

PHY320 Astrophysics

Gustavus Adolphus College Spring 2018

Instructor: Dr. Steven Mellema

Office: Olin Hall 210

Office Hours: MTWRF 8:30-9:50am

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Textbooks:

An Introduction to Modern Astrophysics 2nd Edition, by Carroll and Ostlie, Pearson, ©2007

Mathematical Handbook of Formulas and Tables, by Murray R. Spiegel (Schaum's Outline Series)

Course Policy and Evaluation:

1. **Class Meetings and Reading Assignments:** The class will meet Monday, Wednesday and Friday from 10:30-11:20AM for lecture, small-group problem solving, homework review and, occasionally, for exams. Attached is a daily calendar of activities for the course. When reading assignments are made for a class session, the reading is expected to be completed **before** coming to the class.
2. **Homework:** Homework problems will be assigned according to topics from the textbook, and are due at the beginning of class on the due date given by the instructor. Late homework may be accepted at the discretion of the instructor with a reduction in credit.
3. **Group Problems:** Frequently in class, students will work cooperatively, in assigned groups of 3-4 members, to solve problems. A group solution will be submitted, with all group members receiving the same grade. There will be no make-up for group problems missed due to absence.
4. **Laboratory:** The laboratory work consists of the observing exercises described on page 3 below. Students will work in groups of two (or three) on these experiments. Each group will maintain a laboratory notebook for these experiments, which will be collected and graded periodically. A formal report in the style of a short "scientific letter" will be prepared by each group for labs 2, 3, 4, 5, 6, & 7.
5. **Project:** Each laboratory group will select a project to be completed in the second half of the semester. Suggestions are included on the following page. The group will collaborate to make a presentation and to write a formal report on the project.
6. **Attendance:** Regular attendance at all class meetings is expected. Students will be held responsible for informing themselves of all announcements/assignments made in class.

7. **Exams:** There will be three hour exams and a two-hour, comprehensive final exam (see the calendar below). Students must arrange **in advance** to take an exam at other than the scheduled time, and may do so **only** for a valid health or school-related reason. Exams missed without pre-arrangement are entered as zero credit and cannot be made up.

8. Evaluation:	Homework	20%
	Laboratory	25%
	Group Problems	5%
	Hour Exams	10% each
	Final Exam	20%

Assignment of final letter grades will be based upon the following guidelines:

	B+ = 86-90%	C+ = 74-78%	D+ = 62-66%
A = 94-100%	B = 82-86%	C = 70-74%	D = 58-62%
A- = 90-94%	B- = 78-82%	C- = 66-70%	

9. **Incompletes:** A grade of incomplete will **only** be given for work not completed due to circumstances beyond the control of the student (*this is the College policy*).

10. **Academic Honesty:** Having signed and agreed to abide by the College's Honor Code, students thereby pledge that, in all academic exercises, examinations, papers, and reports, they shall submit their own work. In the context of this course, students are expected to collaborate and to discuss their out-of-class assignments. However, submitting under one's own name work that is merely copied from another is a violation of the Honor Code. (The full text of the Gustavus Academic Honor Code Policy may be found at: https://gustavus.edu/general_catalog/current/acainfo).

11. **Disability Services:** Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability (or you think you may have a disability of any nature) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Disability Services Coordinator, for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Disability Services as early as possible. Disability Services (<https://gustavus.edu/advising/disability/>) is located in the Center for Academic Resources & Enhancement (CARE). Disability Services Coordinator Kelly Karstad (kkarstad@gustavus.edu or x7138) can provide further information.

12. **Help for Students Whose First Language is not English:** Support for Multilingual students is available via the Multilingual and Intercultural Program Coordinator. Please schedule appointments by phone at x7545 or by email to Carly Overfelt (coverfel@gustavus.edu).

Astrophysics Laboratory Schedule

Lab 1 Finding Celestial Objects – Due 2/26

Lab 2 Using the CCD Camera – Due 3/5

Lab 3 Color Filters & CCD Camera – Due 3/19

Lab 4 Solar Spectrometry – Due 4/9

Project Phase – Proposal Due 4/16 - Possible Areas for Projects:
Finding Asteroids, H-R Diagram for a Cluster, Stellar Spectroscopy, Photometry of Variable Stars

Lab 5 UVBRI Photometry – Due 4/23

Lab 6 Stellar Spectrometry – Due 4/30

Lab 7 Galactic Spectrometry – Due 5/21

Project presentations will be given in the last week of classes, and final paper due at the time of the final exam.

Astrophysics Laboratory Reports

INTRODUCTION:

You are a research physicist during the 21st century. Your job is to conduct experiments, make discoveries, and publish results. You hope to become famous and win a Nobel Prize before the age of thirty, so the quality of your publications is very important. The results of your research are to be published in *Astrophysics Journal* or a similar journal. Most journals accept results published in “scientific letter” style (described below). Good luck making history!

INSTRUCTOR'S NOTES:

Philosophy of Reports - I want you to take your role as a research physicist seriously. I am the editor of the journal in which you are trying to get your papers published. Whether or not your papers are accepted for publication (and your lab grade) depend on how well the paper is written and the quality of the scientific evidence you present to support your findings. You must convince me that your results are real and not just experimental noise!

Final Project - Each group will do a laboratory project during the final half of the semester. The results of this project will be submitted in letter format and defended orally (see below).

I. Scientific Letter Format - The scientific letter style of presenting experimental results is a short paper used to announce significant new findings or discoveries.

- The paper should be no longer than three typed pages or its equivalent and should contain the following items.
- The paper should have a title, statement of authorship, abstract, body, and a reference list. The abstract is a brief, summary statement explaining what was done and the significance of the results that were obtained.
- The body of the paper should contain an introductory paragraph that places the work in context and states why it is important. Next the experimental setup (no procedure information), results, data analysis, and theory are described. You are trying to convince the reader that you know what you are talking about. Include anything that you feel supports your conclusions, for example, data tables, diagrams, graphs with captions, and equations. Finally, the body of the text should include a concluding paragraph, which restates the most important results or findings. Any references used should then be listed.
- All figures should have complete captions so that the reader can understand what is being shown without referring back to the main text.

II. Oral Presentation of Experimental Results - Due to the large number of scientists working today a brief oral presentation style has been developed, called “the 10 minute talk”. This is an oral presentation in which the scientist is given 10 minutes to state his or her case and the audience is then given 5 minutes for questions. The presentations usually include very short text, graphs, tables, and equations as appropriate. These talks are usually given using overhead transparencies. Practice your talk before giving it to the class since ten minutes goes by very quickly and you will therefore only have time to include the most essential things (8 to 12 slides is usually appropriate).

FEBRUARY 2018

Subject PHY320 Period 3

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
				1	2	3/4
	5	6	7	8	9	10/11
1	12 Syllabus; Introduction Celestial Coordinates Chapter 1	13	14 Celestial Mechanics Chapter 2	15	16 Continuous Spectra Chapter 3	17/18
2	19 Special Relativity Chapter 4	20	21 Quantum Optics Chapter 5	22	23 Telescopes Chapter 6	24/25
3	26 Binary Systems Chapter 7	27	28 Spectral Classes and HR Diagrams Chapter 8			

MARCH 2018

Subject PHY320

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
WEEK 3				1	2 Stellar Atmospheres	3/4
					Chapter 9	
WEEK 4	5 Hour Exam 1 (Chapters 1-8)	6	7 Stellar Interiors	8	9 Our Sun	10/11
			Chapter 10		Chapter 11	
WEEK 5	12 Star Formation	13	14 Stellar Evolution	15	16 Stellar Pulsation	17/18
	Chapter 12		Chapter 13		Chapter 14	
WEEK 6	19 Massive Star Deaths	20	21 Stellar Remnants	22	23 Black Holes	24/25
	Chapter 15		Chapter 16		Chapter 17	
WEEK 7	26 Close Binary Systems	27	28 Hour Exam 2 (Chapters 9-18)	29	30 No Class: Spring Break	31
	Chapter 18					

APRIL 2018

Subject PHY320

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
						1
	2 No Class: Spring Break	3 No Class: Spring Break	4 No Class: Spring Break	5 No Class: Spring Break	6 No Class: Spring Break	7/8
8 WEEK	9 The Solar System Chapter 19	10	11 Atmospheres	12	13 Terrestrial Planets Chapter 20	14/15
9 WEEK	16 The Earth	17	18 Jovian Planets Chapter 21	19	20 Kuiper Belt Objects Chapter 22	21/22
10 WEEK	23 Asteroids and Comets	24	25 Formation of Planetary Systems Chapter 23	26	27 The Milky Way Chapter 24	28/29
11 WEEK	30 Hour Exam 3 (Chapters 19-23)					

MAY2018

Subject PHY320

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
WEEK 11		1	2 Types of Galaxies	3	4 Galactic Evolution	5/6
			Chapter 25		Chapter 26	
WEEK 12	7 Galactic Formation	8	9 Large-Scale Structure	10	11 Active Galaxies	12/13
			Chapter 27		Chapter 28	
WEEK 13	14 Cosmology	15	16 Relativity and Cosmology	17	18 The Early Universe	19/20
	Chapter 29				Chapter 30	
WEEK 14	21 Evolution of Large Scale Structure	22	23 Final Exam Review	24 No Class: Reading Day	25	26/27 Final Exam*: Sat. 1:00-3:00 PM
	28	29	30	31		

***Note: The final exam will be 50% on Chapters 24-30 and 50% comprehensive.**