

**Instructor:** Gregory Howes  
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**Office Hours:** 10:45–11:45am T, 9:30–11:30am W, or by appointment  
**Department:** Physics & Astronomy, 203 Van Allen Hall, Prof. Phil Kaaret, Chair

**Catalog Description:** The aim of this course is to explore fundamental plasma processes at the frontier of modern research in plasma physics: turbulence, magnetic reconnection, shocks, instabilities, and radiation. These critical processes impact the evolution of plasma systems, from laboratory and fusion plasmas, to heliospheric plasmas such as the solar corona or Earth's magnetosphere, to more extreme environments in distant astrophysical systems such as galaxy clusters and black hole accretion disks. The course will not only serve to provide a fundamental foundation to understand these topics in ongoing research, but will also aim to provide key connections to the current literature on these topics.

**Meeting:** Tuesday and Thursday 9:30am - 10:45am  
618 Van Allen Hall

**Textbooks:** These three texts are available electronically through the University of Iowa Libraries as part of the Cambridge Core collection:  
1) Donald A. Gurnett & Amitava Bhattacharjee, *Introduction to Plasma Physics: With Space, Laboratory and Astrophysical Applications*, 2nd edition, 2017.  
2) T. J. M. Boyd, & J. J. Sanderson, *The Physics of Plasmas*, 2003.  
3) Paul M. Bellan, *Fundamentals of Plasma Physics*, 2006.

**Web Page:** <http://www.physics.uiowa.edu/~ghowes/teach/phys7730/index.html>

**Grading:** Homework: 60%  
Final Project: 40%

**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. Some assignments may involve a certain amount of computer work. 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.

**Final Project:** You may complete the final project on any plasma physics topic of your choice (ideally related to your own thesis research), with the format in one of three possible forms: (i) a "course lecture" on a new topic, or an extension of a topic we have covered, consisting of a set of lecture notes similar to those that I hand out at the beginning of each lecture; (ii) a detailed calculation of a particular mathematical problem arising in plasma physics; or (iii) a literature review of the present state of knowledge on a particular topic, for example what is presently known about the structure of quasiparallel and quasiperpendicular collisionless shocks. The project should be approximately 5–10 pages, and may be handwritten or typed.

**Topics:**

1. Fundamental Plasma Physics Concepts (3 weeks)
2. Turbulence (4 weeks)
3. Collisionless Shocks (3 weeks)
4. Magnetic Reconnection (3 weeks)
5. Instabilities (1 week)
6. Radiation (1 week)

**COLLEGE OF LIBERAL ARTS AND SCIENCES (CLAS)**  
**Graduate Course Syllabus Insert**  
**Spring 2022**

**ATTENDANCE AND CLASSROOM EXPECTATIONS**

Students are responsible for attending class and for knowing an instructor's attendance policies, which vary by course and content area. All students are expected to attend class and to contribute to its learning environment in part by complying with University policies and directives regarding appropriate classroom behavior or other matters.

**ABSENCES**

Students are responsible for communicating with instructors as soon they know that an absence might occur or as soon as possible in the case of an illness. Delays in communication could result in a forfeit of what otherwise might be an excused absence.

**ABSENCES: ILLNESS, UNAVOIDABLE CIRCUMSTANCES, AND UNIVERSITY SPONSORED ACTIVITIES**

Students who are ill, in an unavoidable circumstance affecting academic work, or who miss class because of a University sponsored activity are allowed by UI policy to make up a missed exam. Documentation is required by the instructor except in the case of a brief illness. Students are responsible for communicating with instructors as soon as the absence is known (<https://opsmanual.uiowa.edu/students/absences-class#8.1>).

**ABSENCES: HOLY DAYS**

The University is prepared to make reasonable accommodations for students whose religious holy days coincide with their classroom assignments, test schedules, and classroom attendance expectations. Students must notify their instructors in writing of any such Religious Holy Day conflicts or absences within the first few days of the semester or session, and no later than the third week of the semester. If the conflict or absence will occur within the first three weeks of the semester, the student should notify the instructor as soon as possible. See [Operations Manual 8.2 Absences for Religious Holy Days](#) for additional information.

**ABSENCES: MILITARY SERVICE OBLIGATIONS**

Students absent from class due to U.S. veteran or U.S. military service obligations (including military service-related medical appointments, military orders, and National Guard Service obligations) must be excused without penalty. Instructors must make reasonable accommodations to allow students to make-up exams or other work. Students must communicate with their instructors about the expected possibility of missing class as soon as possible. (For more information, see <https://opsmanual.uiowa.edu/iv-8-absences-class%C2%A0-0>).

**ACADEMIC MISCONDUCT**

Plagiarism and the process for addressing academic misconduct of graduate students are defined in [Section IV, Article F "Plagiarism by Graduate Students" of the UI Graduate College Manual of Rules and Regulations](#). Please contact the CLAS Associate Dean for Graduate Education for any necessary assistance in navigating the process mandated by the Graduate College.

