AST 301 Fall 2009 Scalo
Review and sample questions for exam 2

The exam is on Wednesday, Sept. 23. It covers sec. 3.5 (Doppler), ch. 4 (Spectroscopy), and ch. 5 (Telescopes).

Ch. 4 is probably the most difficult to understand because it is nearly pure physics, so try to always keep in mind why all these things are relevant to astronomical observations.

In Ch. 5, besides the ideas, I would like you to know something about the following famous telescopes (I have randomized their order)—you should know what wavelength region they are used for, if they are ground-based or space-based, and what might be unique or different about them. They are:
Hubble Space Telescope, Keck, Arecibo, VLT, VLA, VLBI, IRAS, Chandra, Spitzer.

We will talk about some of these in class, but basically I want you to know which of these are in orbit and why, which have the best resolution, what wavelength range each telescope is designed to observe (not numerically, just e.g. "infrared.")

Crucial terms that you should be comfortable with (means: be able to explain to someone) include: **redshift and blueshift, excited state, ionization, absorption and emission lines, thermal broadening, rotational broadening, resolution, seeing limit, scintillation, diffraction limit, interferometer, adaptive optics, CCD.** *Of course there are more, but if you can explain these without consulting the book or notes, you are probably prepared.*

You know what to study and which end-of-chapter and web site questions to try from the reading guide ("Guide to Reading and Study"; web site questions are on a pdf you should already have downloaded for exam 1; if not, download from web site), and what will be emphasized from the lectures, so I will just give you these sample questions as a review for the 2nd exam. If you can answer them without much trouble AFTER you have studied completely, you are ready. If not, study more. (I have tried to make these typical of more difficult questions on the exam.)

It would be a good idea to see whether you can explain most of the bold-faced words in each chapter summary in everyday language, as well as the most important of these listed above, and to note whether you are only repeating something you memorized.

Julie will have office hours on Tuesday afternoon, and I will be in but only about 3-4. It might seem like a problem, but I think it is much easier if you can call me on the phone to discuss the material any time between 9am and 9pm Monday or Tuesday. Please feel free to call me at home (478-2748—this is usually the easiest procedure)—it is no bother. If I'm not at home, leave a message but please pronounce your name and phone number clearly and slowly—I'll return the call just as soon as I can. I'd be glad to answer questions or try to review some material with you that way instead of at office hours.

Finally, don't forget to try 1. The end of chapter questions listed on the "reading and study guide" handout; 2. The textbook website questions listed on the same handout (link through course web site); 3. The homework problems I will send you on Friday; 4. The sample questions below. Many of these will appear on the exam.

Sample questions—A suggestion: Try #10 with other pairs of telescopes named above:

1. You observe a certain spectral line of the element sodium in two different stars, labeled A and B. The wavelength of the spectral line should be at 6000 Angstroms (.00006 cm.), but the measured wavelengths are 5999 Angstroms for star A and 5998 Angstroms for star B. Which of the following is true?
a) Star A is approaching, star B is receding.
b) Star A is receding, star B is approaching.
c) Both A and B are approaching the Earth, but B is approaching at a higher speed.
d) Both A and B are receding from the Earth, but B is receding at a higher speed.

2. In an atom, say hydrogen, what does a higher orbital have that a lower orbital has less of?
a) electrons b) protons c) neutrons d) energy.

3. What physical effect causes the transitions that give rise to emission lines?
a) Doppler effect b) collisions c) turbulence d) absorption of photons

4. What is emitted from an atom when one of its electrons makes a transition from a lower energy state to a higher energy state?
a) proton b) photon c) electron d) nothing

5. A spectral emission line is observed in the radio part of the spectrum. Which is probably true of the source of emission?
a) It is emission from a rotational transition of a molecule.
b) It is emission from a vibrational transition of a molecule.
c) It is emission from an electronic transition of a molecule.
d) The source of emission must be a star much hotter than the sun.

6. You observe an unusual star whose spectrum exhibits strong absorption lines due to hydrogen atoms. Which of the following is true of this star? (If you know the answer to this rather subtle question without reviewing further, I predict you will get a very high grade on the exam.)
a) It is red in color.
b) It must have a large abundance of element hydrogen compared to other stars.
c) This star has no molecules in its atmosphere.
d) This star must be rotating much more rapidly than the sun.

7. What problem is adaptive optics used to correct?
a) the blocking of light by molecules in the Earth's atmosphere
b) defects in the optics of the telescope
c) slight errors in the telescope's mount to compensate for the Earth's rotation
d) effects of atmospheric turbulence
e) reduce the amount of background noise in a CCD

8. One reason radio telescopes have to be large is that (careful!)
a) they can then obtain good resolution by improving the seeing limit.
b) radio waves do not reflect from surfaces the way optical (visual) light does.
c) the Earth's atmosphere blocks out so much radio radiation.
d) the amount of radio energy reaching the earth from astronomical sources is very small compared to the energy at other wavelengths.

9. A 2-m telescope can collect a given amount of light in 1 hour. Under the same observation conditions, how much time would be required for a 4-m telescope to perform the same task?
a. 15 minutes. b. 30 minutes. c. 2 hours. d. 8 hours. e. none of the above

10. What is a major difference between the VLA and VLT telescopes?
a. VLA is an interferometer, VLT is not. b. VLA operates in the optical, VLT in the ultraviolet.
c. VLA is in space, VLT is on the ground. d. VLA aims for faint objects, VLT for high resolution.