Contact Information

Instructor:	Jim Crumley
Office:	107 Peter Engel Science Center
Email:	jcrumley@csbsju.edu
Phone:	363–3183
Office Hour:	1 pm even days (or by appointment or just stop by)

Course Information

Lecture:	8:00–9:10 am Days 246 (Mods C+D)
Room:	167 Peter Engel Science Center
Textbook:	*Space Science* edited by Harra and Mason
Web Site:	http://www.physics.csbsju.edu/368/

Introduction

Space Physics is the study of what goes on in the solar systems between the Sun and its satellites — the planets, moons, comets, asteroids, etc. In elementary science classes this region is often described as vacuum that contains no matter. This is an exaggeration — even though the number density of particles in most regions of the solar system is small enough to be considered a vacuum by earthbound standards, matter still exists in all regions. This matter usually exists as a plasma. Along with the plasma, many different types of waves exist in space. Much of this course will deal with the plasma and waves in space and their interactions with each other.

In some ways, Space Physics is one of the oldest branches of physics. Since before recorded history, people have been fascinated by the night sky. Much of what interested ancient people involved the stars, which would now be classified as astronomy, but some of the most striking phenomena, including most importantly the aurora borealis and australis, have their roots in Space Physics. Though Space Physics has its roots in the distant past, it did not really come into its own as a field of study until after man-made satellites were first launched into space. In-situ measurements are key to understanding the space environment and in this course we will often look at spacecraft data.

Homework Assignments

Homework will be assigned roughly once a cycle and be due roughly a cycle later.

Grading

The grade in this class will be 35 % from the total homework grade, 10 % from quizzes/participation, 20 % from the first test grade, and 35 % from the final test.

Course Schedule

Cycle		Date	Sections	Title	Topics
7-2	W	3/11	1, 4.1–4.4	Introduction to Space Physics	Plasmas and space
7-4	F	3/13	4.5.1–4.5.4	Basic Plasma Physics	MHD and shocks
7-6	T	3/17	4.5.5–4.5.7	Plasma as Particles	Reconnection and magnetospheres
8-2	R	3/19	4.5.7–4.6	More Magnetospheres	SW interaction with other bodies
8-4	M	3/23	6.1–6.3	Introduction to the Sun	Solar structure, energy
8-6	W	3/25	6.4–6.6	More on the Sun	Neutrinos, helioseismology, B_{Sun}
9-2	F	3/27	6.7–6.9	Solar atmosphere	Photosphere, chromosphere, corona
9-4	T	3/31	6.10–6.12	Solar Wind	Solar wind and flares
9-6	R	4/02	1,4,6	Review	Review for Test 1
10-2	M	4/06	1–5	Test 1	
10-4	W	4/08	5.1–5.4	Aurora	Solar activity and aurora
				Easter Break	
10-6	W	4/15	5.4–5.6	Aurora II	Aurora and substorms
11-2	F	4/17	5.7–5.12	Solar Activity	Flares, ionosphere, CMEs
11-4	T	4/21	5.13–5.16	Magnetic Storms	Storms, substorms, and CMEs
11-6	F	4/24	9.1–9.3	Introduction to MHD	Conservation and Maxwell’s eqns
12-2	T	4/28	9.4–9.7	MHD details	Momentum eqn, reconnection
12-4	R	4/30	9.8–9.9	MHD waves	Acoustic and Alfven waves
12-6	M	5/04	1,4–6,9	Review	Review for Final
Final	W	5/06		Final Exam	

References

- *Physics of Space Plasmas* by Parks an introductory Space Physics book aiming at the first year of grad school level. Fairly completely and readable, though it focuses more on plasma physics than I like for this course. Used this test the last time I taught this course.

- *Introduction to Space Physics* edited by Kivelson and Russell — at a similar level to Parks, but organized by space physics structures and regions instead of by plasma physics topic as Parks does. Used this text the first time that I taught this course.

- *Introduction to Plasma Physics* by Chen — classic plasma physics book with examples focused on lab plasmas.

- *Basic Space Plasma Physics* by Baumjohann and Treuman — divides things by plasma topics like Parks, but orders them differently. Not quite as easy to read as Parks.

- *Space Physics* by Kalleronde — tries an approach somewhere between Parks and K&R. It starts with quite a bit of theory, then moves through regions of space.