture #21	
		26	4/24	Lecture #22	
14	None None	27	4/29	Lecture #23	HW#8 due 5/1
		28	5/1	Lecture #24	
15	Review Lectures #1–24 Review HW #1–8	29	5/6	Lecture #25	
		30	5/8	Final Review	
Finals Week, 5/12–5/16				Final Exam	TBD

Textbooks:

Required: **GB**=Gurnett & Bhattacharjee (2017) *Introduction to Plasma Physics: With Space and Laboratory Applications*

Optional: **BS**=Boyd & Sanderson (2003) *The Physics of Plasmas*

Additional College of Liberal Arts and Sciences (CLAS) Syllabus Information

Academic Honesty and Misconduct

All students in CLAS courses are expected to abide by the [college's standards of academic honesty](#). Undergraduate academic misconduct must be reported by instructors to CLAS according to [these procedures](#). Graduate academic misconduct must be reported to the Graduate College according to Section F of the [Graduate College Manual](#).

Student Complaints

Students with a complaint about a grade or a related matter should first discuss the situation with the instructor and/or the course supervisor (if applicable), and finally with the DEO (Chair) of the department, school or program offering the course. Sometimes students will be referred to the department or program's Director of Undergraduate Studies (DUS) or Director of Graduate Studies (DGS).

Undergraduate students should contact [CLAS Undergraduate Programs](#) for support when the matter is not resolved at the previous level. Graduate students should contact the [CLAS Dean's Office](#) when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the drop deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course [here](#). When you drop a course, a "W" will appear on your transcript. The mark of "W" is a neutral mark that does not affect your GPA. To discuss how dropping (or staying in) a course might affect your academic goals, please contact your Academic Advisor. Directions for adding or dropping a course and other registration changes can be found on the [Registrar's website](#). Undergraduate students can find policies on dropping CLAS courses [here](#). Graduate students should adhere to the [academic deadlines](#) and policies set by the Graduate College.

Grading System and the Use of +/-

This course will use +/- grading, ranging from A+ to D- and F.

Date and Time of the Final Exam

The [final examination date and time](#) will be announced by the Registrar generally by the fifth week of classes, and it will be announced on the course ICON site once it is known. **Do not plan your end of the semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam.** According to the Registrar's final exam policy, students **have a maximum of two weeks after the announced final exam schedule** to request a change if an exam conflict exists or if a student has more than two exams scheduled for the same day (see the [policy](#) here).

Attendance and Absences

Attendance at lectures is not required, but is strongly encouraged. Attendance during in-class examinations is mandatory. [University regulations require that students be](#)

[allowed to make up examinations](#) that have been missed due to illness, religious holy days, military service obligations (including service-related medical appointments), or other unavoidable circumstances or University-sponsored activities. Students with UI-authorized activities must discuss their absences with the instructor as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

Communication: UI Email

Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community. For the privacy and the protection of student records, UI faculty and staff can only correspond with UI email addresses.

Mental Health Resources and Student Support

Students are encouraged to be mindful of their mental health and seek help as a preventive measure or if feeling overwhelmed and/or struggling to meet course expectations. Students are encouraged to talk to their instructor for assistance with course-related concerns. For additional mental health support, please see the guidance and resources at mentalhealth.uiowa.edu, including the 24-7 [UI Support and Crisis Line](#).

Additionally, the Office of the Dean of Students can help students navigate personal crisis situations. They can provide one-on-one support, help with identifying options, and access to [basic needs resources \(such as food, rent, childcare, etc.\)](#). Student Care and Assistance: 132 IMU, dos-assistance@uiowa.edu, or 319-335-1162 and more info: dos.uiowa.edu/assistance

University Policies

Accommodations for Students with Disabilities

The University is committed to providing an educational experience that is accessible to all students. If a student has a diagnosed disability or other disabling condition that may impact the student's ability to complete the course requirements as stated in the syllabus, the student may seek accommodations through [Student Disability Services](#) (SDS). SDS is responsible for making [Letters of Accommodation \(LOA\)](#) available to the student. **The student must provide an LOA to the instructor as early in the semester as possible, but requests not made at least two weeks prior to the scheduled activity for which an accommodation is sought may not be accommodated.** The LOA will specify what reasonable course accommodations the student is eligible for and those the instructor should provide.

Free Speech and Expression

Absences for Religious Holy Days

Classroom Expectations

Non-discrimination

Sexual Harassment/Misconduct and Supportive Measures

Sharing of Class Recordings (if appropriate)