AST 301 – Scalo—Reading and Study for Exam 4

Exam 4 covers chapters 17, 18, and 19, as stated on the syllabus, (except sec.19.6 will be postponed).

By now I assume you know what types of questions are relevant for exams; basically try them unless they concern a topic we aren't covering (only a few such things—see below); just don't worry much about about numerical problems, except for the simplest of them (see below).

Because there is so much information there, the exam is weighted toward Chapter 17—nearly half the exam questions are on this chapter.

It will probably help if I summarize here a few things about each chapter.

Chapter 17

1. Don't spend much time trying to completely understand "proper motion," "tangential velocity" and how they, along with radial velocity, give the "space" (i.e. total) motion, but I do expect that you have read that section of the text and know what the terms mean. I just want you to understand that a star's velocity has two components that have to be measured using different techniques.

2. Discovery 17-2 on the Hipparcos Mission. You should read it to appreciate how this unglamorous space mission has really revolutionized our estimates of distances. I will probably ask a question about it, but don't worry about the details, i.e. the list of specific discoveries or its size or things like that.

3. In sec. 17.3, don't read about "The Magnitude Scale" or the "More Precisely" on p.446 about this topic, unless you want to; i.e. it isn't on the exam.

4. Concerning spectral types, memorize the letters OBAFGKM as a decreasing temperature scale, and try to understand why the most prominent spectral lines are different in each class (Table 17.2). If someone said "Spectral type B (or K or any spectral class) star" you should be able to tell them something about their properties.

5. You SHOULD read the "More Precisely 17-2" on p. 451. Even though it is rather mathematical, it is important to understand it, because it is essentially the only way we can estimate the diameters of most stars.

6. In sec. 17.6, we only discussed "luminosity class" briefly in lecture, but you should read about it, just to understand that we can tell, for example, giants from main sequence stars using their spectra.

7. In sec.17.7, the main thing to understand is that it makes sense that Kepler's 3^{rd} law as modified by Newton allows us to get masses of stars in binary systems, but you should mostly know the results. What is the range of masses of main sequence stars? Where (along the main sequence) are the most massive? Least massive? What is the mass-luminosity relation and how does that tell us something very important about how the lifetimes of stars depends on mass?

Be sure you understand how knowledge about the masses of stars, and their luminosities, allows us to estimate their lifetimes..

Chapter 18

This chapter isn't long, but be sure you read it thoroughly. It mostly has some great pictures, but also gives you an inventory of the gas and dust structures that are observed between the stars, and how they appear and why. The importance here is that stars actually do form from this "interstellar medium", and that is the subject of the following chapter. Don't worry if you don't understand "polarization" (p.471) and how that tells us the shapes of dust grains—I think it is too difficult a concept given the time we have. Concerning the "emission nebulae" (sec.18.2), I just want you to know why a gas cloud near a hot star would appear this way, and to appreciate it as a real-life example of the emission line physics we discussed in Ch.4. (Also, considering that it requires a hot star, why do you expect most emission nebulae to trace out the regions where the youngest stars reside in space?) Don't worry about "forbidden lines" unless you are interested—you would have to have a course in quantum mechanics to really understand it. But do read 18.3, 18.4, and 18.5, as well as Discovery 18-1 (UV astronomy and the "Local Bubble"—they are short, and important.

Chapter 19.

Most of this material will have been covered in class and will appear on the exam, EXCEPT that we will only go up to and including sec. 19.5 (Shock Waves and Star Formation), but save sec.19.6 (the last section, on Star Clusters) for next time. Probably the most important part is sec. 19.2, because it is similar to what you'll be reading for the next exam, using the H-R diagram to describe the evolution of stars. However you DON'T have to memorize the "stages" that the authors describe, not by number—i.e. I won't ask you "In what stage does X occur?" I don't care about the numbers, just that you understand something about the evolution, how a cloud becomes a protostar which becomes a main sequence star.

Here are a few sample questions. If you have studied and understand the material, you should feel comfortable giving the correct answers.

1. If we know the apparent brightness of an object, its luminosity may be calculated if we also know its ____________.

a) distance b) radial velocity c) surface temperature d) mass

2. If a star has a parallax of 0.05 seconds of arc, then its distance in parsecs is:

a) 0.05 b) 5 c) 2 d) 20 e) 200

3. The radius of a star can be estimated if the ___________ and ___________ of the star are known. (Assume no other information is available.)

a) parallax and spectral type b) temperature and luminosity
c) mass and temperature d) mass and luminosity

4. A certain star is observed to have a surface temperature of about 20,000K and a luminosity equal to the sun's luminosity. From this we can infer that the star is

a) more massive than the sun. b) less massive than the sun.
c) probably a young star. d) probably a white dwarf.

5. A spectroscopic binary is one in which

a) we can see both stars and obtain the spectrum of one of the stars.
b) the Doppler effect is used to infer that a star is a member of a binary.
c) the inverse square law is used to obtain the sum of the masses.
d) the spectral type of one or both of the stars is used to infer its luminosity class, and hence estimate its distance.
e) the spectral type of one or both of the stars is used to estimate their temperatures, and hence place them on the H-R diagram, allowing mass to be estimated from the mass-luminosity relation.

6. Most spectral lines of interstellar molecules are in the __________ part of the spectrum.

a) ultraviolet b) visible c) infrared d) radio

7. What effect does magnetic fields have on the process of stellar birth?

a) It speeds it up. b) It causes fragmentation.
c) It heats the cloud. d) It opposes the collapse of the cloud.

8) About how far away is the most distant star for which we know the trigonometric parallax accurately?

a) 1 pc b) 50 pc c) 200 pc d) 3000 pc e) 100,000 pc