PHYS 672: Magnetospheric Physics Syllabus Spring 2018

Instructor: Prof. Hui Zhang
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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 magnetopause, and on to the inner magnetosphere, 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 %	A
80 % -- 85 %	A-
75 % -- 80 %	B+
70 % -- 75 %	B

65 % -- 70 %	B-
60 % -- 65 %	C+
55 % -- 60 %	C
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	
2	M Jan 22	MHD Shocks and Discontinuities	
	W Jan 24	The Bow Shock	
	F Jan 26	The Magnetosheath	Problem Set 1 is Due
3	M Jan 29	Location of the Magnetopause	
	W Jan 31		
	F Feb 2	Magnetopause current	Problem Set 2 is Due
	M Feb 5	The Magnetic Reconnection	

4	W Feb 7		
	F Feb 9		Problem Set 3 is Due
5	M Feb 12	Other plasma transport mechanisms	
	W Feb 14		
	F Feb 16		Problem Set 4 is Due
6	M Feb 19	The Magnetospheric Cusp	
	W Feb 21		
	F Feb 23		Problem Set 5 is Due
7	M Feb 26		
	W Feb 28	Mantle, LLBL	
	F Mar 2		Problem Set 6 is Due
8	M Mar 5		
	W Mar 7	Review	
	F Mar 9	Mid-term Exam	
X	M Mar 12	**Spring Break**	
	W Mar 14		
	F Mar 16		
9	M Mar 19	The Magnetospheric Convection	
	W Mar 21		Problem Set 7 is Due
	F Mar 23		
10	M Mar 26	The Plasmasphere	
	W Mar 28	The Plasmaspheric Plume	Problem Set 8 is Due
	F Mar 30	Plasmapause	
11	M Apr 2	Ring Current	
	W Apr 4	Radiation Belt	Project topic chosen
	F Apr 6		
12	M Apr 9	Inner Belt, South Antactic Anormaly	
	W Apr 11	Outer Belt	Project progress report
	F Apr 13	Inner Magnetosphere Coupling	
13	M Apr 16	Quiet Magnetotail	
	W Apr 18	The Magnetosphere-Ionosphere Coupling	Project progress report
	F Apr 20		
14	M Apr 23	The Magnetospheric Substorm	
	W Apr 25	The Magnetospheric Storm	Project is due
	F Apr 27		Presentations
15	M Apr 30		
	F May 4	8:00am-10:00am Final Exam	