Syllabus
PTYS 403/503 – Spring 2019
The Physics of the Solar System

Course Description: The goal is to give a survey of planetary science with an emphasis on quantitative aspects of the physics of the solar system. The emphasis throughout will be on basic physical processes and the various approximations used in their application to realistic and relevant problems. Broad aspects of solar-system physics will be covered, including: planetary orbits, dynamics of smaller bodies and dust in the solar system, the nature and origin of light, radiative transfer, solar system formation, planetary interiors, surfaces and atmospheres, solar-system magnetism, the Sun, asteroids, comets, and extrasolar planets. A more-detailed list of topics is given in the attached tentative lecture schedule. This is a co-convened undergraduate/graduate course. The lectures and material will predominantly be aimed at the advanced under4graduate level. Students enrolled in 503, the graduate section, will be required to do some additional, perhaps more-challenging assignments (c.f. the grading policy below), as well as a term paper and in-class presentation.

Meeting Time: T, Th 9:30-10:45AM – Kuiper Space Sciences Room 312

Instructor: Joe Giacalone, Professor of Planetary Sciences
Office: Kuiper Space Sciences – Room 411
Tel: 626-8365; Email: giacalon@lpl.arizona.edu
Office Hours: after class (or just stop by)
Administrative Assistant: Vicki Robles de Serino (Room 415; tel: 621-9692)

Teaching Assistant: Rachel Fernandes, Graduate Student in Planetary Sciences
Office: Kuiper Space Sciences – Room 324
Email: rachelbf@lpl.arizona.edu
Office Hours: Friday, 9:30-10:30AM (or email to discuss additional meeting times).

Prerequisites: As quoted in the departmental catalogue of classes, either PHYS142 or PHYS251 is a prerequisite for this class. Basically, you should have some calculus-based physics background as this course will focus primarily on the physics of the solar system and will use calculus-level mathematics, such as derivatives, integrals, vector analysis, and algebra. You should consult with the instructor if you have any questions about your level of preparation for this course.

Grading: Your final grade will be based on a cumulative performance on homework and exams. Final grades may be based on a common statistical curve, but you are assured of the following grade based on your overall final average: (A) 90% or above, (B) 80-90%, (C) 70-80%, (D) 60-70%. The weighting of the assignments is as follows:

Students enrolled in 403
- 50% Problem sets (~5 assignments)
- 25% Average of 2 mid-term exams
- 25% Final Exam

Students enrolled in 503 (graduate credit)
- 45% Problem sets (~5 assignments*)
- 20% Average of 2 mid-term exams

20% Final Exam
15% Term Paper and presentation (details will be announced in class)

* there will likely be an additional problem or two. Per homework assignment, for students enrolled in the 503.

Assignments and Exams: There will be ~5 homework assignments during the course. The assignments will be announced in class and will be available for download from the course website. The assignment must be turned in on the due date at the beginning of class, generally one week after it is assigned. Solutions to the homework assignments will be made available on the website. Late homework will usually incur a late penalty, and will not be accepted once solutions have been posted on the course website.

There will be two mid-term exams, both of which will take place during the regular class period in the same room as the lectures. The tentative dates are given in the attached lecture schedule and are also available on the course website. The final exam will take place on Tuesday, May 9 from 8:00-10:00AM, also in the same room as the lectures.

Textbook: There is no required textbook for this course. Much of the material to be covered in this class can be found on the internet, and the instructor will provide the relevant links, or instructions in class. There are, however, a number of relevant and possibly useful books that cover some of the material that will be covered in this class. They include:

1. "Planetary Sciences" Imke de Pater and Jack J. Lissauer, Cambridge University Press
2. "Worlds Apart: A Textbook in Planetary Sciences" Consolmagno and Schaefer, Prentice Hall
3. "Physics and Chemistry of the Solar System (revised edition)" John S. Lewis, Academic Press
4. "Planetary Science: The Science of Planets Around Stars" G.H.A. Cole, M. M. Woolfson, Institute of Physics Publishing
5. "The Solar System (second edition)" John A Wood, Prentice Hall
6. "Moons and Planets (fifth edition)" William. K. Hartmann, Cengage Learning
7. "Universe" Freedman and Kaufman, WH Freedman and Co.

Course Website: (either of these will work)
www.lpl.arizona.edu/classes/Giacalone 403
www.lpl.arizona.edu/classes/Giacalone 503
The website will post class lectures (scanned transparencies in pdf format, some PowerPoint slides and movies), and solutions to homework.

General Policies:

Academic Integrity: For general guidelines on this, please refer to the University's code of academic integrity: http://deanofstudents.arizona.edu/codeofacademicintegrity
With regards to homework for this class, you are encouraged to work with other students; however, the work that you turn in must be your own.

Attendance: This course will adhere to the University's policy on attendance. Below are the relevant links.

> The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop
>
> .The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy.
>
> Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Note, although lectures and assignments will be posted on the course website, success in this course will require that you attend and participate in each class

Threatening Behavior Policy: This course will adhere to The UA Threatening Behavior by Students Policy, which prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations: It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations. Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Non-discrimination and anti-harassment policy: This course will adhere to the UA Nondiscrimination and Anti-harassment Policy. The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Note that the workload and course requirements are subject to change at the discretion of the instructor with proper notice to the students.

Tentative Schedule for PTYS403/503 – Spring 2019

week	dates	Lecture 1	Lecture 2
1	1/10		Introduction / solar system inventory and physical characteristics, distance and length scales
2	1/15-1/17	Introduction (cont.) units, sample back-of-the-envelope calculations	Continued discussion of notation, distance scales, angular measure, orbital periods
3	1/22-1/24	Planetary Orbits 1: Kepler's laws, Newtons Laws	Planetary Orbits 2: The two body problem
4	1/29-1/31	The restricted three-body problem, Hill sphere, Hohmann transfer orbits	Orbits of small bodies and dust: Radiation pressure
5	2/5-2/7	Orbits of small bodies and dust: Poynting Roberson drag	Yarkovsky effect, Orbital decay
6	2/12-2/14	Electromagnetic forces on charged dust grains, Orbital resonances, Kirkwood gaps, planetary rings	Solar System Formation: Jeans instability, angular momentum conservation
7	2/19-2/21	**Mid-Term Exam #1**	(NO CLASS)
8	2/26-2/28	Blackbody Radiation, Nature of light and radiation. Solar radiative heating and the equilibrium temperature of the planets	Physics of planetary interiors, interior temperature
9	3/5-3/7	*(spring break)*	*(spring break)*
10	3/12-3/14	Tidal forces	Radioactive age dating, isochron method
11	3/19-3/21	Planetary Atmospheres 1: Introduction, basic structure, retention, exosphere	Planetary Atmospheres 2: Hydrostatic Equilibrium
12	3/26-3/28	Planetary Atmospheres 3: Onset of convection, turbulence, vorticity, circulation	Expanding Atmospheres, Solar Wind
13	4/2-4/4	Blast Waves and Shocks	Solar System Magnetism 1: Overview, dynamo theory
14	4/9-4/11	**Mid Term Exam #2**	Solar System Magnetism 2: Planetary magnetospheres
15	4/16-4/18	Solar System Magnetism 3 The Sun's magnetic field, solar activity, sunspots	The Heliosphere
16	4/23-4/25	Cosmic Rays and Solar-Energetic Particles	Turbulence in fluids, atmospheres, solar wind, and interstellar space
17	4/30	t.b.d.	
18	5/7	**FINAL EXAM T.B.D.**	