

PHYS 3359/5393 Astrophysics

Last updated: August 24th, 2020

Term: Fall 2020

Lecture: TR 6:00 pm – 7:20 pm in HSSN 217 and via [Microsoft Teams](#)

Prerequisites: PHYS 2421 and MATH 2326.

One year of calculus-based introductory physics, one year of calculus, one semester of differential equations. We will learn some thermodynamics, quantum mechanics, classical mechanics, and electromagnetism as needed.

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Grading Policy:

Forum discussions 14 points (1 new discussion per week/1 point each)

Research mini projects 60 points (4 projects/15 points each)

Homework 28 points (1 problem set per week/2 points each)

Collaboration Limited to 8 points (details below)

Total 110 points

A: 90+ points

B: 80-89 points

C: 70-79 points

D: 60-69 points

F: 0-59 points

Alternative1: You will get an A if you contribute to all forum discussions and the average of the best 3 scores on your research mini projects is 90% or higher. (Research route)

Alternative2: You will get an A if you complete four research mini projects and get a 90% average on your homework assignments. (Analytical route)

Textbooks

Lectures on Astrophysics by Steven Weinberg, Cambridge University Press, 2019. (Required)

An introduction to the 'nuts and bolts' aspects of astrophysics via a collection of astrophysical calculations that can be done simply and analytically and yet are relevant to the real world. Intended for those who care about the rationale of astrophysical formulas as well as their applications.

An Introduction to Modern Astrophysics by Bradley Carroll and Dale Ostlie, 2nd Edition, Cambridge University Press, 2017. (Required)

This book is 1359 pages and covers in significant detail pretty much every sub-field of astrophysics. Also known as BOB (Big Orange Book).

The Physics of Stars by A. C. Phillips, 2nd Edition, Wiley, 1999. (Optional)

A bit dated and with a limited scope, but the material covered is explained well, with a nice balance between the math and the physics.

Astrophysics in a Nutshell by Dan Maoz, 2nd Edition, Princeton University Press, 2016. (Optional)
The explanations are good, but the math is less rigorous.

Advanced Astrophysics by Neb Duric, Cambridge University Press, 2004. (Optional)
The division of topics is nice, but the math is often terse.

Lecture Notes

My lectures notes (and hence the class) will follow Weinberg, I will upload my lecture notes to Bb in case you find them useful. Recorded lectures will be on Microsoft Stream.

Forum discussions

New discussions will be started every Thursday and you will have two weeks to make 2 meaningful contributions. Meaningful means that you read the assignment, spent some time thinking and researching your answer or question, and this is reflected in the quality of your contribution. Aim for one or two coherent paragraphs per contribution. Your participation is worth a maximum of 1 point for each discussion.

There will be several questions to start the discussion and you are encouraged to ask more questions. At least one of your contributions should be an answer, but your second contribution can be an answer or a question. Feel free to contribute beyond what is required to get points. Discussions typically will be about particular scientific papers related to topics covered in class but of broad interest or peculiar beauty.

Research mini projects

There will be 4 research mini projects during the semester. Each consists of either a coding project or a writing project and a recorded presentation. Coding projects can be in any computer language but will have particular objectives. Writing projects consist of summarizing a paper from the literature down to two or three pages (introduction, methods, analysis, conclusion) with your own explanations and derivations. The recordings should be 5 to 10 minutes and should explain your results. The project proper is worth 10 points and the presentation is worth 5 points. You are encouraged to collaborate with your peers.

These assignments are due: September 17th, October 15th, November 12th, and December 10th. Topics will be announced in class and on Blackboard. If you are particularly interested on a topic, feel free to suggest papers or ideas for projects.

Homework

There will be 14 problem sets during the semester which will be posted on Tuesdays and are due the following Tuesday (should be uploaded to Blackboard). There are 110 possible points in this class, so late homework is not accepted. If you have partial work, upload what you have as partial credit will be given.

Collaboration

You are encouraged to seek help from and help others in the class. For each research project that you turn in you can assign up to 4 points to peers who helped you. Write down their name(s) and include a sentence explaining what the contribution was. You can manage/assign these points as you wish. For example, you can work closely with another student on your respective projects and each of you then assign 4 points to the other. Another example is you get help from four different students on different parts of your code or derivation and you give 1 point to each.

Final grade

The goal is for everybody to work hard, learn and enjoy the material. Sometimes worrying about your grade introduces dynamics that preclude this, but good grades are necessary to achieve our goals in life. There are 110 points available in the course and you need 90 for the A. There are also 2 alternative routes to get an A.

Week	Lectures	Topics
1	Aug. 25, 27	Hydrostatic equilibrium
2	Sept. 1, 3	Radiative transport
3	Sept. 8, 10	Nuclear reactions
4	Sept. 15, 17	Main sequence of stars (First research mini project due)
5	Sept. 22, 24	White dwarfs and neutron stars
6	Sept 29, Oct. 1	Orbital dynamics
7	Oct. 6, 8	Gravitational waves
8	Oct. 13, 15	Spectral lines from interstellar gas clouds (Second project due)
9	Oct. 20, 22	Heating and cooling of gas clouds
10	Oct. 27, 29	Star formation
11	Nov. 3, 5	Accretion disks
12	Nov. 10, 12	Dynamics of galaxies (Third project due)
13	Nov. 17, 19	Galactic disks and spirals
14	Nov. 24	Quasars
15	Dec. 1, 3	Buffer

Final exam schedule for Thursday Dec. 10th 7:00 pm (Fourth project due)

Life gets in the way

With several routes towards the A that are based on different expectations, this course is robust against most life events (and it has to be because of the current health crisis). That being said, if something happens in your life that will affect your long-term performance in this class, let me know as soon as possible so that we can find a solution.

Students with Disabilities

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at <https://www.utep.edu/student-affairs/cass/>. Accommodations might include but are not limited to note takers, readers, or extended time on assignments. Please take care of this as soon as possible.

Academic dishonesty

Don't cheat, it is not worth it. There is no fine line between openly discussing science and stealing someone else's work. If a student is suspected of cheating, evidence will be collected and submitted to the Assistant Dean of Students for consideration. There is zero tolerance on this aspect.