

STELLAR ASTROPHYSICS
PHYS 6371 SYLLABUS – FALL 2018
<http://www.physics.smu.edu/~kehoe/6371/F18.html>

Instructor: Professor Bob Kehoe **Office:** Fondren Science 113
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Texts: Introduction to the Theory of Stellar Structure and Evolution, Prialnik (2009).

Further Reading: Stellar Interiors, Hansen, Kowaler, Trimble, Springer (2004).

Stellar Structure and Evolution, Kippenhahn and Weigart, Springer (2012).

Class Coordinates: Tues. & Thurs. 2:00pm – 3:20pm in Rm 158 Fondren Science

Course Objectives: The course is designed to provide a comprehensive understanding of the physical processes that underlie stars. All phases of the stellar development are included, from formation, to main sequence H burning, to giant and more advanced stages including planetary nebulae, supernovae, white dwarfs, neutron stars and black holes. The physical processes of energy generation and transport, equilibrium and instability are addressed. Underlying nuclear reactions and nucleosynthesis are discussed. Stellar interior and atmosphere structure physics will be included.

Method of Instruction: The class will consist of lectures. Homework is a valuable aid in learning the material in the course, and will be worth 20% of the course grade. The bulk of the graded portion of the course will come from one research project in stellar astrophysics from each student, to be worth 80% of the course grade.

Research Project and Report: The research project will involve several elements generally encountered in a physics research project. Literature research and review on a chosen topic will be due in the first half of the course for 25% of the overall project grade. The research project itself will entail data reduction and analysis, application of appropriate statistical methods, and development of scientific measurements and conclusions. A draft of the full report will also be due in week 12, worth 10% of the final grade. The final report will include discussion of motivation, methodology, data and results of the research project.

Grading and Attendance Policy: In all cases, it is *crucial* to show your work *clearly* to get credit for solutions to physics problems. Regrading requests must be well-justified in writing. Anticipated absences resulting from religious observance or officially sanctioned extracurricular activity must be brought to the instructor's attention at least 2 weeks in advance. Make-up exams will need to be arranged with the instructor.

Other References: The following texts may be useful supplements to the reading material of this course:

Understanding Stellar Evolution, Lamers & Levesque, IOP Publishing (2018).

Stellar Evolution, Iben, Cambridge (2013).

Atoms, Stars and Nebulae, Aller, Cambridge (1991).

Cauldrons in the Cosmos, Rolfs and Rodney, U. of Chicago Press (1988).

Introductory Astronomy and Astrophysics, Zeilik and Smith, Saunders College Publishing, (1987).

Introduction to Stellar Structure: Stellar Structure and Evolution, vol. 3, Cambridge (1992).

Physics of Stellar Evolution and Cosmology, H. Goldberg and M. Scadron, Gordon and Breach Science Publishers (1981).

An Introduction to the Study of Stellar Structure, Chandrasekhar, U. of Chicago (1939).

PHYSICS 6371 SCHEDULE

[Note: Px.y means Prialnik chapter 'x' and section 'y'. Kx.y refers to Kippenhahn and Hx.y to Hansen.]

Week	Material	
Aug 21 T	Introduction	P1
Aug 28 T	Stellar Evolution Equations	P2
Sep 4 T	Equation of State Project report outlines and review	P3.1-3.3, H3.1-3.7
Sep 11 T	Energy Transport: Radiative, Conductive Processes	P3.4-3.7, H4
Sep 18 T	Variable Stars	Notes, H2.9-2.11, H2.13
Sep 25 T	Nuclear Reactions Project update, Motivation section draft due	P4, H6
Oct 2 T	Stellar Models	P5, H7, K19-21
Oct 9 T	*Fall break, no classes	
Oct 11 Th	Energy Transport: Convection and Instability Week 1-7 HW due	P6, H5
Oct 23 T	Stellar Evolution Project update discussion	P7, K22-25
Oct 30 T	Star Formation	P8.1, K26-28
Nov 6 T	Main Sequence	P8.2-8.6, K30
Nov 13 T	Late Stage Evolution Draft of full Project Report due	P8.7-8.9, P9, K31-33
Nov 20 T	Stellar Life Cycle	P10, K34-35
Nov 27 T	Supernovae and Gamma-ray Bursts; Week 8-13 HW due	Notes, K36
Dec 12 W	Final exam 11:30am-2:30pm - final reports due	