ASTR/PHY 322: High-Energy Astrophysics

Lehigh University, Fall 2020

Instructor: Timm Wrase, Lewis Lab 418, see me in person by email appointment
timm.wrase@lehigh.edu (for example to discuss your term paper)
Office hours: I am available for virtual meetings after class and Thursdays from 2-3pm
Class time and place: Monday, Wednesday and Friday 1:35-2:25pm, Zoom link

Textbook: Rosswog and Brüggen *Introduction to High-Energy Astrophysics*

General course requirements:

- Read the relevant chapters in the book before or after each class.
- Attend all classes.
- Complete all assignments on time.
- See me if you are having trouble or any questions, concerns or comments about the course!

Overview: This course will provide an introduction to high-energy astrophysics, a research area that dramatically improved the understanding of our universe in the last decades. In particular, we plan to cover the following topics: white dwarfs, neutron stars, black holes, supernovae, binary systems, neutrinos, accretion disks, special and general relativity, cosmic rays, radiative processes, nuclear fusion, gamma ray bursts and active galactic nuclei.

Homework: Homework will be assigned each Friday and is due the following Friday on CourseSite. You may work together on the homework, but please make sure that you are able to complete the problems on your own. The work turned in must be your own. Your lowest homework score will be dropped.

Term Paper: Based on at least one published paper from the last 5 years, you will write a 6-12 pages term paper. Details and further guidelines are posted on CourseSite. We will have brief individual meetings to discuss your favorite topics on 09/02 and 09/16 during class hours.

Exams: The course will have two midterm exams: one on Monday 9/28/2020 and one on Monday 11/02/2020. The final exam date will be decided later in the semester by the registrar's office. The final will be comprehensive and will consist of three sections.

Grading: The final grades in the course will be based on homework (25%), term paper (15%), midterms (15% each) and the final exam (30%).

Initial Competencies: Students should have a basic knowledge of special relativity, quantum mechanics and multivariate calculus.

Final Competencies:

- Students understand how special and general relativity effect what we observe in the universe today.
- Students will know the methods and observing techniques to study high-energy emission.
- Students can explain the basic physical processes involving high energy particles and/or creating high energy emission.
- Students will demonstrate an understanding of the basic physics in accretion processes observed for a variety of sources.
- Students will have insight into current high-energy astrophysics research.

eLearning with Zoom: To meet the challenge of teaching and learning during the COVID-19 pandemic, Lehigh instructors and students will be adopting new forms of instruction and interaction; following new guidelines around classroom behaviors; and doing our best to be patient, flexible, and accommodating with each other. In remote synchronous meetings, students are expected to attend just as they would any other Lehigh class. Zoom classes work best when all students come to class ready to participate and *have their webcam turned on*. If you have a strong preference not to do so, please let me know. Students should respect the in-classroom privacy by not taking screenshots or recording class sessions. I will record our Zoom sessions; however, any recorded live sessions will be shared only with students in the class and will be deleted at the end of the semester.

Accommodations for Students with Disabilities: Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at https://studentaffairs.lehigh.edu/disabilities.

The Principles of Our Equitable Community: Lehigh University endorses The Principles of Our Equitable Community. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Important Dates:

09/02/2020: Individual, informal term paper topic discussion (no regular class)

09/04/2020: HW1 due

09/07/2020: Labor Day, no class

09/11/2020: HW2 due

09/16/2020: Individual, informal term paper topic discussion (no regular class)

09/18/2020: HW3 due

09/25/2020: HW4 due

09/28/2020: Midterm I

10/02/2020: HW5 due

10/09/2020: HW6 due

10/16/2020: HW7 due and term paper abstract due

10/23/2020: HW8 due

10/30/2020: HW9 due

11/02/2020: Midterm II

11/06/2020: HW10 due

11/13/2020: HW11 due

11/20/2020: HW12 due

11/23/2020-11/27/20: Pacing break and Thanksgiving break, no class

12/04/2020: HW13 due and term paper due

12/??/2020: Final Exam (date to be determined by registrar office)