

# AST 714, Spring 2007

## Astrophysics II

Professor: Daniel Proga, Department of Physics, University of Nevada, Las Vegas  
 Tel: 895-3507, Email: [dproga@physics.unlv.edu](mailto:dproga@physics.unlv.edu)

Class time: Tuesday/Thursday 1:00-2:15 pm, BPB 247

Reference Books: 1) *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei*,  
 by D. E. Osterbrock and G. J. Ferland (OF)  
 2) *The Physics of Astrophysics Vol. II: Gas Dynamics* by F. H. Shu (S)

Website: <http://www.physics.unlv.edu/~dproga/AST714S07.html>

Office hours: Wednesday 1:30-2:30 pm, BPB Rm. 240

Week	Date	Subject	Reading
1	Jan. 16	Overview	
	Jan. 18	Photoionization Equilibrium I	Ch. 2 OF
2	Jan. 23	Photoionization Equilibrium II	Ch. 2 OF
	Jan. 25	Thermal Equilibrium I	Ch. 3 OF
3	Jan. 30	Thermal Equilibrium II	Ch. 3, 22 OF
	Feb. 1	Calculations of Emitted Spectrum I	Ch. 4 OF
4	Feb. 6	Calculations of Emitted Spectrum II	Ch. 4 OF
	Feb. 8	Comparison of Theory with Observations I	Ch. 5 OF
5	Feb. 13	Comparison of Theory with Observations II	Ch. 5 OF
	Feb. 15	Introduction of Gas Dynamics	Ch. 6 OF, 1 S
6	Feb. 20	Kinetic theory and Fluid Mechanics	Ch. 2 S
	Feb. 22	Transport Coefficients for Diffusive Effects	Ch. 3 S
7	Feb. 27	Fluids as Continua	Ch. 4 S
	March 1	Equilibria of Self-Gravitating Spherical Masses	Ch. 5 S
8	March 6	Inviscid Barotropic Flow	Ch. 6 S
	March 8	Viscous Accretion Disks	Ch. 7 S
9	March 13	Spring Break	
	March 15	Spring Break	
10	March 20	<b>Mid-term exam</b>	
	March 22	Fluid Instabilities	Ch. 8 S
11	March 27	Viscous Shear Flows and Turbulence	Ch. 9 S
	March 29	Mixing-length Theory of Convection	Ch. 10 S
12	April 3	Spiral Density Waves I	Ch. 11 S
	April 5	Spiral Density Waves II	Ch. 12 S
13	April 10	Method of Characteristics	Ch. 13 S
	April 12	Steady Supersonic Flow	Ch. 14 S
14	April 17	Shock Waves	Ch. 15, 16 S
	April 19	Blast Waves and Supernova Remnants	Ch. 17 S
15	April 24	Gravitational Collapse	Ch. 18 S
	April 26	Opt. Thick Radiative Shocks and Ionization Front	Ch. 19, 20 S
16	May 1	<b>Student Presentation</b>	
	May 3	<b>Student Presentation</b>	

### **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. In the astrophysical context, the electromagnetic radiation is very important in determining the gas state. Therefore, the course comprises two major parts: (i) microphysics of gas exposed to radiation and (ii) gas dynamics. In the part one, observational motivation for studying astrophysics of gas will be given. The part two will be more theoretical although strongly rooted in astronomical applications. This course is worth 3 credits and is recommended for all astronomy major graduate students.

### **Grading:**

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 proviso 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 fluid dynamics. 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.
- The mid-term exam is on March 20. 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 ( $\geq 85$ ), 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:**

- This is a survey course at the beginning level, which discusses stars, stellar systems and galaxies. Topics will include stellar evolution, formation of galaxies, and cosmology. A minimum of mathematics is required. Recommended for non-science majors. 3 credits.
- The UNLV Disability Resource Center (DRC) houses the resources for students with disability. If you have a documented disability that may require accommodations, you will need to contact the DRC for the coordination of

services. The DRC is located in the Student Services Complex (SSC), Room 137. Their numbers are: VOICE (702) 895-0866, TTY (702) 895-0652, FAX (702) 895 0651. For additional information please visit:

<http://studentlife.unlv.edu/disability>.

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