

Ay101: Physics of Stars

Fall 2019 Syllabus

Time: 9am-9:55am, MWF

Room: Cahill 219

Instructor: Jim Fuller, jfuller@caltech.edu

Units: 9 (3-0-6)

Student Level: graduate students and seniors

Website: <http://www.tapir.caltech.edu/~fuller/Ay101>

TA: Mia de los Reyes, mdelosre@caltech.edu

Textbooks:

- *Stellar Interiors - Physical Principles, Structure, and Evolution* by Hansen, Kawaler, & Trimble
- *Stellar Structure and Evolution* by Kippenhahn, Weigert, & Weiss
Ebook can be found here:
<https://clsproxy.library.caltech.edu/login?url=http://dx.doi.org/10.1007/978-3-642-30304-3>
- (optional) *Principles of Stellar Evolution and Nucleosynthesis* by Clayton

Topics:

- Stellar structure, thermodynamics, equations of state, convection, opacity, radiative transfer, stellar atmospheres, nuclear reactions, stellar data analysis, and stellar models.
- Evolution of low- and high-mass stars, supernovae, and binary stars.

Grading:

- Five problem sets, each worth 10% of final grade
- Oral midterm, worth 20% of final grade
- Written, take-home final exam, worth 30% of final grade

Homework Policy:

Please attempt to solve the problems on your own before consulting other students. You may consult books and published papers but not old homework solutions from this or any other class. After that, discussion of the problems with other students in this class to improve your understanding of the underlying physics is permitted and encouraged. However, you may not copy homework solutions. The formal Ay101 policy is that students can freely discuss the problems, but they need to work out solutions on their own without referring to others' solutions.

Homework is due by 5pm on the dates indicated. Limited extensions can be obtained by emailing Mia or Jim in advance. Grades are reduced by 10% for each day that homework is late.

Class Schedule:

Reading assignments are indicated by HKT (Hansen, Kawaler, & Trimble) and KWW (Kippenhahn, Weigert, & Weiss).

Wed Oct 2:	I. Physical properties of stars
Fri Oct 4:	I. continued
Mon Oct 7:	In class activities <i>read HKT chs. 1-2, optionally KWW chs. 1-4</i>

Wed Oct 9: II. Equilibrium and timescales
 Fri Oct 11: III. Equations of stellar structure
read HKT chs. 4-5, optionally KWW chs. 5, 7, 17, 19
 Mon Oct 14: In class activities; **Problem set 1 due**
 Wed Oct 16: IIIb. Convection
 Fri Oct 18: IV. Energy generation and opacity
 Mon Oct 21: In class activities
 Wed Oct 23: V. Homology and the main sequence
 Fri Oct 25: VI. Equations of state
read HKT ch. 3, optionally KWW chs. 13-16
 Mon Oct 28: In class activities; **Problem set 2 due**
 Wed Oct 30: VI. continued;
 Oct 30-Nov 1: Oral Midterms
 Fri Nov 1: No class (midterms)
 Mon Nov 4: In class activities
 Wed Nov 6: IX. Nuclear reactions
read HKT ch. 6, optionally KWW ch. 18
 Fri Nov 8: X. Abundances of elements
 Mon Nov 11: In class activities; **Problem set 3 due**
 Wed Nov 13: VIII. Pulsating stars
read HKT ch. 8, optionally KWW chs. 29, 31
 Fri Nov 15: VII. Helioseismology
read HKT ch. 9, optionally KWW chs. 34-36
 Mon Nov 18: In class activities
 Wed Nov 20: XI. Supernovae and compact remnants
 Fri Nov 22: XI. continued
 Mon Nov 25: In class activities; **Problem set 4 due**
 Wed Nov 27: XII. Stellar evolution
read KWW chs. 30-33
 Fri Nov 29: No class (Thanksgiving)
 Mon Dec 2: In class activities
 Wed Dec 4: XIII. Binary Stars
 Fri Dec 6: XIV. Stellar atmospheres
 Mon Dec 9: No class (study period); **Problem set 5 due**
 Fri Dec 13: **Final exam due by 5pm**