

AST 723, Fall 2014

Introductory Astronomy: The Solar System

Professor: Daniel Proga, Department of Physics and Astronomy, UNLV
 Tel: 895-3507, Email: dproga@physics.unlv.edu
 Class time: Monday/Wednesday 10:00-11:15 am, BPB 249
 The Reference Book: *The Physics of Astrophysics, Vol. II: Gas Dynamics* by F. Shu
 Other books: *Fluid Mechanics* by Landau and Lifshitz
 Classical Electrodynamics by Jackson
 Website: <http://www.physics.unlv.edu/~dproga/AST723F14.html>
 Office hours: Formally the office hours are on Tuesday from 1:30 pm to 2:30 pm in my office (BPB Rm. 240). However, feel free to stop anytime with questions/problems/suggestions.

Week	Date	Subject	Reading
1	Aug. 25	Overview	Ch. 1
	Aug. 27	Introduction to Gas Dynamics	Ch. 2
2	<i>Sept. 1</i>	<i>Labor Day Recess</i>	
	Sept. 3	Transport Coefficients for Diffusive Effects	Ch. 3
3	Sept. 8	Fluids as Continua	Ch. 4
	Sept. 10	Equilibria of Self-Gravitating Spherical Masses	Ch. 5
4	Sept. 15	Inviscid Barotropic Flow	Ch. 6
	Sept. 17	Viscous Accretion Disks	Ch. 7
5	Sept. 22	Fluid Instabilities	Ch. 8
	Sept. 24	Viscous Shear Flows and Turbulence	Ch. 9
6	Sept. 29	Mixing-length Theory of Convection	Ch. 10
	Oct. 1	Method of Characteristics	Ch. 13
7	Oct. 6	Steady Supersonic Flow	Ch. 14
	Oct. 8	Shock Waves	Ch. 15 & 16
8	Oct. 13	Blast Waves and Supernova Remnants	Ch. 17
	Oct. 15	Mid-term exam	
9	Oct. 20	Gravitational Collapse and Star Formation	Ch. 18
	Oct. 22	Opt. Thick Radiative Shocks and Ionization Front	Ch. 19 & 20
10	Oct. 27	Magnetohydrodynamics	Ch. 21
	Oct. 29	Hydromagnetic Equations and Hydromagnetic Waves	Ch. 22
11	Nov. 3	Magnetostatics and the Parker Instability	Ch. 23
	Nov. 5	The Magnetic Virial Theorem	Ch. 24
12	Nov. 10	Hydromagnetic Shock Waves	Ch. 25

	Nov. 12	Magnetic Reconnection and Dynamo	Ch. 26
13	Nov. 17	Ambipolar Diffusion	Ch. 27
	Nov. 19	Plasma Physics	Ch. 28
14	Nov. 24	Longitudinal Plasma Oscillations and Landau Damping	Ch. 29
	Nov. 26	Orbit Theory and Drift Current	Ch. 30
15	Dec. 1	Study Week	
	Dec. 3	Study Week	
16	Dec. 8	Student Presentation	

Course description:

This is an astrophysics course for astronomy major graduate students. It is a survey course designed to introduce the students to the basic concepts and principles of gas microphysics and dynamics. The course comprises three major parts: (i) single-fluid theory (ii) waves, shocks, and fronts, and (iii) magnetohydrodynamics and plasma physics. This course is worth 3 credits and is recommended for all astronomy major graduate students.

Course goals: Identify physical laws governing behavior of matter in astrophysical objects. Apply key concepts in fluid dynamics - such as waves, shock, viscous fluids, fluid instabilities, diffusion -to understand objects in hydrostatic equilibrium (e.g., stars) and very dynamical objects (e.g., supernovae and accretion disk). Learn some numerical techniques used to solve gas dynamics problems.

Learning outcomes:

The outcomes will include familiarity with the key physical processes operating on astrophysical fluids. In addition, the course will enhance students' critical thinking and appreciation of astronomy as a global/multicultural/interdisciplinary activity that generations have benefited from on very many different levels.

Exams, tests & scores:

- The course grade will be based on homeworks, a numerical problem assignment, a mid-term exam, and a presentation.
- There will be five homeworks during the semester. Each homework will be worth 5 pts. (the total of 25 pts can be earned from homeworks). You may use any available materials to solve the problems. You are also encouraged

to discuss the problems with each other, while you are trying to solve homework problems, with the provision that after the discussions you must write up your solutions yourself, independently from anyone else. This rule will be taken very seriously under the UNLV honor system. In particular, it should be stated in the submitted solutions who you have discussed the problems with (as a form of acknowledgements).

- Each student will be given a problem to be solved using numerical methods. It is to master a concept/idea and use a computer to generate a numerical solution of a specific problem. There will 20 pts. to be earned from this.
- Each student will be assigned to read one or more research papers related to this course. Some additional thinking and possible ideas of research projects are encouraged. Each student will give an hour presentation at the end of the semester. 30 pts will be assigned for reading / presentation. This will be on Dec. 8-th.
- The mid-term exam is on October 15. There will be 5 problems each worth 5 pts. (i.e., the total of 25 pts can be earned). No printed materials are allowed during the exam.

Final Letter grades will be assigned according to the numerical scores (100 total).

A (≥ 85), A- (80-84),

B+ (77-79), B (73-76), B- (70-72)

C+ (67-69), C (63-66), C- (60-62)

D (50-59)

F (< 50)

Other information:

Academic Misconduct – Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <http://studentconduct.unlv.edu/misconduct/policy.html>.

Copyright – The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://provost.unlv.edu/copyright/statements.html>.

Disability Resource Center (DRC) – The Disability Resource Center (DRC) determines accommodations that are “reasonable” in promoting the equal access of a student reporting a disability to the general UNLV learning experience. In so doing, the DRC also balances instructor and departmental interests in maintaining curricular standards so as to best achieve a fair evaluation standard amongst students being assisted. In order for the DRC to be effective it must be considered in the dialog between the faculty and the student who is requesting accommodations. For this reason faculty should only provide students course adjustment after having received an “Academic Accommodation Plan.” If faculty members have any questions regarding the DRC, they should call a DRC counselor.

UNLV complies with the provisions set forth in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. The DRC is located in the Student Services Complex (SSC-A), Room 143, phone (702) 895-0866, fax (702) 895-0651. For additional information, please visit: <http://drc.unlv.edu/>.

Religious Holidays Policy – Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor no later than the end of the first two weeks of classes, **February 1, 2013**, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. This policy shall not apply in the event that administering the test or examination at an alternate time would impose an undue hardship on the instructor or the university that could not reasonably be avoided. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=4&navoid=164>.

Incomplete Grades - The grade of I – Incomplete – can be granted when a student has satisfactorily completed all course work up to the withdrawal date of that semester/session but for reason(s) beyond the student’s control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. A

student who receives an I is responsible for making up whatever work was lacking at the end of the semester. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring – The Academic Success Center (ASC) provides tutoring and academic assistance for all UNLV students taking UNLV courses. Students are encouraged to stop by the ASC to learn more about subjects offered, tutoring times and other academic resources. The ASC is located across from the Student Services Complex (SSC). Students may learn more about tutoring services by calling (702) 895-3177 or visiting the tutoring web site at: <http://academicsuccess.unlv.edu/tutoring/>.

UNLV Writing Center – One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>

Rebelmail – By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu.