PHYS 231
Introductory Astrophysics
Winter 2020

Instructor:	Prof. S. McMillan (Disque 815, x2709)
Time and place:	M W 12:30–1:50, PISB 108
Office hour:	M 2:00–3:00, Disque 815, or by appointment
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URL:	`http://www.physics.drexel.edu/~steve/Courses/Physics-231`

Course Overview

The goal of this course is to understand the unifying principles of physics that relate familiar phenomena on Earth to what goes on in the larger universe. We will discuss the solar system, the motions of the planets, gravity, and the properties of stars, and try to bring all of these concepts together. We will talk about how just a few simple physical laws can describe and predict the structure and evolution of stars. We will then discuss energy transfer, radiation, and the detection of the most distant galaxies, and finally the structure and evolution of the universe itself. All in 9 weeks!

No prior knowledge of astronomy or astrophysics is assumed. Knowledge of mechanics at the PHYS 101–201/PHYS 113–115 level is assumed, as well as elementary differential and integral calculus. On a day to day basis, I expect you to come to class, ask questions, do the readings, and keep up with your homework.

Course Outline

The course material will include the following topics, approximately on the schedule indicated:

- Week 1: Scales in the universe; motion under gravity
- Week 2: Light, magnitudes, and spectroscopy
- Week 3: Stars and the Hertzsprung-Russell diagram
- Week 4: Radiative transfer and stellar structure
- Week 5: Stellar evolution, white dwarfs, neutron stars, black holes
- Week 6: Star formation and the interstellar medium
- Week 7: Structure of the Milky Way galaxy; dark matter
- Week 8: Other galaxies, the Hubble classification, galaxy evolution
- Week 9: The expanding universe; Hubble's law; dark energy
- Week 10: Introduction to cosmology

These topics may be modified as necessary as the quarter progresses. A more detailed breakdown of material covered, including text references, will be placed on the course web page.

Textbook

The text for this course is *Astrophysics in a Nutshell*, 2nd Edition, by Dan Moaz (Princeton University Press, 2016). This advanced undergraduate text provides excellent discussions of astrophysics on many scales, as well as providing good introductions to many of the theoretical issues involved. Additional material may be handed out in class, and/or placed on the course web page. All handout material should be regarded as required reading.

Evaluation

The final grade for the course will be based on the following:

1. Class participation (10% of the total). You are expected to attend all lectures, to participate in discussions, and to ask questions. Some of the topics we'll be covering are quite esoteric, so if I don't have feedback, I don't know if you're understanding the material.
2. Approximately 6 homework assignments completed during the quarter (40%). The bottom homework grade will be dropped.
3. An in-class mid-term examination (20% of the total), tentatively scheduled for Wednesday, February 5 (week 5).
4. A final examination (30%), to be held during finals week.

Assignments will be due one week after they are distributed. All homeworks will be graded out of 100%. Late homeworks will receive reduced credit, at a rate of -5% per day late. Homeworks turned in after they are discussed in class (normally within 1 week of the due date) or after the final examination will receive zero credit. Some homeworks may include simple programming assignments, in which you will be expected to write a program (in the language of your choice) to solve a physical problem.

Learning Outcomes

On completing this course, students should be able to

- discuss the basic physical principles that determine the structure of stars,
- outline the key features and outcomes of stellar evolution,
- describe the properties of stellar remnants,
- discuss the process of star formation and how it couples to the physics of the interstellar medium,
- describe the large-scale structure of the Milky Way and other galaxies,
- discuss the evidence for dark matter in galaxies and on larger scales,
- state Hubble's law and describe the observations supporting the existence of dark energy in the universe.

Drexel Learning Priorities

- Information Literacy – Possess the skills and knowledge to access, evaluate and use information effectively, competently and creatively.
- Technology Use – Make appropriate use of technologies to communicate, collaborate, solve problems, make decisions, and conduct research, as well as foster creativity and life-long learning.
- Professional Practice – Apply knowledge and skills gained from a program of study to the achievement of goals in a work, clinical, or other professional setting.

Academic Policies

Discussion is strongly encouraged when solving problem sets, but the work you turn in must be your own. If a friend describes how to solve a problem without specifically writing down any equations, then you may use that information in your own words in your own solution. However, if you directly transcribe someone else's work, you are committing plagiarism.

You may not copy anyone else's exam, homework, or program. All of these actions are considered cheating and will be dealt with in the following manner. The first infraction will result in a zero for all parties involved. The second infraction will result in an "F" for the course and a report to the Office of Academic Affairs.

Please refer to the following University policies on academic dishonesty:

`http://drexel.edu/provost/policies/academic_dishonesty/`
`http://drexel.edu/studentlife/community_standards/studentHandbook/general_information/`

In addition, the following policies apply to disability accommodation and course-drop scheduling:

`http://drexel.edu/oed/disabilityResources/students/`
`http://www.drexel.edu/provost/policies/course_drop/`