Name:_____

Astronomy 253

Review Exam 1 (Group Problems 6)

2004-February-27

You have one hour to complete the exam. You may not use any notes or other reference material, but you will probably need a calculator.

Well, OK, this is a practice exam, so you can consult any notes or reference material you want. In fact, do it in pairs! It's Group Problem Day, after all!

Indicate clearly if you continue any problem on to the back of the page.

The following relations may or may not be useful:

$$1 \text{ radian} = 206265''$$

O B A F G K M

$$G = 6.67 \times 10^{-11} \frac{\text{m}^3}{\text{kg s}^2}$$

$$1 \text{ pc} = 3.1 \times 10^{16} \text{ m}$$

$$M_\odot = 2 \times 10^{30} \text{ kg}$$

$$F = m\,a$$

$$E = m\,c^2$$

$$\Delta m \Delta p \leq \tfrac{\hbar}{2}$$

$$m_1 - m_2 = -2.5 \log\left(\frac{F_1}{F_2}\right)$$

$$F = \frac{L}{4\pi\, d^2}$$

$$m - M = 5 \log\left(\frac{d}{10\,\text{pc}}\right)$$

M = m measured at 10 pc.

$$\theta = \frac{l}{d} \quad ; \quad \theta \text{ in radians}$$

$$d = \frac{1}{p}$$

(d in pc, p in $''$)

1. Next to each image, write a number 1-5 which corresponds to the best classification (using the Hubble classification scheme) for that object:

   1. E
   2. S0 / Sa
   3. Sb / Sc
   4. SBb / SBc
   5. (Not a galaxy)

(a)  _____

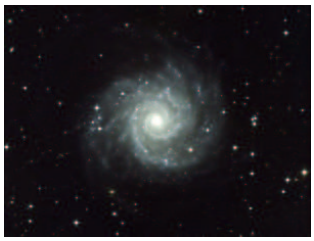
(b) 

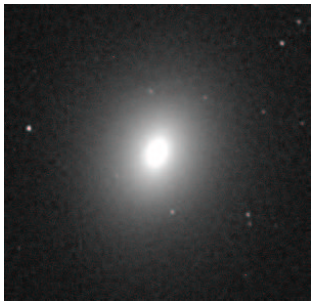
_____

(c)  _____

(d)  _____

(e)  _____

(f)  _____

(g)  _____

(h)  _____

Go on to the next page

2. A Type II supernova is a "core collapse" event, when a star of mass $M > 8M_\odot$ exhausts its nuclear fuel and collapses upon itself; the resulting "bounce" from the collapse generates a huge explosion which leaves behind a neutron star or a black hole. In which object or objects from Problem 1 would such an event most likely be found? (Indicate at least one but no more than three. Extra points off if you hurt my cat.) Justify your choices in a sentence or two.

3. A star field is observed twice six months apart. Two stars in this star field have a measurable parallax; Star 1 has a parallax of $0.09''$, and Star 2 has a parallax of $0.03''$.

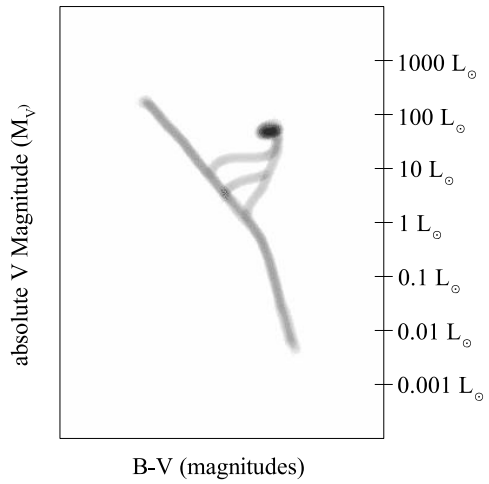
   (a) What are the distances d_1 and d_2 to each star?

   (b) If the two stars have identical spectral type, describe how the magnitudes of the two stars would compare.

   (c) If the two stars have the same magnitude and the same reddish color (i.e. the same T_{eff}), what can you conclude about the classification of the two stars?

Go on to the next page

4. Suppose that the stars in another galaxy have the following H-R diagram:



(a) What color (i.e., "bluish" or "reddish") are the brightest stars in this galaxy?

(b) Where stars in this galaxy formed all at once, continuously over time, or in a number of discrete bursts? If the latter, how many bursts?

(c) To the nearest two billion years, when were stars last formed in this galaxy?

(d) Can you say anything about the metallicity of this galaxy? If so, what? If not, what would you need in order to say something about the metallicity?

(e) Describe as much as you can about what you might expect to see in the spectrum of this galaxy.

Go on to the next page

5. Suppose that the surface brightness of the Milky Way as observed by somebody outside the galaxy at galactic latitude $+90^\circ$ is 5 $L_\odot/pc^2$.

   (a) Draw a sketch of the galaxy, showing where the region of the Milky Way being observed is, where this observer is, and where the observer is looking.

   (b) How distant must this observer be for the surface brightness to be as described?

   (c) Suppose that this observer is as the distance of the Andromeda Galaxy (800 kpc). What magnitude will he see coming from 1 pc^2 of the Milky Way?

Continued on next page...

(d) How many arcseconds will 1 pc subtend for this observer at 800 kpc distance?

(e) How many magnitudes per square arcsecond will the observer at 800 kpc measure from the region of the Milky Way in question?

(f) Suppose there is another observer ten times farther away (8 Mpc). How many magnitudes per square arcsecond will this observer measure from the region of the Milky Way in question?

(g) How many magnitudes will the observer at 8 Mpc observe from 1 pc^2 of the region of the Milky Way in question?

Do not go on to the next page, because there isn't one.