ASTRONOMY

In the Department of Physics and Astronomy

Associate Professors Dale Kocevski and Elizabeth McGrath; Laboratory Instructor I Michaela Allen

Astronomy is one of the oldest sciences and deals primarily with developing an understanding of our origins on a cosmic scale. Students interested in graduate study in astronomy should complete the physics major with a concentration in astrophysics and should strongly consider doing an honors project and thesis. They are also encouraged to pursue summer research with faculty before the start of their senior year. Colby physics majors who have taken Astronomy 231 and 342 and completed a research project in astronomy have always been admitted into graduate programs in astronomy or astrophysics. Students in any major discipline who are interested in a more general exposure to astronomy should consider the astronomy minor.

The physics major with a concentration in astrophysics is described in the “Physics” section of the catalogue.

Requirements for the Minor in Astronomy

No requirements for the astronomy minor may be taken satisfactory/unsatisfactory. The grade point average for the astronomy minor is calculated using all courses that can satisfy the requirements listed below.

Students must take either Astronomy 151 or 172 and the following required courses:

Astronomy

• 231 Introduction to Astrophysics
• 342 Galaxies and Cosmology

Physics

• 141 Foundations of Mechanics (or 143 Honors Physics)
• 145 Foundations of Electromagnetism and Optics

Mathematics

• 120, 121, 125, or 130 Single-Variable Calculus (or Honors Calculus I, 135 or 161)

Note: Students cannot fulfill the astronomy minor if electing to major or minor in physics. Physics majors interested in astronomy should consider the astrophysics concentration.

Course Offerings

AS151s Stars, Stellar Systems, and Cosmology  An introductory survey of modern astronomy—covering the solar system, stars and stellar evolution; galaxies; and cosmology—for students of both science and non-science backgrounds. The physical processes at work in the universe and the methods we use to learn about the universe will be emphasized. The use of mathematics at the level of first-year algebra is required. Fulfills the non-lab science requirement unless optional (one-credit) lab selected. Three or four credit hours. N. MCGRATH

AS172fs Extraterrestrial Life  Is Earth home to the only living organisms in the universe or should we expect life elsewhere? If extraterrestrial civilizations do exist, can we expect to make contact with them? We will focus on the clues to understanding the origins of life on Earth and its possible distribution throughout the cosmos. By the end of the course, you should be able to answer the following questions: How did Earth and the solar system form? Why is Earth habitable, but Venus and Mars are not? Are there other worlds that might support life? How many advanced civilizations might exist in our galaxy? Three credit hours. N. KOCEVSKI

AS231f Introduction to Astrophysics  A general introduction based on topics needed for astrophysical research, accessible to all who are comfortable with calculus and computer analysis of data. Topics include celestial mechanics, thermal radiation, spectral line creation, radiative transfer, star formation, nucleosynthesis, stellar evolution, galaxy structure, and cosmology. Weekly labs alternate between afternoon and night. Students must be available Monday through Thursday evenings for five required observing labs held on clear nights to be selected by the instructor. Lecture and laboratory. Prerequisite: A working knowledge of introductory college-level physics and calculus, or concurrent enrollment in Physics 141 or 143. Four credit hours. N, Lb. ALLEN, MCGRATH

AS262f Data Science in Astrophysics  Focuses on the mathematical and statistical analysis of large astronomical datasets using the tools of data science and data analytics. Emphasis will be placed on data mining, machine learning, big data analytics, and knowledge discovery techniques in astrophysics. Students will learn about statistical uncertainty, model fitting, machine learning algorithms, and data
visualization. Prerequisite: Astronomy 231. Four credit hours. KOCEVSKI

**AS335f General Relativity and Cosmology** Listed as Physics 335. Four credit hours. BLUHM

**AS342s Galaxies and Cosmology** How did the universe as we observe it today come into existence? The physics behind the birth of the universe and its evolution over cosmic time, and an introduction to modern extragalactic astronomy and cosmology, i.e., the part of astrophysics that deals with the structure and evolution of the universe as a whole and its major constituents: dark matter, dark energy, galaxies, black holes, and large-scale structures. Topics include the Big Bang theory, composition of the universe, dark matter and dark energy, cosmic nucleosynthesis, and the formation and evolution of galaxies. Prerequisite: Physics 141 (or 143) and 145. Four credit hours. KOCEVSKI

**AS491f, 492s Independent Study** Individual topics or research in areas where the student has demonstrated the interest and competence necessary for independent work. Prerequisite: Permission of the instructor. One to four credit hours. FACULTY