AST 301-Scalo
Review sheet for exam #6

This exam covers chapters 22, 23, and 24.
Ch. 22--Study it all, except: Don't worry about "More Precisely 22-2.
Ch. 23: Omit: The historical discussion of "Discovery 23-1; Sec. 23.5 Galactic Spiral Arms (617-622); and Sec. 23.7, The Galactic Center)
Ch. 24: Try reading More Precisely 24-1, but I won't test you directly on that material. Omit sections 24.4 (Active Galactic Nuclei), and 24.5 (The Central Engine of an Active Galaxy).

The exam will be long, with about 40-45 questions.

I strongly recommend that you try all the Review and Discussion, and True-False/Multiple Choice questions at the end of each chapter; they are nearly all good ones, at the level that will be typical on the exam. (But not numerical problems.) In fact I will, as usual, take a few of the exam questions from the end-of-chapter and online questions.

As with Chapter 21 on the last exam, a good way to review Chapter 22 is to try to "tell the story" of the evolution of stars of different masses, this time starting with the red giant phase, when the helium has burned to carbon in the core, making sure you can explain all the events that occur after that. Each time you use some new terminology, e.g. "neutron degenerate core," try to explain what you mean, as if you were explaining this to someone with no background.

Most of Chapter 23 is concerned with how difficult it was to discover what kind of structure we live in (a galaxy, with a disk and a bulge and a halo). You should be able to explain how finding the distances to certain types of objects were the key to being able to get a picture of the galaxy we live in. You should know (roughly) the size of our galaxy (in parsecs), how far the Sun is from the Galactic Center, and the thickness of the galactic disk. Try to explain how the ages of the halo objects are known, and the ages of disk objects; how does this lead to a picture for how our Galaxy formed? Explain how the metal abundances in globular clusters are a crucial key.

There is a very basic theme running through all the material in Chapters 23 and 24: A lot of it is about learning to get distances to more and more distant objects so that we can map the structure of our own Galaxy (chapter 23) and the large-scale structure of the universe (starting with 24 and continuing in 25 on the next exam). In our Galaxy the use of these "standard candles" allows us to see the disk-halo structure and the presence of spiral arms; RR Lyrae variables give us the globular clusters in the halo and the resulting information about the evolution of our galaxy, Cepheid variables the distances to the nearest galaxies, then supernovae, the Tully-Fisher relation, and the Hubble relation to learn about the large-scale universe. The Hubble relation is especially important, since it tells us something very important about the history of the universe and allows us to map the most distant galaxies. Try to explain how each of these standard candles is used and what we learn from it—that would be a good way to review much of this material.

Here are some sample questions to see if you are prepared to take the exam. As usual, most of these tend to be a little more difficult than the average exam question.

1. What type of object were millisecond pulsars likely to have been before becoming what they are presently?
a. single pulsars b. novae c. x-ray bursters d. gamma ray bursters

[over]

2. The masses of neutron stars
a. must be at least 8 solar masses. b. must be at least 1.4 solar masses.
c. are only known for those neutron stars in binary systems.
d. are only known for neutron stars that are also white dwarfs.
3. Why did it take until recently to realize that gamma ray bursts are extremely far away?
a. Previous gamma-ray telescopes were not sensitive enough.
b. Their spectroscopic parallax could not be measured because their luminosity was unknown.
c. Only recently were "afterglows" observed that allowed the distances to be estimated using spectral lines.
d. Gamma ray stars, that correspond to the gamma ray bursters, have only recently been discovered.
4. The major question in understanding gamma ray bursts has been
a. why their periods are so short b. why their light curves are so similar to each other
c. why the energy comes out as gamma rays d. the source of energy required to power them
e. why they are so far away
5. For an object falling into a black hole, which of the following would be seen by a distant observer?
a. The object would get brighter the closer it got to the black hole.
b. Time would speed up as it got closer to the black hole.
c. Light emitted by the object would increasingly redshift as it got closer to the black hole.
d. The object would begin to flicker, giving a method for estimating the size of the event horizon.
6. The key to identifying a black hole candidate, rather than some other type of stellar remnant, in a binary star system is the following.
a) one of the two stars cannot be seen
b) the unseen companion in the system must have a sufficiently high mass
c) the system must be a strong source of x-ray emission.
d) the seen companion must be an evolving main sequence or giant star
e) there must be evidence for a very hot accretion disk.
7. What type of radiation is most useful in the mapping of the Galactic structure?
a. dust emission b. visible light c. radio spectral lines d. infrared spectral lines
8. What two observations of objects allow for a determination of the Milky Way's mass?
a) mass and velocity. b) age and distance from the galactic center.
c) mass and age. d) velocity and distance from the galactic center.
9. Which of the following gives an estimate of the age of our Galaxy?
a. Cepheid variables b. globular clusters c. spiral arms d. observations of hydrogen gas
10. Which type of galaxy is the most numerous in the Local Group?
a. giant elliptical b. spiral galaxies c. dwarf irregular and elliptical galaxies
11. What observation is used in the Tully-Fisher relationship to determine distances?
a. the maximum brightness of supernovae b. Cepheid light curves
c. recessional velocity d. neutral hydrogen gas 21-cm line broadenin
12. Using the Hubble relation, what single observation is needed of a galaxy in order to determine its distance?
a) luminosity b) line broadening c) mass d) spectrum