

# ASTR 250: Fundamentals of Astronomy

Spring 2020 – Section 001

MWF from 11-11:50 am

## Syllabus

### I. Contact and User Information

#### Professor

Dr. Don McCarthy

Email: [dmccarthy@as.arizona.edu](mailto:dmccarthy@as.arizona.edu) (include “ASTR 250” in your subject line)

Twitter: @stellarDon

Office: Steward Observatory, room N404. Ride the main elevator up to the fourth floor and walk straight ahead.

Office hours: Wed. 12:30-1:45 pm and by appointment. Do not hesitate to contact me!

Study session: Thur. 2-4 pm (room 304A at Bookstore Administration on level #3 SUMC)

#### Teaching Assistant

Mr. Michael Hammer

Email: [mhammer@email.arizona.edu](mailto:mhammer@email.arizona.edu)

Office: Steward Observatory, room 341

Office Hours: TBD

### Links and Tutoring

Class Web site: <http://lavinia.arizona.edu/~dmccarthy/ASTR250/index.html>

ATOMM: Astronomy Tutoring Offered for Majors, by Majors  
3<sup>rd</sup> floor library (Parker Room) in Steward Observatory  
Tuesday (2-4 pm); Wednesday (3-5 pm); Thursday (1:30-3:30 pm)

### II. Course Overview

ASTR 250 is a calculus-based introductory course in astronomy and astrophysics, aimed at sophomore astronomy majors and science majors from other departments. Topics include: Basic spherical trigonometry and observational astronomy, our Solar System and Kepler’s Laws, exoplanets, virial theorem, stellar evolution and nucleosynthesis, galaxy structure and evolution, dark matter and dark energy, the Big Bang, and the structure and evolution of the universe. Long term benefits also include mastery of techniques for analyzing questions, formulating logical solutions, physical intuition, the scientific method, written communication, and the use of numerical techniques, both mental and electronic.

Prerequisites: PHYS 141 (or 161H); Calculus I [MATH 122B or 125]; and Calculus II [MATH 129]

#### Expected Learning Outcomes:

1. Demonstrate the ability to meaningfully analyze, apply and integrate the principle findings, common applications, current problems, fundamental techniques, and underlying theory of the astronomy discipline.
2. Employ discipline skills related to the observational techniques, instrumentation, computational methods, and software applications used to investigate modern astrophysical phenomena and problems.
3. Develop proficiency with communicating, translating, and interpreting fundamental astronomical concepts and research results in oral and/or written formats.

4. Conduct guided research and/or develop mastery-knowledge of a specific area of the discipline of astronomy.

5. Participate in the scholarly, ethical, and discipline specific practices of the field at an emergent level.

Expectations: Each student is expected to come prepared for every scheduled class. As a general rule, students should invest ~3 hours per credit unit on homework assignments (i.e., ~9 hours per week), preferably starting each assignment well ahead of the due date. During class, students should participate actively in problem-solving discussions with their peers. Students are always expected to present logically organized, legible solutions and to write clear sentences and paragraphs using good English grammar.

Time and location: MWF from 11-11:50 am in room 204 of Steward Observatory. We will also utilize room 208 for in-class problem solving and for presentations of homework solutions. There may be occasional exceptions to be announced beforehand in class and on our Web site. Classes will begin promptly. If you arrive late, please enter quietly. Food and drinks are not allowed in the classrooms.

Textbooks:

1. “*Foundations of Astrophysics*,” by B. Ryden and B.M. Peterson, published in 2010 by Addison-Wesley, ISBN-13: 978-0321595584. This book is available in the UA Bookstore, and at Amazon.com, for used, rented, and new copies.

2. A free, online textbook for this class is available in Web view and PDF format from <https://openstax.org/details/astronomy>.

Class Web sites: The site listed above is the focal point for the course. All course materials are posted there and available for downloading. Our class has a minor presence on the University’s D2L site which might be used for lecture recordings and essay submissions.

