

Astronomy 382C: Astrophysical Gas Dynamics

Course Information

Contact Information

Instructor: Prof. Stella Offner
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Virtual Office Hours: 11am Thursday or by appointment.
<https://utexas.zoom.us/j/6557782889>

Description

The dynamics of gases underpins our understanding of a broad range of astrophysical phenomena from stellar structure to galaxy evolution. This course introduces the fundamentals of classical gas dynamics, including the equations of motion, shocks, instabilities and fluid behavior in different limits. We will apply the principles of gas dynamics to investigate self-gravitating, magnetized, and ionized gases. We will cover astrophysical problems relating to shock waves, turbulence, accretion disks, winds and jets. We will read and discuss a variety of seminal papers.

Textbooks

This course has been compiled using a variety of reference materials, including textbooks and journal articles. As with all graduate classes, it is to your advantage to read as many different sources as possible and even seek out your own supplementary reading material. If you have never taken a fluid dynamics course previously, I recommend you buy and digest a non-astrophysical fluids text.

Required Reading: (1) *Choudhuri*, The Physics of Fluids and Plasmas
(2) *Feynman Lectures*, Vol II Chpt 40, 41 (online)

Supplementary Reading: *Shu*, Gas Dynamics
Landau & Lifshitz, Fluid Mechanics (online)
Acheson, Elementary Fluid Dynamics
Batchelor, An Introduction to Fluid Dynamics
Tritton, Physical Fluid Dynamics
Binney & Tremaine, Galactic Dynamics
Pringle & King, Astrophysical Flows
Frank, King and Raine, Accretion Power in Astrophysics

Class Structure and Grading

Overview: There will be weekly problem sets and an oral final exam at the end of the course. The lecture, homework, and reading schedule is found in detail on the course webpage on Canvas. At least one homework will require programming.

Grading Components:

- **Homework** (70%). Each homework assignment is due at the beginning of class. Students may work together but must write up their solutions individually.
- **Paper Presentations** (10%). Students will be expected to lead a discussion on a paper related to gas dynamics. Non-presenting students should prepare to contribute to the discussion.
- **Exams** (20%). There will be one final exam covering all the course material.

Missing Homework: Extensions will not normally be permitted for the homework assignments. If you do not complete an assignment on time as a result of unforeseeable problems, complete the assignment and notify me as soon as possible. I may accept the late work with or without a penalty at my discretion.

Posting of Grades

To protect the privacy of your grades, I will post them to Canvas.

Class Policies

Communications: The course webpage on the Canvas system will be updated with course announcements, supplementary resources and deadlines. It is your responsibility to check these on a regular basis.

Email is recognized as an official mode of university correspondence; therefore you are responsible for reading your email for university and course-related information and announcements. Please check your email regularly and frequently.

To facilitate interaction your Zoom camera should be turned on during class. Astronomy-related virtual backgrounds are optional.

Muting: To reduce ambient background noise, please keep microphones muted unless speaking or participating in discussion.

Syllabus Changes: I reserve the right to make changes to the syllabus and class schedule if necessary. If any changes are made they will be announced through Canvas and new versions will be uploaded.

Academic Honesty

Collaborating on homework is encouraged, but each student should complete their own homework solution set for submission.

Cheating is highly destructive. It corrodes the academic environment and cheapens the value of your education. I will not tolerate cheating, nor should you. There are severe penalties for representing anyone else's work as your own or assisting anyone else to submit work that is not their own. Plagiarism will receive a zero.

The University of Texas policy on academic honesty and plagiarism can be found on the **Student Conduct and Academic Integrity website**: <http://deanofstudents.utexas.edu/conduct>

Students with Disabilities

Students with documented disabilities are encouraged to request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities (512-471-6259). <http://diversity.utexas.edu/disability/>. Please provide proper documentation from the SSD Office at the beginning of the semester.

Diversity, Equity and Inclusion

Astronomy belongs to all people, independent of race, religion, gender, gender identity, gender expression, or sexual orientation. Incidents of discrimination, assault, harassment, threats, intimidation, profiling, or coercion based on membership or perceived membership will not be tolerated.

Please see <https://cmhc.utexas.edu/wellbeing/universityresources.html> for a list of student resources. Note all faculty members, including myself and your research advisors, are also resources.

The University of Texas President's statement of community values can be found here: <http://equity.utexas.edu/presidents-statement/>

UT Austin Land Acknowledgement

I would like to acknowledge that we are meeting on the Indigenous lands of Turtle Island, the ancestral name for what now is called North America.

Moreover, I would like to acknowledge the Alabama-Coushatta, Caddo, Carrizo/Comecrudo, Coahuiltecan, Comanche, Kickapoo, Lipan Apache, Tonkawa and Ysleta Del Sur Pueblo, and all the American Indian and Indigenous Peoples and communities who have been or have become a part of these lands and territories in Texas.