

# PHY 474 (grad) – Stellar Astrophysics

**Schedule:** (Remote), Mondays & Wednesdays, 4:20-5:50 PM (*Spring 2021*)

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This course on Stellar Astrophysics will focus on stellar atmospheres, energy generation in stars, stellar evolution, and stellar remnants. Knowing all this is important because almost all chemical elements except hydrogen and helium are a product of stellar evolution, and thus we can only understand the chemical history of the Universe, including our presence in it, by learning about stars, how they produce energy, evolve, and seed the next generation of star forming regions.

**Textbook:** There is an online textbook for the course posted in D2L (Jorgen Christensen-Dalsgaard, 6<sup>th</sup> edition). You must come prepared to class by doing the daily reading.

**Office Hours:** Due to the special circumstances this quarter, all office hours will be on Zoom. **Information about these Zoom office hours is posted in D2L.** In addition, office hours are also available by appointment. Upon agreeing on a convenient time for such appointments, I will direct you to a Zoom session. If two or more students have the same questions, I may direct you to a shared Zoom session to save time, as long as you have no objections.

**Grading Policy:** There will be in-class exercises, homework assignments, an exam, and a literature review (unique to the graduate portion of this cross-listed course) that culminates in a talk and a final paper. The final paper must be completed to receive a passing grade. The course grade will be determined on the following basis:

<b>Class Participation</b>	<b>20%</b>
<b>Homework</b>	<b>25%</b>
<b>In-class Exam</b>	<b>25%</b>
<b>Literature Review (Talk &amp; Final Paper)</b>	<b>30%</b>

The final grading scale will be the following (changes may be made if necessary, but only to the student's advantage):

A– to A: 85% and higher	B– to B+: 70%-85%	C– to C+: 55%-70%
D to D+: 40%-55%	F: less than 40%	

While it is true that course grades will be assigned based on the total score, students must demonstrate a *reasonable* performance on all the graded activities to be eligible for a certain grade. This rule is in place to ensure that students participate fully in all aspects of the course. Also, a grade of incomplete is given only under extreme circumstances (e.g., an extended stay in the hospital). An incomplete is not a mechanism to improve an unsatisfactory grade.

**Class Participation:** Participation in class is a significant component of this course accounting for 20% of the grade. Participation involves reading before class, being present in the zoom sessions during class, working on the assigned worksheet for the day with the members of your group; questions are strongly encouraged. Classes will generally consist of mini-lectures interspersed with in-class exercises, which may be multiple-choice or descriptive questions meant to be answered orally or, more frequently, written activity on in-class worksheets. These worksheets will be available at the designated link on D2L, generally about an hour before class. The in-class exercises are meant to allow you to grasp the concepts before you go on to solve homework problems on your own. *No make-ups are allowed for in-class exercises.* The following are based on my philosophy that in order to learn, one must be a responsible stakeholder who comes to class prepared to participate in the activities and discussions planned for the day.

- Daily discussions will be based on worksheets and/or readings. You should do the assigned reading before coming to class. Like many other activities in this class, I am trusting you to do this (without having you go through reading quizzes). Remember, science is an activity based on trust. When you submit a paper for publication, the journal trusts that you have carried out the experiments, simulations, or analysis honestly in the manner stipulated for such activities. Please do not betray this trust.
- Absences, coming late to class, leaving early, and carrying on conversations (including private chats) when the instructor or another student is trying to make a point will all be cause for points subtracted from a daily count of points awarded.
- Although there are no make-ups for missed classes, you are allowed two unexcused absences for which you do not have to provide any documentation, unless you miss a third class, in which case you may be asked (at the discretion of the instructor) to provide documentation from the Dean of Students to be allowed to continue in the course.
- If you have only two absences during the quarter, you will be eligible to receive 40-100% of class points for the first absence and 40-80% for the second absence, with the actual number of points to be determined at the end of the quarter based on your general record of work completion in the course (i.e., if you've missed out on assignments and participation points, you may expect to be awarded fewer points for missed days).

Due to the special circumstances this quarter, all students have an even greater shared responsibility than usual to make sure that they cooperate to make each class a success.

- All classes this quarter will be conducted as Zoom sessions, unless the university announces that class meetings on campus are to be allowed again. Some classes may be asynchronous, and the instructor will provide advance information regarding such exceptions.
- It is your responsibility to arrange for a computer or laptop to join the Zoom sessions. Please arrange for a webcam if you don't have one. You must also have a functional microphone (either computer or external) so you can be heard.
- Please do not hop on and hop off Zoom sessions unless instructed to do so. Your class participation points require you to be present for the entirety of the session. Late arrivals and early departures will be penalized.
- Part or all of these sessions may be recorded. If a session is recorded, it will be made available in D2L.

**Homework:** Homework assignments may include problems, essays, and papers, and will usually be due in D2L by 5 PM on Fridays (unless announced otherwise).

Late homework will be accepted until 8 AM on Monday (or as announced, if the regular deadline is not Friday) for 80% credit; after that it will not be accepted; but contact the instructor before the regular deadline for exceptions past this late deadline in extenuating circumstances (may require documentation from the Dean of Students); such extensions may be provided at the instructor's discretion, but likely no more than once for the quarter. Submit late homework into the D2L Dropbox set up for late submissions – no other form of submission will be accepted. In particular, do not attach homework to email to make an end-run around the D2L deadline or late deadline; such emails are automatically deleted and do not count as submissions.