**ACADEMIC ACCOMMODATIONS**

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 a 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. Additional information can be found on the [SDS website](#). Note that accommodations are not granted retroactively but from the time of the student's request to the instructor onward. Graduate students serving as Teaching Assistants, Research Assistants, or Fellows must contact Faculty and Staff Disability Services (<https://hr.uiowa.edu/support/faculty-and-staff-disability-services>) for assistance with accommodations.

**CLASS RECORDINGS: PRIVACY AND SHARING**

Course lectures and discussions are sometimes recorded or live-streamed. These are only available to students registered for the course and are the intellectual property of the faculty member. These materials may not be shared or

reproduced without the explicit written consent of the instructors. Students may not share these recordings with those who are not enrolled in the course; likewise, students may not upload recordings to any other online environment. Doing so is a breach of the Code of Student Conduct and could be a violation of the Federal Education Rights and Privacy Act (FERPA); also see <https://dos.uiowa.edu/policies/code-of-student-life/>.

#### **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 ([Operations Manual, III.15.2](#)). Emails should be respectful and brief, with complex matters addressed during the instructor's drop-in hours, for example. Faculty are not expected to answer email after business hours or during the weekends.

#### **FREE SPEECH AND EXPRESSION**

The University of Iowa supports and upholds the First Amendment protection of freedom of speech and the principles of academic and artistic freedom. We are committed to open inquiry, vigorous debate, and creative expression inside and outside of the classroom. Visit Free Speech at Iowa for more information on the University's policies on free speech and academic freedom: <https://freespeech.uiowa.edu/>.

#### **COMPLAINTS ABOUT ACADEMIC MATTERS**

Students with a complaint about a grade or a related academic matter should first visit with the instructor and then with the course supervisor (if applicable), and finally with the director of the school, department, or program offering the course. If a graduate student has not been able to resolve the issue through the director of the school, department, or program, they should contact the associate dean for graduate education in the College of Liberal Arts and Sciences.

#### **FINAL EXAMINATION POLICIES**

The final exam schedule is published during the fifth week of the fall and spring semesters or on the first day of summer classes; students are responsible for knowing the date, time, and place of their final exams. Students should not make travel plans until knowing this information. A student with exams scheduled on the same day and time or who have more than two final exams on the same day should visit this page for how to resolve these problems by the given deadline (<https://registrar.uiowa.edu/makeup-final-examination-policies>). No exams are allowed the week before finals, but with some exceptions made for labs, language courses, and off-cycle courses (<https://registrar.uiowa.edu/final-examination-scheduling-policies>).

#### **HOME OF THE COURSE**

The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the policies and procedures for its courses. Graduate students, however, must adhere to the academic deadlines set by the Graduate College. See <https://grad.uiowa.edu/academics/deadlines>.

#### **MENTAL HEALTH**

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 specific class-related concerns. For additional support and counseling, students are encouraged to contact University Counseling Service (UCS). Information about UCS, including resources and how to schedule an appointment, can be found at [counseling.uiowa.edu](https://counseling.uiowa.edu). Find out more about UI mental health services at: [mentalhealth.uiowa.edu](https://mentalhealth.uiowa.edu). Student Health can also address related concerns (<https://studenthealth.uiowa.edu/>). These visits are free to students. After hours, students are encouraged to call the Johnson County Community Crisis Line at (319) 351-0140 or dial 911 in an emergency.

#### **NON-DISCRIMINATION STATEMENT**

The University of Iowa prohibits discrimination in employment, educational programs, and activities on the basis of race, creed, color, religion, national origin, age, sex, pregnancy, disability, genetic information, status as a U.S. veteran, service in the U.S. military, sexual orientation, gender identity, associational preferences, or any other classification that deprives the person of consideration as an individual. The university also affirms its commitment to providing equal opportunities and equal access to university facilities. For additional information on nondiscrimination policies, contact the Director, [Office of Institutional Equity](#), the University of Iowa, 202 Jessup Hall, Iowa City, IA 52242-1316, 319-335-0705, [oi-e-ui@uiowa.edu](mailto:oi-e-ui@uiowa.edu). Students may share their pronouns and chosen/preferred names in [MyUI](#), which is accessible to instructors and advisors.

#### **SEXUAL HARASSMENT**

The University of Iowa prohibits all forms of sexual harassment, sexual misconduct, and related retaliation. The [Policy](#)

[on Sexual Harassment and Sexual Misconduct](#) governs actions by students, faculty, staff and visitors. Incidents of sexual harassment or sexual misconduct can be reported to the [Title IX and Gender Equity Office](#) or to the [Department of Public Safety](#). Students impacted by sexual harassment or sexual misconduct may be eligible for academic supportive measures and can learn more by [contacting the Title IX and Gender Equity Office](#). Information about confidential resources can be found [here](#). Watch the [video](#) for an explanation of these resources.