

PHYS:7729

Plasma Physics II

Spring 2023

Instructor:	Gregory Howes
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Office Hours:	10:00–11:00am T, 10:00am–12:00pm 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, 618 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 23rd and Thursday, Apr 13th 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).

COVID-19:

- If you have symptoms consistent with COVID-19, stay home. Do not go to class or work while symptomatic. If you develop symptoms while on campus, go home. Call a health care professional who can assess your symptoms and risk factors and help you make a plan. Consult your UI Health Care provider, Student Health, or personal health care provider to see if you need a COVID-19 test.
- You will not be penalized for missing this class due to illness, and I will work with you to ensure that you are able to make up work as needed.
- If you test positive for COVID-19, you are strongly encouraged to follow CDC protocols for isolation, mask use, and testing to return to normal activities.

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Plasma Physics II Schedule

Spring 2023

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	1/17	Lecture #1	
		2	1/19	Lecture #2	
2	GB Chap. 4, Sec. 4.5 (p.137–141) BS Chap. 11, Sec. 11.1–11.2 (p.425–433)	3	1/24	Lecture #3	
		4	1/26	Lecture #4	
3	Prepare for and deliver Cold Plasma Wave Presentations	5	1/31	Lecture #5	HW#1 due 1/31–2/2
		6	2/2	Lecture #6	
4	GB Chap. 7, Sec. 7.3 (p.239–260) BS Chap. 4, Sec. 4.5–4.7 (p.108–130)	7	2/7	Lecture #7	HW#2 due 2/9
		8	2/9	Lecture #8	
5	None	9	2/14	Lecture #9	HW#3 due 2/16
		10	2/16	Lecture #10	
6	Review Lectures #1–10 Review HW #1–3	11	2/21	Midterm #1 Review	Midterm Exam #1
		12	2/23	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	2/28	Lecture #11	
		14	3/2	Lecture #12	
8	GB Chap. 9, Sec. 9.3–9.4 (p.346–356)	15	3/7	Lecture #13	HW#4 due 3/9
		16	3/9	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	3/21	Lecture #15	HW#5 due 3/23
		18	3/23	Lecture #16	
10	GB Chap. 11, Sec. 11.1 (p.428–441) BS Chap. 10, Sec. 10.1–10.2 (p.376–388)	19	3/28	Lecture #17	HW#6 due 3/30
		20	3/30	Lecture #18	
11	GB Chap. 2, Sec. 2.2 (p.6–9) BS Chap. 11, Sec. 11.7 (p.453–458)	21	4/4	Lecture #19	HW#7 due 4/6
		22	4/6	Lecture #20	
12	Review Lectures #11–20 Review HW #4–7	23	4/11	Midterm #2 Review	Midterm #2
		24	4/13	No Lecture	
13	Read Barenblatt (2003), p.1–26 Read Taylor (1950a) and (1950b)	25	4/18	Lecture #21	
		26	4/20	Lecture #22	
14	None None	27	4/25	Lecture #23	HW#8 due 4/27
		28	4/27	Lecture #24	
15	Review Lectures #1–24 Review HW #1–8	29	5/2	Lecture #25	
		30	5/4	Final Review	
Finals Week, 5/8–5/12				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*

Academic Honesty and Misconduct

All students in CLAS courses are expected to abide by the [CLAS Code 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 Director or Chair of the school, department, or program offering the course.

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 [Associate Dean for Graduate Education and Outreach and Engagement](#) when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the 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. 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 and withdrawing [here](#). Graduate students should adhere to the [academic deadlines](#) and policies set by the Graduate College.

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 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 in one day (see the [policy](#) here).

College of Liberal Arts and Sciences (CLAS) Course Policies

Attendance and Absences

University regulations require that students be allowed to make up examinations which have been missed due to illness or other unavoidable circumstances. Students with mandatory religious obligations or UI authorized activities must discuss their absences with me as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

Exam Policies

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.

University Policies

[Accommodations for Students with Disabilities](#)

[Basic Needs and Support for Students](#)

[Classroom Expectations](#)

[Exam Make-up Owing to Absence](#)

[Free Speech and Expression](#)

[Mental Health](#)

[Military Service Obligations](#)

[Non-discrimination](#)

[Religious Holy Days](#)

[Sexual Harassment/Misconduct and Supportive Measures](#)

[Sharing of Class Recordings](#)