AST 301 Fall 2007
Review for Exam 3

This exam covers only chapters 6 and 15, the solar system and its formation, NOT chapter 16 (the Sun), which we don't have time to cover in class and so will postpone. Suggested end-of-chapter and online questions were sent to you by email and are available at the class website.

Chapter 6: There are a few basic things like being able to name the planets in order of distance from the Sun, listing (in clear language) the regularities concerning planetary orbits and rotations, as well as the exceptions. I think a good preparation would be to pretend you are giving some friends a verbal tour of the solar system. Tell them as much as you can about the two classes of planets (be specific—e.g. what properties are different? And explain any "technical" terms!). Tell whatever you know about each planet, the nature of asteroids, comets, meteors,… and how they probably got to be where they are (e.g. did you remember to tell your visitor that most comets spend most of their time very far from the sun? Make sure you imagine being asked why this is so and how we know it—can you give a reasonable answer? Did you mention the "Oort cloud?")

Remember that you don't have to know anything about the various space missions discussed in this chapter.

Chapter 15: This chapter is continuous with Chapter 6 because it is concerned with developing a theoretical model that can explain most of the features of our solar system that we read about in Chapter 6. I suggest you try testing your understanding of the material by telling a friend (imaginary or not) a narrative that begins with the collapse of a big gas cloud under its own gravity and ends up with the solar system as it is today, filling in all the intermediate steps and the explaining the physical processes that are thought to be responsible for these steps. Why was temperature so important? Why was rotation so important? Why was the small fraction of material in the original cloud that was in the form of microscopic dust grains probably crucial to the formation of the planets? What are "planetesimals" and how did they form? Can you name a few lines of evidence that they once did exist? Explain clearly why the terrestrial and jovian planets have such different properties in terms of the theory described in this chapter.

The section on the discovery of extrasolar planets is one of the most exciting and evolving areas in astronomy at this time, so I want to make sure you study that well. I will NOT test you on the method of gravitational lensing, but read about it if interested. Make sure you understand that there are several techniques that can be used to detect extrasolar planets (name them, explain them), but basically only one of them has been successful, so far, in detecting large numbers of extrasolar planets. Can you explain why that is? What do you learn from this technique? What could you learn about a planet from other techniques? Of the numerous extrasolar planets that have been discovered, what are some of the surprising results? They are all massive (e.g. like Jupiter or larger)—was this a surprise? Explain. Why do these discoveries point to the importance of the protostellar

wind (observed to be blowing hard and fast from most young stars) during the later stages of evolution of planetary systems?

Sample questions on next page.

Sample questions.

1. Which of the following has a mostly icy composition? (Explain why this might be.)
a) asteroid b) Venus c) comet d) Jupiter

2. What is the *approximate* age of the solar system, according to the best available scientific evidence? (Explain how this age was obtained.)
a. about a hundred million years b. 5 billion years c. 5000 years
d. 500,000 years e. greater than 10 billion years

3. Which of the following is NOT a way in which the terrestrial and jovian planets differ?
(Be able to list the ways in which they DO differ.)
a) The terrestrial worlds are small, while the jovian worlds are large.
b) The terrestrial worlds have few or no moons, while the jovian worlds have many moons.
c) The orbits of the terrestrial worlds are relatively close together, while the orbits of the jovian worlds are farther apart.
d) The jovian planets have orbits that are highly inclined to the average plane of the solar system.

4. Most of the extrasolar planets that have been discovered orbiting stars besides the sun are
a. on nearly circular orbits, not what was expected.
b. large jovian-like planets with distances from their star more like the terrestrial planets of our solar system.
c. orbiting very far from their parent star.
d. rare compared to what was expected.

5. Which of the following techniques can be used to estimate the density of an extrasolar planet?
a. radial velocity method b. astrometric method c. transit method

6. What is the major physical process that should cause the material around young stars to form a disk, rather than, say, a sphere?
a. powerful winds from the newly formed star b. gravity
c. collisions between particles d. rotation

7. What has been a major surprise from recent searches for extrasolar planets?
a. Most solar-type stars don't have planets.
b. Terrestrial-sized planets have not been found.
c. Many of the planets discovered have very eccentric orbits.