

## Astronomy 45

### Introduction to Astrophysics

#### Problem Set 3 - Due Friday February 23, 2001

1. Find the absolute magnitude of each of the following stars of apparent magnitude  $m$  and distance  $d$ .
  - a.  $m = 7$ ;  $d = 10\text{pc}$
  - b.  $m = 20$ ;  $d = 100\text{ pc}$
  - c.  $m = 0$ ;  $d = 100\text{ pc}$
  - d.  $m = 3.5$ ;  $d = 5\text{ pc}$
  - e.  $m = 17.5$ ;  $d = 20\text{ pc}$
  - f.  $m = -5$ ;  $d = 1/10\text{ pc}$  (there is no such star)
2.
  - a) A star is approaching at a radial velocity of  $30\text{ km s}^{-1}$ . It emits a photon with a rest wavelength of  $630\text{ nm}$ . What is the observed wavelength?
  - b) A galaxy is receding at a velocity of  $60,000\text{ km s}^{-1}$ . What is the observed wavelength of the CaII emission line which has a rest wavelength of  $397.0\text{ nm}$ ?
3. Proxima Centauri is the closest star to the Sun (it is part of a triplet system). It lies at the epoch 1950.0 coordinates  $(\alpha, \delta) = (14^h 26.3^m, -62^\circ 28')$ . The brightest star in the system is  $\alpha$  Centauri, located at  $(14^h 39.6^m - 60^\circ 44')$ .
  - a) What is the angular separation between the two stars?

3. (cont.)
- b) What is the projected distance between them in the plane of Proxima Centauri if Proxima Centauri is 4.3 lyr away? The distance to  $\alpha$  Centauri is 4.4 lyr. What is the distance between the two stars? (The plane of a star is the plane containing the star normal to the line of sight).
- c) The apparent visual magnitudes of the three stars are 0.0, 1.3 and 11.0. What is the total apparent visual magnitude? What is the total flux observed in the visual band? Use Table 2-15.
4. What is the minimum number of measurements of spectral lines that are needed to determine the velocity of an emitting object?