

Astronomy 300A
Dynamics and Mechanics in Astrophysics
(Spring 2021)

Lectures: 9:30AM-10:45AM Tu/Th
Zoom Link, rm ID: 845 8706 0519
Pwd: 6.67e-8
In person: Meinel Op Sci. Rm 410

Instructor: Prof. K. Kratter
Office: SO N328 (emphasis on the N)

Office hours:
Available on Request
Note: ATOMM tutoring is also available

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
Order of Magnitude Reasoning
Stellar & Planetary dynamics
Galactic dynamics
Atmospheres
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: 25% (drop lowest score)
- In class activities / problem solving: 25% (drop lowest score)
- Semester Project: 10%
- 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 For this course we will primarily use “Principles of Astrophysics,” by Charles Keeton. This book is available for **FREE** from the UofA online library system as a PDF document. You can find it [online here](#). I also recommend looking at ”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.

Although it is **NOT REQUIRED** for the course, I also recommend Frank Shu’s “Physics of Astrophysics.” This is available in [multiple campus library locations](#). For this course, the gas dynamics volume is most relevant. Other supplementary material will be provided online throughout the semester.

MIDTERM TESTS There will be three, tentatively “in class” tests during the semester, pending COVID-19 restrictions. Dates will be set at least 2 weeks in advance. If required we will shift to an online examination process. All online exams will be open book.

Semester Project Student will work with a partner on a literature review project, coupled with a basic class concept. Each team will prepare a presentation to teach the material to the class during the course of the semester. More information will be provided in class.

Final Exam In lieu of a written final exam, the final exam will be given orally to each student individually. We will practice this skill throughout the course of the semester.

Course Conduct and Expectations

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:

1. NO cellphones in class. They must be kept in a bag or pocket and on silent.
2. Laptops / tablets ONLY for note taking.
3. No class disruptions (talking, note passing, etc).
4. For remote meetings, please keep your camera on, and microphone muted when not speaking
5. Obey the University of Arizona Code of Academic Integrity: [available here](#)
6. Follow the University of Arizona Non-threatening behavior policy: [available here](#)
7. Adhere to the University of Arizona nondiscrimination and anti-harassment policy: [available here](#)

Course Email and Websites:

In this class we will make regular use of D2L . It is your responsibility to check D2L regularly for course notifications / updates / and assignments.

Course Updates: 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.

Students with disabilities At the University of Arizona, we strive to make learning experiences as accessible as possible. 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.