Email Communication: We will use our official University email addresses for communications. When you email us, be sure to **identify yourself** and to **use an appropriate subject line including the course name “ASTR 250.”** For example: “ASTR 250: Question about optical depth”. Otherwise, your messages may not be read and a response will be delayed.

### **III. Your Personal Star Name**

On the first day of class you will be assigned a Star Name as your code name for all submitted materials and for posting of grades. **To protect your privacy, never write your personal name or student ID number on any assignments in this course. Instead, use the number of your Star Name.**

### **IV. Homework**

Homework assignments are a major component (50-65%) of this course and will emphasize skills in logical thinking, physical intuition, numeracy, writing, calculus, and astrophysics. Students will often present their solutions during class. The following **rules** apply to homework assignments:

***You must adhere to the policies about Teamwork and Academic Integrity, below and in Section IX!***

1. Electronic submissions will not be accepted.

**2. Content and Quality:** All submissions must exhibit excellent clarity with legible handwriting, clearly organized and logical arithmetic solutions. Some problems require an opinion or interpretation to be clearly stated. In these cases, a grade will be determined more by reasoning and writing performance than by the exact answer.

You must always **SHOW**, or explain, **HOW** you reached a solution by clearly writing the intermediate, logical steps in a solution and/or describing the solution logically in words. Simply listing an answer is not acceptable and will not receive any points.

**3. Due date policy:** All assignments are due at the start of class on the dates specified on the course Web site. You may request to submit an assignment late by emailing Dr. McCarthy in advance of the deadline, so we can agree a plan towards completion. Otherwise, a **late-penalty** of 20% may be assessed. Assignments will not be accepted more than one week late.

**4. Teamwork policy:** Students are encouraged to share intellectual views and to discuss assignments within the following boundaries. You may **START** an assignment in a team. However, after deciding **HOW** to approach a problem, **you must then make all your own derivations, measurements, graphs, and tables and always use your own wording to interpret and express conclusions.** Homework solutions that appear identical are a violation of the Code of Academic Integrity and will receive a grade of zero plus potential expulsion from the course and University.

**5. In-class work:** In-class homework problems require students to work in pairs or groups of three. Attendance is required to receive full credit for these problems; half credit will be given for in-class problems submitted as normal homework with skipped attendance.

**6. “Recovery Points”:** If you incorrectly solve a homework problem, you may correct the problem and turn it back in for half additional credit with the next homework assignment.

**7. “TBD” grades:** Sometimes students misread a question, get started in the wrong direction, or make a simple mistake leading to the wrong conclusion. Such assignments will receive a “TBD” grade (i.e., “to be determined”), allowing you to get back on track if you meet with Dr. McCarthy within one week to discuss your work and arrange to improve it.

## **V. In-class “Quizzes”**

“Quizzes” will consist of questions and problems during each class and will be given to promote understanding, self-assessment, attention, participation, and teamwork.

## **VI. Exams**

There will be two exams: A mid-term (March 4) and a final exam (May 11; 10:30 am – 12:30 pm). You may bring a handwritten, double-sided page of notes (“crib sheet”) to consult during exams. Exams will emphasize understanding and skills, not memorization. Here are links to the University’s Final Exam Regulations and Schedule:

<https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>  
<http://www.registrar.arizona.edu/schedules/finals.htm>

## **VII. Grading**

Grades will be derived from the following categories with the indicated percentage weights. Students have an alternative option for calculating their semester grade if they consult with Dr. McCarthy by February 3.

OPTION #1 (Default):

Average of daily homework (65%)  
Exams: Mid-term (10%); Final (15%)  
Participation (10%)

OPTION #2 (Negotiable by February 3):

Average of daily homework (55%)  
Telescope Proposal (15%)  
Exams: Mid-term (10%); Final (10%)  
Participation (10%)

“Participation” includes attending class regularly, completing assignments, in-class quizzes, asking relevant questions during class, seeking help during study sessions and office hours, helping to lead discussions and presentations of homework solutions, etc.

Final course grades will be assigned as follows: A (90-100%); B (80-89%); C (70-79%); D (60-69%); E (<60%). Borderline grades, such as B+, will be rounded to the next letter grade only if the student has participated actively throughout the semester.

