ASTR:7830 Space and Astrophysical Plasmas Spring 2024

Semester: Spring 2024
Instructor: Gregory Howes
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Office Hours: 1:00-2:00pm W, 9:30-11:30am Th, or by appointment
Department: Physics & Astronomy, 203 Van Allen Hall, Prof. Mary Hall Reno, Chair

Catalog Description: Dynamics and evolution of space and astrophysical plasmas; heliosphere, planetary magnetospheres, accretion disks; plasma waves, shock waves, turbulence.

Meeting: Monday, Wednesday, and Friday 10:30am - 11:20am
156 Van Allen Hall

Textbooks: No required texts, but I suggest you purchase one of the recommended texts below:
1) C. T. Russell, J. G. Luhmann, and R. J. Strangeway *Space Physics: An Introduction*. 2016.
2) Toshiki Tajima & Kazunari Shibata, *Plasma Astrophysics*, 2002.

Web Page: `https://homepage.physics.uiowa.edu/~ghowes/teach/astr7830/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. 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.

Topics:
1. Fundamental Plasma Physics Concepts (Single Particle Motion, MHD) (3 weeks)
2. Magnetospheric Physics (Structure and Dynamics) (5 weeks)
3. Heliospheric Physics (Structure and Dynamics) (2 weeks)
4. Astrophysical Systems (Accretion Disks, Galaxy Clusters, Supernova Remnants) (4 weeks)
5. Plasma Physics Phenomena (Shocks, Reconnection, Turbulence, Instabilities) (throughout)

Reference books:
W. Baumjohann & R. A. Treumann, *Basic Space Plasma Physics*
C. J. Clarke & R. F. Carswell, *Principles of Astrophysical Fluid Dynamics*
J. Frank, A. King, & D. Raine, *Accretion Power in Astrophysics*
D. Gurnett and A. Bhattacharjee, *Introduction to Plasma Physics with Space and Laboratory Applications*
R. Kulsrud, *Plasma Physics for Astrophysics*
H. J. G. L. M. Lamers & J. P. Cassinelli, *Introduction to Stellar Winds*
J. Pringle & A. King, *Astrophysical Flows*
F. H. Shu, *The Physics of Astrophysics, Volume II: Gas Dynamics*
R. A. Treumann & W. Baumjohann, *Advanced Space Plasma Physics*

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 CLAS courses here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

Grading System and the Use of +/-

A	**B**	**C**	**D**	**F**
A+	B+	C+	D+	F
A	B	C	D	
A-	B-	C-	D-	

Attendance and Absences

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 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. Find out more about UI mental health services at mentalhealth.uiowa.edu.

Student Care and Assistance provides assistance to University of Iowa students who are experiencing a variety of crisis and emergency situations, including but not limited to medical issues, family emergencies, unexpected challenges, and sourcing basic needs such as food and shelter. More information on the resources related to basic needs can be found at basicneeds.uiowa.edu/resources/. Students are encouraged to contact Student Care & Assistance in the Office of the Dean of Students (Room 135 IMU, dos-assistance@uiowa.edu, or 319-335-1162) for support and assistance with resources.

University Policies

Accommodations for Students with Disabilities
The University is committed to providing an educational experience that is accessible to all. 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. **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. Additional information can be found on the SDS website.

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)