Syllabus – PHYS 673 Space Physics – Fall 2014

Course Information:

PHYS 673:	Space Physics, 3 credits, Fall 2013
Meeting Times:	Thursday 2:30-4:30
Meeting Location:	Elvey 708E
Prerequisites:	Undergraduate E&M, Plasma Physics (PHYS 626)

Instructor Information:

Instructor:	Peter Delamere, Associate Professor of Physics
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Office Hours:	by appointment

Scope: The term "Space Physics" encompasses the space environement from the sun to the outer heliosphere. Within this space environment are both magnetized and unmagnetized planets, comets, moons, and asteroids, embedded in a supersonic plasma outflow from the sun – the solar wind. The aim of this course is to provide a broad introduction to *heliospheric physics*, utilizing basic plasma physics concepts. This course will logically progress toward a more detailed course on magnetospheric physics, though a few basic concepts of magnetospheric physics will be introduced in this course.

Approach: The emphasis will be a very broad overview of space plasma physics from the sun to the outer heliosphere and the interstellar wind. The basic concepts are applicable to magnetospheric and ionospheric physics. The basic measurements that help us to understand the space plasma enviroment will be discussed. Particular emphasis will be given to back-of-the-envelope estimates in Space Physics.

Topics: Introduction to basic plasma physics (including MHD and plasma kinetic processes), magnetic dynamos, solar physics, reconnection, solar wind, shocks, interaction of the solar wind with unmagnetized objects (comets, asteroids, moons), interaction of the solar wind with magnetized obstacles (magnetospheres), the heliosphere (termination shock), heliospheric tail, and dusty plasmas.

Textbook: *Physics of Solar System Plasmas* – Tom Cravens – Cambridge University Press.

Grading:

Homework	30%
Midterm Exam	20%
Final Exam	30%
Term Project	20%

Term project: The term project will be defined as "Instrumentation in space plasma physics". The students will research an instrument of choice (e.g. particle detectors, magnetometers etc.) and make a 25 minute in-class presentation. A historical overview of the measurement technique should be provided, highlighting some of the most significant scientific discoveries.

Course Policies:

(a) Attendance and participation in class is expected of all students.
(b) Assignments are due at the beginning of class on the due date.
(c) Students are encouraged to work together on homework problems, but the final written solutions must be individual work.
(d) Students must acknowledge all sources of information – included fellow students – used in homework solutions and final projects. The UAF catalog states: "The university may initiate disciplinary action and impose disciplinary sanctions against any student or student organization found responsible for committing, attempting to commit or intentionally assisting in the commission of . . . cheating, plagiarism, or other forms of academic dishonesty. . . "
(e) All UA student academics and regulations are adhered to in this course. You may find these in the UAF catalog (section "Academics and Regulations").

Schedule:

Topic	Weeks/Dates	Relevant Chapters
Plasma Basics	1-3	1-4
Dynamo theory	4	5
Stellar atmosphere	5	5
Solar Wind/inner heliosphere	6-7	6
Shocks	8	7
Midterm Exam		
Solar wind/outer heliosphere	8	6
Mass loaded plasmas	9	7
Alfvén waves and momentum transfer	10	7
Plasma interaction with unmagnetized obstacles (comets, asteroids, and moons)	11-12	7
Solar wind interaction with magnetized obstacles	13-14	8
Plasma, neutral gas, and dusty plasmas	15	8
Final exam	15	