Honors Credit: Students wishing to contract this course for Honors Credit should email Dr. McCarthy to set up an appointment to discuss the terms of the contact. Information on Honors Contracts can be found at <http://www.honors.arizona.edu/faculty-and-advisors/contracts>.

Incomplete (I) or withdrawal (W) Grades: Requests must be made in accordance with University policies, which are available as follows:

<http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete>  
<http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal>

### **VIII. Optional Telescope Proposal**

Students may write a rigorous Observing Proposal comprising 15% of the final grade, due in class on May 6. The goals of this project are to put into action most of the astrophysical concepts addressed in this course and to introduce each student to the rigors of the proposal process. Proposals must connect scientific goals with realistic observations using existing instruments and telescopes. The proposal must adhere to the same format, and content, as required by Steward Observatory’s general Call for Proposals each semester.

Proposals may address any astrophysical topic but must be realistic, quantitative in nature, and demonstrate fundamental understanding of the proposed science, the associated observational techniques, and data analysis. The topic must be submitted to Dr. McCarthy by February 3, in a brief paragraph which may evolve into the “abstract” of the ultimate proposal. All topics must be approved by Dr. McCarthy before proceeding further. Students must meet with Dr. McCarthy at least monthly to demonstrate progress and understanding.

Students may be asked to present their proposals orally to interested class members at the end of the semester.

### **IX. Course Policies**

Academic Integrity

Dr. McCarthy and the Department of Astronomy adhere to the University's Code of Academic Integrity. The Dean of Students’ Web site below describes the Code and resources that are available to you for improving your work. Students are encouraged to share intellectual views and discuss

freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Such violations of the Code can be penalized by expulsion from the University and negative reports in your official records. **If you are having difficulty in this course, PLEASE just ask for help instead of sacrificing your future.** <http://deanofstudents.arizona.edu/academicintegrity>

The University Libraries have some excellent tips for avoiding plagiarism, available at <https://new.library.arizona.edu/research/citing/plagiarism>.

***Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent.*** Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

**Teamwork Policy:** You may **start** an assignment in a team. However, once you decide HOW to approach a problem, **you must then make all your own measurements and use your own wording** to interpret and express conclusions. Any assignments that appear identical will be awarded "zero" points and can lead to expulsion from the class and the University. At a minimum, such violations of the Code will lead to an Academic Integrity investigation with the Dean of Students Office.

Attendance and Absences:

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

You are required to attend each class in accordance with University policy: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: <http://policy.arizona.edu/human-resources/religious-accommodation-policy>

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored: <https://deanofstudents.arizona.edu/absences>

**Holidays:** All holidays observed by organized religions will be honored for those students who show affiliation with that particular religion. All absences pre-approved by the Dean of Students will also be accepted. <http://www.registrar.arizona.edu/calendar-religious-holidays>

**Behavior:** To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Dr. McCarthy promises to be respectful of all students. He expects you will do the same as stated in the Student Code of Conduct and other University guidelines concerning disruptive and threatening behavior.

<https://deanofstudents.arizona.edu/student-code-conduct-student-faqs>

<http://policy.arizona.edu/education-and-student-affairs/disruptive-behavior-instructional-setting>

The University's Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself.

<http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>

Special accommodations: Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate, or experience, barriers related to the format or requirements of this course, please meet with Dr. McCarthy so that we can discuss ways to ensure your full participation in the course. If you determine that disability-related accommodations are necessary, please register with Disability Resources (520-621-3268; <https://drc.arizona.edu/>) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

Nondiscrimination and Anti-harrassment:

Dr. McCarthy is committed to creating and maintaining an environment free of discrimination as described in the University's policy at the link posted below. Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. He also wants to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

<http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Food Insecurity:

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. In addition, the University of Arizona Campus Pantry is open for students to receive supplemental groceries at no cost. Please see their Web site at: [campuspantry.arizona.edu](http://campuspantry.arizona.edu) for open times.

## **X. Subject to Change Statement**

Required language: Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.