AST 353
"Astrophysics"
Spring 2012

Professor Gregory A. Shields
TTh 2 p.m. in RLM 15.216B
Unique No. 47690

Course Description

This course deals with the structure and evolution of the stars, and with selected topics in high energy astrophysics. The science of stellar structure aims to understand how the fundamental properties of stars (such as size, luminosity, and temperature) are determined by the mass of the star and the laws of physics. We will study hydrostatic equilibrium, thermal energy transport, and nuclear energy generation as they relate to the internal nature of stars and the observed patterns of stellar properties. Stellar evolution aims to understand the life history of stars from their birth in contracting gas clouds, through maturity as main sequence stars, to their advanced evolution as red giants, and finally their death as white dwarfs, neutron stars, or black holes. We study the violent death of massive stars in supernova explosions, and the resulting exotic phenomena involving pulsars and binary X-ray sources.

This course is intended for astronomy majors and other science and engineering majors with a strong background in undergraduate math and physics, including mechanics, electricity and magnetism, differential and integral calculus, and vector calculus. This course carries the Quantitative Reasoning flag.

Prerequisite. Physics 316 (Electricity and Magnetism) or equivalent; AST 352K or AST 307 is recommended.

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Web page: http://www.as.utexas.edu/~shields/shields.html

Teaching Assistant. TBA

Grading. Course grade will be based on two exams in class, term paper and presentation, and homework. Exams will be closed book involving numerical problems and essay questions. Exams will cover lectures, assigned reading, and homework. Exam weights and (tentative) dates are:

First Exam	25%	TBA
Second exam	30%	TBA

Homework will count 30%. Term paper and presentation will count 15%.

Required Textbook. Francis Leblanc, "An Introduction to Stellar Astrophysics", John Wiley & Sons, Ltd. (2010), ISBN 978-0-470-69956-0 (paperback). (Note: this book was used in AST 352K "Stellar Astronomy" in Fall 2011. AST 353 will cover the topics and chapters not covered in AST 352 K: Ch. 2 Stellar Formation, Ch. 5 Stellar Interiors, and Ch. 6 Nucleosynthesis and Stellar Evolution.

Help session. TBA

Astronomy Department Policies. See "Memo to Undergraduate Astronomy Students Regarding Astronomy Courses" (http://outreach.as.utexas.edu/students/memo.html).

Star Parties. The Department has observing sessions Wednesday evenings on the roof of RLM and Friday and Saturday at Painter Hall (http://outreach.as.utexas.edu/public). You can use the 9-inch yourself if you are checked out on it. McDonald Observatory in west Texas also has public programs (http://mcdonaldobservatory.org/visitors; phone 471-5285).

Drop Dates. February 1 is the last day to drop a class for a possible refund. April 2 is the last day to change to or from the credit/no credit basis. After April 2, you may drop the course or withdraw from the University only for urgent and substantiated, nonacademic reasons. Please consult the University's published calendar (http://registrar.utexas.edu) to verify these dates and for further information.

About the Instructor. Professor Shields was born in Los Angeles, California and grew up in Nebraska and Kansas. He earned a B.S. in Physics from Stanford University in 1968 and a Ph.D. in Astronomy from Caltech in 1973. Following a postdoctoral fellowship at Harvard, he joined the UT faculty in 1974. He now holds the title of The Jane and Roland Blumberg Centennial Professor in Astronomy, and served as Chairman of the Department of Astronomy from 1990 to 1994. He has taught both graduate and undergraduate courses throughout his career at UT. His research interests include studies of ionized nebulae in galaxies and the nature of quasars and their central black holes. He has published numerous research papers and popular articles.

Background needed. AST 353 is one of several upper division courses required for Astronomy majors. The level of the course is aimed at giving a good foundation for success in graduate school. The prerequisite for this course is Physics 316 "Electricity and Magnetism". There is no formal Astronomy course prerequisite for AST 353, but many students will have had AST 307 "Introductory Astronomy" or AST 352K "Stellar Astronomy". In order to be competitive in AST 353, students who have had no previous course in astronomy will need to study some basic background material by the second week of the semester. Reading resources will be made available, and students will be asked to work a set of homework problems designed to acquire and demonstrate knowledge of the essential background topics. This will allow us to move quickly into the main subject material of the course. Important background topics include Newtonian gravitation and orbital motion, spectra and radiation laws (Wien's law and the Stefan-Boltzmann law), basic properties of stars, and the H-R diagram. The first few lectures will review these topics. As noted above, some students will have used our textbook in AST 352K, covering Chap. 1, 3, 4, and possibly 7. Other students would benefit from studying, as a minimum, Chap. 1 and Chap. 3 through Sec. 3.

Suggested Introductory Textbooks

Some of these texts are available at the UT Libraries or may be borrowed from the instructor. Any standard descriptive introduction to astronomy should be helpful. Editions dated around 2006 or later should be adequate for background purposes.

J. Bennett et al., "The Cosmic Perspective", any edition including stars.

E. Chaisson and S. McMillan, "Astronomy: A Beginner's Guide to The Universe," Prentice Hall. By the same authors, Astronomy Today, Volume II Stars and Galaxies.

M. Seeds, "Stars and Galaxies", Brooks Cole. This is a version of Seed's introductory astronomy textbook Horizons: Exploring the Universe omitting detailed discussion of the solar system.

Many useful tutorials on topics in astronomy can be found on the World Wide Web.

Higher Level Textbooks

Dale Ostlie & Bradley Carroll, "An Introduction to Modern Stellar Astrophysics",
Addison Wesley (1996), ISBN 0-201-59880-9. A more inclusive version, Carroll & Ostlie "An Introduction to Modern Astrophysics," contains material on galaxies and the universe.

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