

SYLLABUS
ASTR 460/560
Stellar Evolution Seminar
Fall 2015

LECTURES: Monday/Wednesday: 11:00 a.m. - 11:50 a.m. (2 credits)
Steward Observatory, Room 202
(Last regular lecture Dec. 9)

INSTRUCTOR: Dr. Nathan Smith
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OFFICE HOURS: Tuesday/Thursday 1:00 p.m. - 2:00 p.m.

EXAMS: None.

The current graduate astronomy curriculum includes a course called Astrophysics of Stars and Accretion (ASTR545), but this course has a focus mainly on the standard theory of stellar interiors and the physics of accretion disks. The undergraduate curriculum includes a basic introduction to astrophysics. This seminar is designed to be complementary to these core courses, and will connect the equations of stellar structure and evolution to the observed properties of a wide variety of stars, including spectral types, luminosity and temperature evolution on the Hertzsprung-Russell diagram, uncertainties in stellar evolution models, the inferred influence of composition, mass loss, binary star evolution, different types of stellar death, dependence on environment, and influence on the galactic environment (feedback). We will also explore some key observational diagnostics of stellar properties along the way. The course will examine both the historical origin of several key ideas in the field, as well as current frontier topics in the literature. The course will benefit students who intend to specialize in research on stars, but will also cover key topics relevant to interpreting observations of galaxies and the role of stars in galaxy evolution and cosmic evolution.

GRADES: Your final grade for the course will be determined based on the assignments and class participation in the following proportion:

In-class Presentations	50%
In class Participation	50%

HOMEWORK: The weekly homework will center on reading relevant papers from the literature (see below), or in some cases excerpts from monographs, for discussion each week. Students are expected to have read the papers when not presenting, and to be intimately familiar with papers (as well as related literature and concepts) when they are presenting.

TOPIC SCHEDULE:

<u>Week</u>	<u>Topic</u>
Aug 24/26	Overview, resources, terminology, pre-main-sequence
Aug 31/Sep 2	Review – The HR Diagram and stellar evolution models
Sep 7/9	Stellar structure, convection, nuclear burning
Sep 14/16	Stellar atmospheres, spectral types, observational diagnostics
Sep 21/23	The Sun, solar wind, low-mass main-sequence stars and brown dwarfs
Sep 28/30	Low-mass post-MS stars, blue stragglers, globular clusters, low metallicity
Oct 1/3	Low-mass late phases; AGB, carbon stars, planetary nebulae, binaries
Oct 5/7	Binaries, white dwarfs, Type Ia supernovae
Oct 12/14	Intermediate-mass stars and the transition to massive stars
Oct 19/21	Massive main-sequence stars, upper mass limit, winds
Oct 26/28	Massive stars: rotation, binaries, mass loss
Nov 2/4	Massive evolved star zoo: red/blue supergiants, LBVs, Wolf-Rayet stars
Nov 9/11	Core collapse supernovae and remnants
Nov 16/18	GRBs, Feedback, population synthesis
Nov 23/25	Exotica (compact objects in binaries)
Nov 30/Dec 2	Low-metallicity, Pop III
Dec 7/9	First stars and reionization

PARTICIPATION IN CLASS: This seminar course is conducted as a discussion requiring active participation by all students enrolled. This is especially true in a small class. We will conduct interactive discussions in class; this will improve your understanding of the material and will count toward your grade. In fact, class participation is a major component of your grade. Students are expected to ask questions often.

LITERATURE PRESENTATIONS: Starting on week 2 (Stellar evolution models) we will begin a regular pattern where every class is spent by students giving in-class presentations accompanied by discussion. We will alternate from one student to the next each day/week. The focus is on work in the literature relevant to the topic that week. There will be some flexibility in format from one topic to the next, but a typical sequence will be (1) a review of one important historical work in the literature that set the stage for the topic, (2) discussion of the basic theoretical ideas relevant to the topic and the most common current observational approaches, and (3) discussion of a modern review article to give the updated current state of the field. Each of these could be roughly 10 minutes, although it is up to you, and should allow ample time for discussion.

These do not need to be polished power-point presentations as one might do in a Journal Club. Instead, the emphasis is on giving background, instigating discussion, engaging the other class members, and answering their questions – the aim should be a presentation more akin to a coffee discussion. All students in the class will read the papers and participate actively in discussions, but the discussion will be led by one student who prepares the presentation that day. The number of presentations will depend on enrollment. Grades will be awarded based on effort, preparation, and mastery of the topic, as well as partly on an individual's facilitating of the discussion. Graduate students will be expected to present a more comprehensive and thorough

discussion of the topic than undergraduates, and will be expected to be less reliant on input from the instructor to guide the discussion than an undergraduate presenter. Graduate students may also present a larger number of times, or may choose more difficult topics.

ACADEMIC DISHONESTY, etc.:

Students are expected to follow all of the university-wide student policies, which are available at <http://catalog.arizona.edu>

Students are also expected to understand and follow the Student Code of Academic Integrity: <http://deanofstudents.arizona.edu/codeofacademicintegrity>

Other than grade and absence policies, the information contained in this syllabus may be subject to change with reasonable advance notice.

STUDENTS WITH DISABILITIES: If you anticipate issues related to the format or requirements of this course, please meet with Dr. Smith. We would like to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with Disability Resources (621-3268; <http://dre.arizona.edu>) and notify Dr. Smith of your eligibility for reasonable accommodations well in advance of the first midterm. We can then plan how best to coordinate your accommodations.

CLASS PARTICIPATION / LEARNER-CENTERED EDUCATION: The University of Arizona has designated itself a “Learner-Centered University.” This means that the student is expected to take an active role in his/her learning. Class time will be peppered with various activities that will require your participation. Be prepared to interact with your classmates, ask questions, and participate in group discussions. This is a seminar course, and will rely heavily upon student in-class participation for presentations as well as discussion. Attendance is therefore required. If you must miss class for one of the reasons below, let Dr. Smith know ahead of time (in all cases that are not emergencies) and please speak with Prof. Smith or another student about what you missed.

- All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion,
- Absences pre-approved by the UA Dean of Students (or Dean’s designee) will be honored.
- Graduate student activities (such as observing runs)

