

ASTRONOMY 300A: DYNAMICS AND MECHANICS IN ASTROPHYSICS

FALL 2022

Time: 11:00AM-11:50AM, MWF, in Steward 204 (in person course modality)

Course Website: on <https://d2l.arizona.edu> (for updates to this syllabus!)

Course Email: astr300a@list.arizona.edu (reaches professor and TA)

Lead Instructor: Prof. Andrew Youdin

Office: SO N418 (don't forget the N) <https://arizona.zoom.us/j/89648767210>

Office Hours: TBD, please respond to the poll on D2L .

Teaching Assistant: Eonho Chang

Office Hours: TBD in Parker Library (respond to poll on D2L).

Course Description

In this course we will survey the role of gravity in astrophysics. We will begin with the study of simple Keplerian orbits, and then explore progressively more complex dynamical systems. We will cover hydrostatics and a short introduction to astrophysical fluid dynamics towards the end of the semester. This class will focus heavily on problem solving skills including the use of dimensional analysis and order of magnitude reasoning. We will also touch on computational methods for problem solving throughout the semester.

Topics to be covered

Dimensional Analysis

Stellar & Planetary dynamics

Atmospheres

Order of Magnitude Reasoning

Galactic dynamics

Fluid Dynamics

Learning Goals

- 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.
- Employ discipline skills related to the observational techniques, instrumentation, computational methods, and software applications used to investigate modern astrophysical phenomena and problems.
- Develop proficiency with communicating, translating and interpreting fundamental astronomical concepts and research results in oral and/or written formats.

Grading: Your course grade will be based on:

- Homework and in class problems: 50% (drop lowest score)
- In class participation: 10% (drop lowest score)
- Midterms: 25%
- Final Exam: 15%

The class will not be curved. The correspondence between final percentages and letter grades will be: **A:** 87% – 100%; **B:** 72% – 87%; **C:** 50% – 72%, **D:** 30% – 50%; **E:** 0% – 30%.

Textbook: The main textbook is “Principles of Astrophysics,” by Charles Keeton. This book is available for **free** from the UArizona library as a downloadable PDF. You can find it [online here](#).

The supplementary textbook is “The Tapestry of Modern Astrophysics,” by Steven Shore. This book is also available as an online PDF [here](#). You will find a different treatment of the same material. We will rely more heavily on the latter book for the portion of the course on fluid dynamics.

Midterm Tests: There will be two in class tests during the semester. Dates will be set at least 2 weeks in advance.

Final Exam: The final exam will be comprehensive, but with more emphasis on material since the last midterm.

Class Attendance: Regular class attendance is expected and the instructors should be notified of any planned absences. Furthermore (and in agreement with University policies):

- Approved absences for religious practices or with Dean’s approval (<https://deanofstudents.arizona.edu/policies/attendance-policies-and-practices>) will be respected. If you must miss the equivalent of more than one week of class, please contact the Dean of Students Office DOS-deanofstudents@email.arizona.edu to share documentation about the challenges you are facing.
- If you feel sick, or if you need to isolate or quarantine based on University protocols, stay home. Except for seeking medical care, avoid contact with others and do not travel. Visit the UArizona COVID-19 page (<https://covid19.arizona.edu/>) for the most up-to-date information.
- Non-attendance for any reason does not guarantee an automatic extension of due date or rescheduling of examinations/assessments. Please communicate and coordinate any request directly with your instructor.

Course Participation and Conduct: Please come to class ready to learn and engage with your peers. Participation and in-class activities make up a substantial portion of your final grade. Much of the traditional lecture material will be assigned as homework, so it is absolutely crucial to prepare outside of class time. We will be doing a lot of in class problem solving. In order to ensure a productive learning environment for all students, please note the following class rules:

- NO cellphones in class. They must be kept in a bag or pocket and on silent.
- Laptops / tablets ONLY for note taking or in class problem solving.
- No class disruptions.
- Obey the University of Arizona Code of Academic Integrity: [available here](#)
- Follow the University of Arizona Non-threatening behavior policy: [available here](#)
- Adhere to the University of Arizona nondiscrimination and anti-harassment policy: [available here](#)

Course Updates: It is your responsibility to check D2L regularly for course notifications, updates, and assignments. The information contained in the course syllabus and schedule, other than the grade and absence policies, may be subject to change with reasonable advance notice.

Course Recordings: Recordings are at the discretion of the instructor. There are particular challenges to recording a class with the use of multiple whiteboards and with interactive problem solving. Students should not expect to rely on course recordings for missed classes, but instead

are expected to do additional readings, consult with their classmates and attend office hours. The university further notes that any class recordings must be viewed on D2L and that all recordings are subject to government and university regulations.

Students with Disabilities or Pregnancies: At the University of Arizona, we strive to make learning experiences accessible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu/>) to establish reasonable accommodations.

Academic advising: If you have questions about your academic progress this semester, please reach out to your academic advisor (<https://advising.arizona.edu/advisors/major>). Contact the Advising Resource Center (<https://advising.arizona.edu/>) for all general advising questions and referral assistance. Call 520-626-8667 or email to advising@arizona.edu.

Life challenges: If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at (520) 621-2057 or DOS-deanofstudents@email.arizona.edu.

Physical and mental-health challenges: If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520) 621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.