ASTR 1040 Accel Intro Astronomy 2: Stars & Galaxies
Spring 2006
Prof. Juri Toomre
TAs: Ben Brown & Adam Jensen
TR 11am, Duane G131 + M recitations
Lecture 1 17 Jan 06
Detailed course syllabus now being passed out
zeus.colorado.edu/astr1040-toomre

Who should take this course?
Prerequisites:
1030 + calculus
Moderate amounts of
quantitative work
(algebra + physics)

Course Information
COURSE WEB PAGE:
zeus.colorado.edu/astr1040-toomre
Can find info on all assignments
(passed out in class), course calendar, lecture notes, and other links
Grading is shown on WebCT

Required Text
The Cosmic Perspective
by Bennett et al., 2003, 3rd ed
(or 4th ed, 2006)
Includes:
Access to textbook website
www.astronomyplace.com
You will need your own
‘astronomyplace’ account!
Most homeworks require it

How to succeed in this course
• GOT TO PUT IN THE TIME:
  4 credits at CU →
  6 to 10 hours outside of classroom (no kidding)

• Read sections BEFORE
  discussion in class
  (secrets of memory)

• Come see us during office hours!

Planetarium sessions
• Three class meetings will be at
  Fiske Planetarium on campus
Observatory Nights

- Starting this Thur 19 Jan at 7pm, then about every 2 weeks (6 in all) – signup for two nights, one in group A, another in B
- Sommers-Bausch Observatory (next to Fiske): 16", 18", 24" telescopes

Read all course information in your syllabus handout (after class)!

Three in-class mid-term exams (m/c, short essay, quantitative analysis): 45%
Homework + observing assignments: 20%
Final exam: 25%
Clickers + discussion contributions: 10%

There are no make-up exams or late turn-ins

Clickers

- Required -- bring to each class!
- Register clicker to your name using instructions on syllabus
- Used for reading quizzes, in-class discussion questions, feedback

More on clickers

- Credit starts next week
- Graded 100% for correct answer, 50% for any answer
- Your grades available online weekly (WebCT)
- Register by next class! If you're using an old clicker, change the batteries NOW!

Important classroom policies

- Working together on homework is encouraged, BUT:
- Your answers must be in your own words -- exact copies will be awarded split credit
- Note sources and whom you worked with on homeworks
- Using another person's clicker is cheating
- Students are expected to follow the CU Honor Code and behave with courtesy to the instructors and their classmates

Beginning of Today’s Class

- Course goals
- Course overview
- Course information
- Introduction: Sizes and Scales
Course Goals
Develop a broad view of what we know about the universe
Understand the forces that shape the universe and its history
Help you understand how we can figure all this out
Appreciate the beauty and richness of what goes on

Course Overview: What we shall study
• Vast range of SIZES and SCALES: finding our way through the universe

Light (Electromagnetic Radiation)
• What is light?
• How do we use it to find out what and where things are?
• Waves vs particles

Telescopes (Tools of the Trade)

Our Nearest Star: The Sun

STARS of very many sizes and colors
Evolution path and color/brightness depends on MASS
STELLAR Birth and Life

STAR DEATH: white dwarfs, neutron stars and black holes

OUR GALAXY: The Milky Way

Exploring a Universe of GALAXIES

GALACTIC evolution

Dark matter, dark energy and fate of universe
**Specific Topics for Today + Thur**

- Nature of astronomy as a science
- Scientific method: we observe, hypothesize, test its predictions, maybe fix it and try again
- Light as waves
- Special colors of light associated with each element
- *Homework 1 passed out today*

**Homework Set 1**

- **Part A** involves going to book website, after login ‘joining our class’ (cm183951 as in syllabus), doing the ‘Light & Spectroscopy’ tutorial in Chap 6 while having your performance e-recorded (can repeat as often as wish). Complete by Thur 26 Jan.

- **Part B** involves completing the ‘Energy Level Diagrams & Spectral Lines’ problem sheet passed out in class today. Due next Thur in class, no lates.

**For next class meeting, read:**

*How to Succeed in this course*, p. xxvi
- Chapter 1, all (Our Place in Universe)
- Review Basic Astronomical terms, p. 4
- Chapter 2, review all (Motion of Stars, Seasons)
- Chap 3, sec 3.5 (Nature of Science)
- First read all of Chap 4 (Matter and Energy)
- Begin reading Chap 6 (Light)

- You can get a copy of these slides after class from course website (can be helpful)
FOUR TYPES OF FORCES IN NATURE

1. GRAVITY
   - weakest, but dominates universe

2. ELECTROMAGNETIC
   -  (Em)

3. STRONG NUCLEAR
   - short range, excludes EM

4. WEAK NUCLEAR
   - 1/3000 EM, only in atomic nuclei

ELECTROMAGNETIC RADIATION

(used for most deductions)

ACT BOTH LIKE

WAVES AND PARTICLES

PHOTONS

(quanta – particles of light)

ELECTROMAGNETIC PROPERTIES

OF WAVES

Waves:

\[ a \times \lambda = c \]

\[ \lambda \times f = c \]

\[ \lambda \times f = \text{Speed} \]

\[ \text{Wavelength} \times \text{Frequency} = \text{Speed} \]

Same for all wavelengths

E-M (LIGHT) AS WAVES

\[ \lambda \times f = c \]

Speed of light

SAME for all wavelengths

E-M SPECTRUM

Quantum Mechanics

(energy of photons varies)

\[ E = hf \]

\[ h \times f \]

\[ \text{higher frequencies} \rightarrow \text{more energy} \]

\[ (\text{UV} \rightarrow \text{X-rays} \rightarrow \text{gamma rays}) \]