Syllabus
PTYS 505A – Fall 2016
Principles of Planetary Physics

Course Description: Introductory physics of planetary and interplanetary gases, fluids and plasmas. Thermodynamics, kinetic theory, plasma physics, hydrodynamics, and magnetohydrodynamics with solar-system applications. This includes planetary atmospheres, solar wind, solar-system magnetic fields, dynamo theory, planetary magnetospheres, and the heliosphere.

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

Instructor: Joe Giacalone (Professor, Department 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, but please send an email before coming over)
Administrative Assistant: Vicki Robles de Serino (Room 415; tel: 621-9692)

Prerequisites: Students should be familiar with classical physics, thermodynamics, electricity and magnetism, vector calculus and both ordinary and partial differential equations.

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:

50% Problem sets (~5-6 assignments)
20% Mid-term exam
30% Final exam

Textbook: There is no required textbook for this course since there is no single book that covers the range of topics addressed in this course. However, a number of relevant and (possibly) useful books will be placed on reserve in LPL library (409 Kuiper Space Sciences).

Course Website: https://www.lpl.arizona.edu/~giacalon/505A-fall16
The website will post class lectures (scanned transparencies in pdf format, some PowerPoint slides and movies), solutions to homework, and other relevant material.

Backup Lecture Day/Time: Because there may be some lectures that I must miss unexpectedly due to travel, there may be occasion to have a makeup lecture on an alternate day. This day/time will be announced in class.

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.

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

Tentative List of Topics by Week

Week	Topic
1	Course Introduction, Summary of Classical Thermodynamics
2	Kinetic Theory of Gasses. Macroscopic equations.
3	Application 1: Planetary Atmospheres (plane parallel approximation, adiabatic, spherical)
4	. Distribution Function, Maxwellian Distribution, Liouville's Theorem, Boltzmann's Equation
5	Moment Analysis of Boltzmann's Equation, More-General Derivation of Fluid Equations. Forms of the Energy Equation (heat conduction, Bernoulli's equation, adabiatic law)
6	Application 2: Atmospheric escape. Solar wind.
7	Application 3: Fluid flow past an obstacle. The Heliosphere. Gravity waves. Shocks
8	Application 3 (continued): Shocks and Blast Waves
9	Plasmas: Electrodynamics, Charged Particles, collective phenomena
10	Magnetohydrodynamic (MHD) Equations: Derivation, applicability, Frozen-flux theorem, magnetic pressure and tension
11	Application 1: The Solar Magnetic Field, Magnetic Dynamo, Sunspots
12	Application 2: magnetic reconnection
13	Application 3: Planetary Magnetospheres. Heliosphere (continued from before, including the solar-system magnetic field).
14	Charged-Particle Motions: Orbit Theory, Adiabatic Motions, Drifts
15	Application 4: trapped radiation in planetary magnetospheres.
16	Energetic Particles in Astrophysical Plasmas: cosmic rays and high-energy solar particles