PHYS 672: Magnetospheric Physics

Syllabus

Spring 2018

Instructor: Prof. Hui Zhang

Office: 708D Elvey Building; Tel: (907)474-5914; E-mail: hzhang14@alaska.edu

Time: Mondays, Wednesdays, and Fridays, 9:15am-10:15am

Place: REIC 207

Office Hours: Mondays, Wednesdays, and Fridays 11:30am-12:30pm, or by appointment.

Credits: 3 credits, 3 hours/week of lecture **Useful Books:** (all on reserve in the GI-IARC Library)

Space Physics: An Introduction, Author: C. T. Russell, J. G. Luhmann, R. J. Strangeway, Publisher: Cambridge University Press (2016), ISBN-10:

1107098823

Introduction to Space Physics, edited by Kivelson and Russell, Cambridge University Press (1995), ISBN-10: 0521457149

Physics of Space Plasmas: An Introduction, Second Edition, Author: George Parks, Publisher: Westview Press (2003), ISBN-10: 0813341302

Basic Space Plasma Physics, Author: W. Baumjohann and R. A. Treumann, World Scientific Publishing Company (1996), ISBN-10 186094017X

Course Description

The Earth's magnetosphere is the region where the Earth's magnetic field is confined by the solar wind. It is made up of various large-scale regions, which vary in terms of the composition, energies, and densities of the plasmas that occupy them. The Earth's magnetosphere changes dynamically due to changes in the dynamic pressure and orientation of the interplanetary magnetic field (IMF). This course provides an introduction to established theory and phenomenology as well as a discussion of current problems on the structure and dynamics of the magnetosphere at the graduate level. The magnetosphere itself provides the structure for the course. The course follows an outside-in approach to the magnetosphere, starting with the solar wind, bow shock, and magnetosheath, then the magnetosphere and its interaction with the ionosphere, the magnetotail, and dynamics of the magnetosphere and its interaction with the ionosphere. It is desirable to have knowledge about "Electromagnetism" and "Plasma Physics". This course is recommended for graduate students with research interests in space physics.

Grades

45% of the grade will be based on problem sets (expect one every week), 15% on the mid-term exam, 20% on the final exam, and 20% on the project.

The course will be graded approximately on the following scale:

> 85 %	Α
80 % 85 %	A-
75 % 80 %	B+
70 % 75 %	В

65 % 70 %	B-
60 % 65 %	C+
55 % 60 %	С
50 % 55 %	C-
45 % 50 %	D+
40 % 45 %	D
35 % 40 %	D-
< 35 %	F

Course Policies

Problem sets will be given in class and are due in class on the due date stated in the problem sets. You are expected to show not only your answer but also steps leading to that answer. Your work should be clean and clear enough for me to understand.

High ethical standards are essential for maintaining credibility. Plagiarism is defined as appropriating passages or ideas from another person's work and using them as one's own. You may work with your classmates on problem sets, however, you should submit your own work, not a copy from another source. Plagiarism on homework or on a project will result in a failing grade.

Students with Disabilities Notice

The University of Alaska Fairbanks is committed to equal opportunity for students with disabilities. Students with disabilities are encouraged to contact the coordinator of Disability Services (Mary Matthews) at the Center for health & Counseling (x7043). See section on "Disability Services" of the UAF Class Schedule (http://www.uaf.edu/schedule/).

Tentative Course Outline

- I. Introduction
- II. The Bow Shock and the Magnetosheath
- III. The Magnetopause
- IV. The Magnetospheric Cusp
- V. The Inner Magnetosphere
- VI. Quiet Magnetotail
- VII. Magnetosphere-Ionosphere Coupling
- VIII. Storm and Substorms

Tentative Weekly Schedule

Week	Date	Lecture Subject	Problem Sets
1	W Jan 17	Introduction	Problem Set 1
	F Jan 19	The Solar Wind and IMF	
	M Jan 22	MHD Shocks and Discontinuities	
2	W Jan 24	The Bow Shock	
	F Jan 26	The Magnetosheath	Problem Set 1 is Due
	M Jan 29	Location of the Magnetopause	
3	W Jan 31		
	F Feb 2	Magnetopause current	Problem Set 2 is Due
	M Feb 5	The Magnetic Reconnection	

F Apr 13 Inner Magnetosphere Coupling M Apr 16 Quiet Magnetotail				
M Feb 12 W Feb 14 F Feb 16 Problem Set 4 is Due	4	W Feb 7		
Section Feb 14 Feb 16 Problem Set 4 is Due		F Feb 9		Problem Set 3 is Due
F Feb 16 M Feb 19 M Feb 21 F Feb 23 Mantle, LLBL M Mar 5 W Mar 7 F Mar 9 M Mar 12 W Mar 14 F Mar 16 M Mar 23 F Mar 2 M Mar 25 M Mar 26 M Mar 26 M Mar 27 M Mar 27 F Mar 30 M Mar 28 F Mar 30 M Apr 4 F Apr 6 M Apr 9 M Apr 11 M Apr 15 M Apr 16 M Apr 16 M Apr 17 M Apr 18 M Apr 20 M Ap			Other plasma transport mechanisms	
M Feb 19	5			
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15 F May 4 8:00am-10:00am Final Exam				