Again, due to the special circumstances this quarter, only the submissions conforming to the following criteria will be graded; all other submissions will receive a grade of zero.

- Each homework assignment must be submitted as one single PDF file; no other format will be graded.
- You may write out solutions by hand, scan as one PDF file, and submit. Or, you may use the latex template provided and generate a PDF to submit. Or, you may use Microsoft Word, but you must save and submit as (one) PDF.
- Number questions and sub-parts correctly. You will receive zero points if you have not numbered a question or sub-part, even if you answered it correctly.
- Hand-drawn graphs will receive a score of zero.

**In-class Examination:** The In-class Examination (see Class Schedule for date) will likely be conducted online; details will be provided as the quarter progresses. Note, therefore, that no early exams will be allowed.

**Make-up Exams:** Make-ups *for in-class exams* will only be allowed for illness, serious family emergencies, special curricular requirements (e.g., attendance at conferences), participation in official university sponsored activities, active military duty, and court-imposed legal obligations. Note that sleeping through an exam because the alarm didn't go off and family vacation time do not appear on this list. *A written communication from the Dean of Students is required allowing for an excused absence during the period of the activity for which a make-up is being sought.* The instructor must be notified in advance that a student will miss the exam. The student should make every effort to schedule her/his make-up exam as soon as possible. If the student misses an in-class exam and does not contact the instructor before it has been graded, the student will receive a score of zero on that test.

**Literature Review:** Early in the quarter, you will pick a topic for the Literature Review from a list supplied to you; these topics will usually be about outstanding and important issues at the frontiers of stellar astrophysics research. You will then review the literature on your assigned topic and prepare a talk and paper on the topic. Additional details, including timelines, will be announced in class and posted in D2L.

**Grading Procedure:** All problems graded for this course (in-class, homework & tests) will be graded not only for correctness of the final result, but also for the method of solution. You must explicitly *show the work* that was done by you in getting to the solution. This means that you must explicitly display the *stream of consciousness* that you used to go from the statement of the problem to its solution via application of the appropriate physical principle(s), a logically complete sequence of mathematical manipulations, together with phrases that illustrate why you chose each step the way you did, wherever such phrases may be necessary. In summary, the problems are meant to test whether *you* understand the material, *not* as an intellectual exercise for the instructor to interpret your solution in order to fill in holes left by you.

**Students with disabilities:** If you are registered with the Office of Students with Disabilities, please make an appointment with the course instructor to discuss any academic accommodations you may need. If you need academic accommodations and are not registered with the Office of Students with Disabilities, please contact the office at 2250 N. Sheffield, Room 307, or by telephone at (773) 325-7290 (TTY 773-325-7296). Upon individual request, this syllabus can be made available in alternative forms.

**Academic integrity:** Plagiarism is the act of presenting the work of another and claiming it as one's own; this applies whether the other person is a student or author, whether the material is obtained from handwritten or computer generated notes, published work or online. As such, plagiarism is unacceptable, and it will be dealt with according to university procedures as outlined in the Student Handbook. Please refer to the Student Handbook for a detailed description of what constitutes the above behavior. Penalties will include a failing grade in the course and may include suspension or expulsion from the university. Note that if two or more solutions are found to be similar, all concerned parties will be penalized, that is, the instructor will hold all parties equally responsible, without determining who copied from whom.

**Detailed Class Schedule:** A class schedule is provided on the next page. Note that this is tentative, and changes may be made at the sole discretion of the instructor. A column labeled ``Assignments due'' has been provided on the extreme right for you to keep a record when homework assignments, and other materials, are due if you prefer to record them in one space; note that all of this information will be in D2L.

The space above intentionally left blank for your notes; the Class Schedule is on the next page.

## Class Schedule

(Class Schedule is tentative, and changes may be made at the sole discretion of the instructor.)

Week	Day & Date	Topics & Other Activity	Assignments due (space for you to keep track; all information in D2L)
Week 1	M 3/29	Introduction, Timescales, Distances, Magnitudes	
	W 3/31	Spectral Analysis, Stellar Masses	
Week 2	M 4/5	Ideal gas equation of state, velocity distribution	
	W 4/7	Hydrostatic Equilibrium	
Week 3	M 4/12	Radiative Energy Transport	
	W 4/14	Stellar Atmospheres	
Week 4	M 4/19	Energy Transport by Convection	
	W 4/21	Mass-Luminosity Relations	
Week 5	M 4/26	Nuclear energy generation	
	W 4/28	PP chain and CNO cycle	
Week 6	M 5/3	Evolution before the Main Sequence	
	W 5/5	The Main Sequence	
Week 7	M 5/10	The evolution of our Sun	
	W 5/12	Post Main Sequence evolution, White Dwarfs	
Week 8	M 5/17	Massive Star Element Synthesis and Supernovae	
	W 5/19	Neutron Stars and Black Holes	
Week 9	M 5/24	Overflow Topics	
	<b>W 5/26</b>	<b>In-class Examination</b>	
Week 10	M 5/31	<i>Holiday (Memorial Day)</i>	
	W 6/2	<i>Student Presentations &amp; Looking Ahead</i>	
<b>Final Paper</b>		Due by _____	