

Syllabus 29:278 **Space and Astrophysical Plasmas**

Semester: Spring 2014
Instructor: Gregory Howes
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Office Hours: 10:45-11:45am TWTh, or by appointment
Department: Physics & Astronomy, 203 Van Allen Hall, Prof. Mary Hall Reno, Chair

Catalog Description: This course covers the fundamentals of the dynamics and evolution of space and astrophysical plasma environments, including the structure of the heliosphere and planetary magnetospheres, structure of accretion disks, solar and stellar winds, and galaxy clusters. Waves, shocks, and turbulence will be explored, focusing on their influence on the evolution of the plasma environment. No prerequisites (the basics of the background plasma physics will be covered in this course), but 029:194 and 029:293 are recommended.

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

Textbooks: No required texts, but I suggest you purchase one of the recommended texts below:
1) Margaret G. Kivelson & Christopher T. Russell, *Introduction to Space Physics*
2) Toshiki Tajima & Kazunari Shibata, *Plasma Astrophysics*

Web Page: <http://www.physics.uiowa.edu/~ghowes/teach/phys278/index.html>

Grading: Homework: 75%
Final Project: 25%

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.

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) (5 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*

The College of Liberal Arts and Sciences Policies and Procedures

Administrative Home

The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook at <http://clas.uiowa.edu/students/handbook>.

Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences (Operations Manual, III.15.2, k.11).

Accommodations for Disabilities

A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See www.uiowa.edu/sds/ for more information.

Academic Honesty

All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

CLAS Final Examination Policies

The final examination schedule for each class is announced by the Registrar generally by the tenth day of classes. Final exams are offered only during the official final examination period. *No exams of any kind are allowed during the last week of classes.* All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of a final exam.

Making a Suggestion or a Complaint

Students with a suggestion or complaint should first visit with the instructor (and the course supervisor), and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS Academic Policies Handbook).

Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Department of Public Safety website.