

Course: Special Topics in Physics. Introduction to Modern Astrophysics

Code: PHYS 4041

Number of Credits: 3

Prerequisites: PHYS 4046, 4062

Instructor: J. Ponce de Leon

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Class period: Monday and Wednesday, 10:00-11:20, room C-312

Office hours: Monday and Wednesday, 11:30- 12:50; 2:30- 5:00 or by appointment

Description

This course serves as an overview of basic astrophysical techniques. The goal is to provide the broad physical foundations (classical and relativistic mechanics, radiation, thermodynamics, quantum physics) used in modern astronomy and astrophysics. Among the topics covered are: Newtonian Celestial mechanics, Blackbody Radiation, Special Relativity, Physics of Stars, White Dwarfs, Neutron Stars, Black Holes, Cosmology, Models of The Universe.

Objectives

After completing this course the student will be familiar with a broad range of astrophysical phenomena and some of the mathematical physics applied to them. The student will have the basic tools to start a directed research program in astrophysics.

Course Content

1. Newtonian Celestial mechanics.
2. Kepler's Laws Derived.
3. The Virial Theorem.
4. The Rocket equation.
6. Blackbody Radiation.
7. Plank's Function for the Blackbody Radiation Curve.
8. The Plank Function and Astrophysics.
9. Special Relativity. Derivation of the Lorentz transformations.
10. Proper Time and Time Dilation. Proper Length and Length Contraction.
11. The Relativistic Doppler Shift.
12. Relativistic Velocity Transformation.
13. Relativistic Momentum and Energy.
14. The Interior of Stars. Derivation of the Hydrostatic Equilibrium Equation.
15. Pressure Equation of State.
16. Stellar Energy Sources.
17. Stellar Model Building. White Dwarfs, Neutron Stars, Black Holes.
18. The Structure of the Universe. Galaxies. Dark Matter.
19. The expansion of the Universe. Newtonian Cosmology. Relativistic Cosmology.
20. Models of The Universe.

21. The Very Early Universe and Inflation.
22. Late Accelerated Expansion and Dark Energy.

Grading

- The grading is based on four exams, each of which has a weight of 25% of the final grade. They will be based on examples done in class, suggested problems, and exercises given through the course.

- The first three exams will be during the time of class on September 27, October 29, and November 28. The date of the final exam is suggested by the registrar.

- The overall score is determined by calculating the percentage of points obtained by the student. Grades are then assigned according to the standard curve: 100-90 % = A, 89-80 % = B, 79-70 % = C, 69-60 % = D, 59-0 % = F.

Bibliography

An Introduction to Modern Astrophysics (2th Edition), by Bradley W. Carrol and Dale A. Ostle, Publisher: Addison-Wesley; 2 edition (October 6, 2007).

Rights of Students with Disabilities

The University of Puerto Rico complies with all federal and state laws and regulations regarding discrimination, including The American Disabilities Act (ADA law) and Law 51 of the Commonwealth of Puerto Rico. Students that receive services from the Vocational Rehabilitation Office should communicate with the professor at the beginning of the semester to discuss any academic accommodation and equipment he (she) needs in accordance to the recommendations from the Office of Disable persons affairs (OAPI) from the Student Dean Office. Other students that need assistance or accommodations should communicate with the professor.