ASTROPHYSICAL SCIENCES 204 – SPRING 2016

"Topics in Modern Astronomy"

I. Instructors

Professor

Prof. Eve Ostriker
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Office hours: M W 4:30-5:30 or by appt.

Teaching Assistants

Justin Ripley
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Tu, Th 3-4 (or by appt.)

II. Class Meetings

Lectures M W 3:00pm - 4:20pm, Peyton 145 (Auditorium)

Problem-solving session M 7:30pm-8:30pm, Peyton 145 (Auditorium)

The two weekly lectures provide an overview of the topics covered this semester, and also a forum for general questions on the material. Many of the topics in the lectures will also be covered in the assigned readings from the textbook, but some material from lectures may not be in the textbook, and vice versa. Students are expected to attend the lectures and will be responsible for all the material covered in class.

There are no formal precepts for this course, but the TAs will hold problem-solving sessions before HWs are due, and review sessions before the midterm and final exams.

III. Textbooks

The required and recommended textbooks are on reserve in Lewis Library, and also available on the course reserve shelf in Peyton "Grand Central" (for use only in the building).

Required: *Foundations of Astrophysics*, by Barbara Ryden and Bradley Peterson. Published by Addison Wesley, ISBN 978-0-321-59558-4

Recommended: *An Introduction to Modern Astrophysics*, by Bradley Carroll and Dale Ostlie. Published by Pearson Education, ISBN 0-8053-0402-9

IV. Course Pre-requisites

This course is intended for students who are concentrating in science, mathematics, or engineering. To take this course, you should have previously completed PHY 103 or 105, and MAT 104. With permission of the instructor, however, some prerequisites may be waived based on comparable prior preparation in physics and mathematics. If you have questions about your background, please see the professor.

V. Course Grading and Policies

Problem sets	35%
In-class exercises	5%
Midterm exam	20%
Final exam	40%

Homework will be assigned approximately once per week, due the following week, and must be turned in at the *beginning of class*. Homework may not be turned in by email. If the University is officially closed on the due date for an assignment, the due date will be moved to the next lecture.

If a student has a planned absence for an academic or other reason (including religious holidays), homeworks must be handed in before the due date by the student, or brought to class on the due date on behalf of the absent student. In the case of absence due to illness on the date a homework assigment is due, it must be handed in as soon as the student returns to class. Following any absences, students are responsible for obtaining class notes and any new assigments.

Late homeworks will not be accepted, except in the case of illness. The lowest homework score will be dropped from the overall HW average, however.

Students who are unable to attend an exam due to illness must contact the instructor *before the scheduled time of the exam*, and supply documentation from the Health Center. At the discretion of the instructor, students who miss an exam due to illness must take either a written or oral make-up exam.

VI. Academic Integrity

University rules regarding academic integrity and the Honor System apply to all work in this course. As a part of these rules, you must give credit to any book, article, or web page that you use in completing homework assignments. These rules also apply to unpublished sources of information. Students are encouraged to discuss assignments and other class material with each other, but as for other courses, copying or paraphrasing from other students' written solutions is not permitted.

VII. Online Materials

Materials for the course, including HW assignments and lecture notes, will be available in Blackboard.

VIII. Course Outline (tentative)

M Feb. 1 – Introduction to class; preview of topics

W Feb. 3 – Earth in space; early history of astronomy (RP 1, 2)

M Feb. 8 – Orbital motion: Kepler's Laws from Newton's Laws (RP 3)

W Feb. 10 – Earth and Moon; tides; Roche/Hill limits; physical properties (RP 4, 9)

M Feb. 15 – More on orbits; Restricted three-body problem; Lagrange points (RP 3)

W Feb. 17 – The Solar System: terrestrial planets, gas giants (RP 10)

M Feb. 22 – Solar System small bodies; exoplanet detection and properties (RP 11, 12)

W Feb. 24 – Electromagnetic radiation: thermal blackbodies, spectral lines, Kirchoff's laws, atomic structure, emission and absorption, Doppler effect (RP 5)

M Feb. 29 – Radiation, cont.

W Mar. 2 – Telescopes: limits on resolution, optical, radio, and other types of telescopes, detectors, atmospheric windows (RP 6)

M Mar. 7 – Stars: general properties and observations (RP 13)

W Mar. 9 – *Midterm exam*

SPRING BREAK – Mar. 12-20

M Mar. 21 – Solar and stellar atmospheres; spectral classification; Hertzsprung-Russell diagram (RP 7.1, 7.2, 14)

W Mar. 23 – Stellar atmospheres, cont.

M Mar. 28 – Stellar interiors: concepts and equations of stellar structure; hydrostatic equilibrium, radiation transport, convection, fusion; tests of stellar models (RP 15)

W Mar. 30 – Stellar evolution and death (RP 17.2, 18.4)

M Apr. 4 – Compact objects: white dwarfs, neutron stars, black holes (RP 18.1, 18.2, 18.3)

W Apr. 6 – The interstellar medium: gas and dust properties and physics; formation of stars and planets (RP 8.3, 16, 17.1)

M Apr. 11 – The Milky Way: a spiral galaxy prototype (RP 19)

W Apr. 13 – The Milky Way, cont.

M Apr. 18 – The zoo of galaxies; galaxy clusters; dark matter (RP 20, 22)

W Apr. 20 – Active galaxies: supermassive black holes and accretion physics (RP 21)

M Apr. 25 – Cosmology: Cosmology: principles of cosmology, expansion of matter-dominated Universe, critical density, generalized Friedmann equation, curvature of space, cosmological constant, cosmic scale factor and redshift, cosmic epochs, expansion history/thermal history (RP 23)

W April 27 – Cosmology: cosmic background radiation, surface of last scattering, measurements of cosmic parameters, geometry of spacetime, dark matter & dark energy, accelerating expansion, inflation, nucleosynthesis, cosmic structure formation (RP 24)

May 2 - May 10 – *Reading Period*

IX. Course Description

This course provides a broad overview of modern astronomy and astrophysics for students in the sciences. Emphasis is on the application of basic physics to understanding of astronomical systems. Topics include the Solar System; planetary systems and exoplanets; the birth, life, and death of stars; white dwarfs, neutron stars, and black holes; the Milky Way and distant galaxies; cosmology, dark matter and dark energy, and the history of the Universe.

This course satisfies the STN General Education requirement.