ASTR 451: Introduction to Astrophysics

Fall 2007, TR 9:30-10:45, Astr 265

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Office Hours: T 2-3pm, W 1-2pm, or by appt.

This is a survey course intended for physics and astrophysics majors. It will be a fairly rigorous treatment of many topics, and will presume some physics background at the level of a fourth-year student. Given possible diverse backgrounds, we can refresh/review some of the relevant background concepts in class or with handouts as necessary. Some introduction to astronomy would be helpful, but is not essential. Please let me know when I've made an incorrect assumption about what background material is familiar or not.

Grading: Grades will be based 100% on problem sets. They will be handed out about once every other week and you will have roughly two weeks to complete the assignment. Late problem sets will be penalized at a rate of 10% per day. There will be no other grades such as exams or quizzes.

Problem Set schedule:

	Handout	Due
#1	Aug 30	Sep 13
#2	Sep 20	Oct 04
#3	Oct 11	Oct 25
#4	Nov 01	Nov 15
#5	Nov 29	Dec 13

Syllabus: The following is a planned course outline. It is flexible to some extent and we may deviate. If you would like to cover a topic not listed below, I would be happy to discuss what you have in mind.

1. Theory of Emission Nebulae
   (a) Thermal Equilibrium.
   (b) Emission and Absorption Processes; Einstein A & B coefficients.
   (c) Radiative Transfer.
   (d) Galactic H II regions, Planetary Nebulae, and Supernova Remnants.
   (e) Other Emission Mechanisms.
2. Stellar Structure and Evolution
   (a) H-R Diagram.
   (b) Main Sequence Structure and Evolution.
   (c) Late Evolutionary Phases.
   (d) The Solar Neutrino Problem.
3. Physics and Emission Properties of Compact Objects.
   (a) White Dwarfs.
   (b) Neutron Stars.
   (c) Black Holes, X-ray Binaries, and Accretion Disks.
4. Cosmology.
   (a) Dark Matter in the Universe.
   (b) Friedmann Cosmologies; Hubble Flow.
   (c) Large Scale Structure and Galaxy Formation.
   (d) Physics of the Very Early Universe; Nucleosynthesis.
   (e) $\Omega = 1$? Inflationary Models.

Colloquia Etc.: To see these topics in action, I recommend coming to the Joint Astronomy Department/NRAO talks that are usually held on Thursday from 4-5pm at the NRAO (located past Slaughter Rec Center). These talks are given by visiting astronomers about recent results on a wide variety of phenomena. The schedule can be found online at http://www.cv.nrao.edu/colloq/. The Physics department typically has one or two astronomy related talks a semester; those are Friday at 4-5pm. [As an added incentive, coffee and goodies are also available at both these.]

Required Text: None. Material will be presented in class lectures, and outside references cited if necessary. Some additional material may be handed out in class occasionally. Coming to class and seeing me when there is a difficulty is certainly the best strategy.

Recommended Texts: Several, some general and some good for a specific topic. If you have had other astronomy courses you may have already seen some of these (or own them). These are the standard and much revered astronomy texts. However, there is no need to rush out and buy these.

General texts: (These are on reserve in the astronomy library.)

HARWIT: *Astrophysical Concepts*

RYBICKI and LIGHTMAN: *Radiative Processes in Astrophysics*

SHU: *The Physical Universe*

SHU: *The Physics of Astrophysics: Vol. I Radiative Processes*

SHU: *The Physics of Astrophysics: Vol. II Gas Dynamics*

Specific topic texts: (In stacks at astronomy, physics, or sci-eng libraries)

BINNEY and TREMAINE: *Galactic Dynamics*

MIHALAS: *Stellar Atmospheres*

OSTERBROCK: *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei*

PEEBLES: *Principles of Physical Cosmology*

SCHWARZSCHILD: *Structure and Evolution of the Stars*

SHAPIRO and TEUKOLSKY: *Black Holes, White Dwarfs, and Neutron Stars*

SPITZER: *Physical Processes in the Interstellar Medium*

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