

Astronomy 312 - Fragile

Homework 2 (assigned 1/19/16; due 1/26/16)

1. Barnard's star has a radial speed of  $-108$  km/s, proper motion of  $10.34''/\text{yr}$ , and parallax of  $0.546''$ .
  - (2) (a) What is the distance to Barnard's star in pc? In km?
  - (2) (b) What is the tangential speed of Barnard's star?
  - (3) (c) What is the space velocity of Barnard's star and the angle that the space velocity makes with the line of sight?
  - (4) (d) In how many years will Barnard's star make its closest approach to the Sun?
  - (2) (e) At its closest approach, what will the distance (in pc) to Barnard's star be? Compare this to the current distance to  $\alpha$  Centauri.
- (4) 2. Use equations 24.16, 24.17, and 24.18 to determine the Galactic coordinates of the star Vega. You may wish to refer to Figure 24.18 to verify your answer.
- (2) 3. (a) Compute the lowest possible density of Sgr A\* based on the data obtained from the orbit of S2. Assume a spherically symmetric mass distribution.
- (2) (b) Assuming a mass of  $4.1 \times 10^6 M_{\odot}$  and a radius of 1 AU (roughly the current limit of resolution of the center of the Milky Way), estimate the density of Sgr A\*.