PHYS 3022 Syllabus

Stars and Planets, Section A, 3 credits

Fall 2026 Semester

Instructor Information

Instructor: Prof. John Wise

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General Course Information

Description

This course covers stellar atmospheres, interiors, and evolutions, as well as the formation and physical properties of planetary systems.

Course Learning Outcomes

Upon successful completion of this course, students should be able to

- Classify stars based on their spectral characteristics, luminosity, and temperature.
- Analyze the fundamental processes in the modeling of stellar atmosphere and interior.
- Describe the life cycle of stars, including the processes of stellar formation, main sequence evolution, and stellar death (supernovae, black holes, and neutron stars).
- Explain distinctive properties of terrestrial and giant planets, and their orbital motion.
- Understand the detection methods of exoplanets and discuss the potential for life beyond our solar system.

Required Course Materials

An Introduction to Modern Astrophysics by Carroll & Ostlie

- Amazon link
- ISBN: 978-1108422161

Grading Policy:

The course grade will be entirely determined from your scores on the following assignments and assessments and will not be curved.

Assignments

- Three tests: 20% each = 60% total
- Homework assignments: 20% total
- Weekly in-class quizzes: 10% total
- Final Project: 10%

Each assignment in a single category will be weighted equally. Work without derivations and explanations will not be accepted for credit. There will not be any extra credit assignments. If there is a concern with any grading, please contact the instructor or teaching assistant within a week of receiving your grade and before the start of finals week. Final letter grades are determined by the scale below and the numerical grade is truncated after the tenth of a percentage, for example, an 89.48% turns into an 89.4%.

Grading scale: A = 89.5-100%, B = 79.5-89.4%, C = 69.5-79.4%, D = 59.5-69.4%, F = <59.4%

Description of Graded Components

- **Tests:** There will be three in-class midterms lasting 75 minutes. Rescheduling tests due to justified reasons and certified by the Dean of Students needs to be requested at least three business days before the exam date. In each test, you may use a handwritten reference index card (4”x6”) to assist you in your exam. You may write anything of particular use on the front and back of the index card. The instructor will provide you with blank index cards a week before the test. Copies and printing are not allowed, and the card must be written by yourself. All other notes, books, calculators, computers, phones, and other electronic devices are not allowed.
- **Homework:** There will be weekly homework problem sets except with weeks in which tests take place. Your homework should be submitted to Canvas in either a typeset (for example, with Word or LaTeX) or scanned handwritten PDF. The homework due dates will be clearly stated on the problem description PDF and on Canvas. The submission deadlines will be Fridays at 11:59pm but is subject to change. Students may submit their work up to two days late with a penalty of 10% per day. No work will be accepted after 48 hours after the deadline. Students may work together on homework sets, but each student must write their own solution.
- **Final project:** The end-of-semester project will consume the last three weeks of the semester. Each project will be conducted in groups of 3-5 students and will be computational. The deliverables will be an in-class presentation (15 minutes),

which includes a qualitative introduction to the topic, the results of your work, and your conclusions. You may use any type of literature, such as other books, journal articles, and online materials to conduct your research. If you use generative AI, please be careful, check the sources, and state how you used it. For more details, see the AI Policy section in the syllabus. The presentations will take place during the last two lecture periods of class, and you will peer review the other presentations.

- **Final Project Suggestions:** You are encouraged to brainstorm a topic for your project and summarize the relevant astrophysics. The topic must be related to stellar astrophysics or extrasolar planets and must be approved by the instructor. Here are some sample topics in which you can construct a more detailed project plan:
    - **Stellar lifecycles:** Use stellar evolution software (for example, MESA) to compute stellar timelines for various stellar masses, metallicities, and rotation velocities from its inception to its endpoint.
    - **Supernova nucleosynthesis:** Study the nucleosynthesis processes occurring during a supernova, explore how various elements are formed during these explosions, and discuss the impact on the chemical composition of the universe.
    - **Stellar binaries and exoplanets:** Choose a binary star system (for example, Alpha Centauri) and investigate its properties, such as orbital dynamics, masses, and potential for exoplanets in the system, using orbital dynamics code that you write from scratch.
    - **Exoplanet characterization:** Select a known exoplanet and create a computational model and detailed report on it. You can discuss its properties, orbit, the technology used to detect and analyze it, and the potential habitability of these exoplanets.
    - **Planetary mission proposal:** Design a proposed planetary exploration mission. You may select a target (planet, moon, asteroid, or comet), outline mission objectives, propose the spacecraft and instruments, and discuss the scientific questions targeted by the mission.

Course Policies

Attendance and/or Participation

Each student should be aware of the regulations that are listed in the student handbook. The class attendance policy, which the Georgia Tech regulations say shall be at the discretion of the instructor, will be as follows: There will be no prescribed maximum number of unexcused

absences for this class. However, if it is apparent that lack of attendance at class may be impairing a student's performance in the course, the instructor may require that the student not miss more classes, under the penalty of failing the course. Please consult http://catalog.gatech.edu/rules/4/ for details on what constitutes an excused absence and other aspects of the Georgia Tech Attendance Policy.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Core IMPACTS is the University System of Georgia's General Education curriculum. If you are teaching a course that counts towards Core IMPACTS, you should include a syllabus statement about the Core area and associated career competencies. This resource developed by the Center for Excellence in Teaching and Learning and Online Education at Georgia State University includes template syllabus statements for each of the Core IMPACTS areas that you may adapt for your course.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Pre- &/or Co-Requisites

- *Pre-requisite:* PHYS 2211 (Principles of Physics I) or PHYS 2231 (Honors Physics I)
- *Pre-requisite:* MATH 2552 or MATH 2562 (Differential Equations)
- *No co-requisites*

Use of Generative AI

When used properly, AI is a great tool to learn and improve your performance and productivity. However, do not use it as a substitute for the learning materials and contact hours of this course. DO NOT use it to solve the problems. Because the majority of the grade comes from tests, your learning and grade will be most likely impaired by not practicing with the homework problems and will not be as well prepared for the in-class assessments. I encourage you to use it responsibly, so you still learn from the class material and not use it as a crutch to boost your grade. AI still makes mistakes even though it has made recent strides in advanced material, where experts (me) can easily spot those errors but not learners.

If you use generative AI for any assignment, please state this in your write-up and how you used it. *I require students to turn in a transcript of your chat session(s) with the LLM (Large Language Model, e.g. Claude, Gemini, ChatGPT, Copilot) if you choose to use one.*

Inclement Weather and Digital Learning Days

If a snow and/or ice storm (or any other cause for the Institute to close) occurs on a day scheduled for a problem set due date, it will be due on the first day the Institute opens again. Check the GT web pages and class announcements on Canvas for information.

Campus Resources for Students

Undergraduate Student Academic Success Resources:

A list of resources for undergraduate students' academic success and information about advising can be found at Success at Tech.

- Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being (student-resource-guide (gatech.edu)