Prof. L. Sparke ASTRONOMY 103 Fall 2006

Review for 12-week Exam (Monday November 20th in class)

Ch. 6: Reflecting and refracting telescopes: why can lenses and mirrors focus light? Light-gathering power. Resolution and "seeing": the effect of Earth's atmosphere.

Ch. 12: The Sun. Luminosity, radius, mass, surface temperature--how do we know? Box 12.1, 12.2. Kelvin scale for temperature; Wien law for λmax, Stefan-Boltzmann law for power radiated per square meter. Energy production: hydrogen 'burns' to He, producing neutrinos that reach Earth. How energy moves within the Sun: radiation, convection. Photosphere, granules and sunspots, magnetic field. Corona, solar wind.

Ch 13: Other stars as Suns: distances from parallax. Apparent brightness and luminosity (*Not* Box 13.1, the magnitude system.) From color to temperature to radius. O B A F G K M classes: why do some stars have strong hydrogen lines and others do not? HR diagram, main sequence. Masses of stars: visual and spectroscopic binaries. Doppler shift: Box 10.1. Why are there no stars with 0.01 $M_\odot$? Why no stars of 100 $M_\odot$?

Ch. 14: Interstellar gas. What are HII regions and how do we observe them? Neutral gas: 21cm line. Molecules in space. Why are radio telescopes sometimes more useful than optical telescopes? Dust scatters light to make stars look redder and dimmer; reflection nebula. How stars form. (Not 14.5, planets of other stars)

Ch. 15: Star lives: interpreting the HR diagram. Where do protostars get the energy to shine? What happens in the core as they reach the zero-age main sequence? End of Sun's life: red giant stage (H burns in shell); helium flash, helium burning, planetary nebula, white dwarf. Lives of massive stars: CNO cycle. Telling the age of a star cluster: how long do stars of different masses stay on the main sequence? [15.8 applies only to single stars!]

Ch. 16: Dead stars: white dwarfs, neutron stars (pulsars), black holes. Binary stars: mass transfer, nova and Type Ia supernova. Exploding massive stars: Type II supernova. Where are elements heavier than carbon made? Gamma ray bursts: hypernova??

Formulas: these will be given on the exam. You don't need to memorize them, but be sure you understand them.

a^3 (in AU) = P^2 (in years) for planets circling the Sun; generally $P^2 = a^3\left[\frac{4\pi^2}{GM}\right]$ or $\frac{a^3}{P^2} = \frac{GM}{4\pi^2}$

$c = \lambda f$ $E = hf = hc/\lambda$

1 nanometer (nm) = 10^{-9} meters; 1AU=150 million km

$\lambda_{\max} = \frac{3mm}{T(K)}$

F (energy, in Watts per sq meter) = σT^4

Perimeter of circle = $2\pi r$; area = πr^2

Surface area of sphere = $4\pi r^2$; volume of sphere = $4\pi r^3/3$

$\frac{\Delta\lambda}{\lambda} = \frac{V}{c}$: Doppler formula

Apparent brightness $b = \frac{L}{4\pi d^2}$

Parallax: p(arcsec) $= \frac{1}{d(\text{parsecs})}$

Review questions

1. It would be to our advantage to build an observatory on the moon primarily because
   A. the moon is closer to the nearest stars
   B. the side of the moon away from the Earth could provide continuous observing
   C. mountains on the moon are five times higher than those on Earth
   D. there is no atmosphere

2. Radio telescopes are better than optical telescopes for studying regions where young stars form, because
   A. radio waves travel freely through the gas and dust out of which the young stars form
   B. radio telescopes are larger than optical telescopes
   C. radio telescopes give a sharper image than optical telescopes because they are larger
   D. young stars do not shine at visible wavelengths

3. If light is emitted at a wavelength of 500 nm from a distant galaxy, traveling away from us at a speed of 30,000 km/sec, it will be observed at a wavelength of
   A. 450 nm B. 500 nm C. 550 nm D. 650 nm

4. Jupiter is roughly 5 AU from the Sun. The amount of energy per unit area, per unit time that arrives at Jupiter, compared to the amount of energy arriving at Earth per unit area, per unit time is roughly
   A. 5 times greater B. 5 times less C. 25 times greater D. 25 times less

5. If a body is heated to a temperature of 6000 degrees Kelvin, the peak of its radiation will be at a wavelength of about
   A. 300 nm B. 500 nm C. 1,000 nm D. 2,000 nm

6. If a star has a parallax of 0.1 sec of arc as viewed from the earth, its distance in parsecs is
   A. 0.1 B. 1 C. 10 D. 100

7. Which of the following is ordered correctly with *increasing* size (the black hole has one solar mass)
   A. neutron star, black hole, white dwarf, sun, red giant
   B. black hole, neutron star, white dwarf, sun, red giant
   C. neutron star, black hole, sun, white dwarf, red giant
   D. black hole, white dwarf, sun, neutron star, red giant
   E. neutron star, white dwarf, sun, red giant, black hole

8. The elements such as nitrogen, oxygen, iron, potassium, etc. that make up the cells in your body were formed
   A. in a supernovae explosion before the Earth was formed
   B. as part of the formation process of the Earth
   C. by volcanic out-gassing
   D. in the Sun, and transported in the Earth via the solar wind

9. In the H-R diagram of a star cluster, the top end of the main sequence tells us its age because
   A. there is a gap between the main sequence and red giants
   B. more massive stars move off the main sequence sooner than less massive stars
   C. all stars in a cluster have the same mass
   D. low-mass stars have longer to reach the main sequence

10. X-rays might indicate a black hole if they are
   A. seen as rapid bursts of X-rays
   B. produced by a binary including a visible companion star of large mass
   C. produced by a single object rather than a binary star
   D. produced by a binary including a compact object heavier than 5 solar masses