Problem Set #7

Due Friday, May 2 by 5pm to Dickinson 104

Unless otherwise indicated, all problems come from "The Cosmic Perspective," 8e

1. Problem 13.43 *Comparing Methods*
2. Suppose that alien astronomers are observing our solar system edge on. What fraction of light will be blocked by a transit of:
    a. Jupiter
    b. Earth
    c. Mercury
3. Kepler 93b is a planet originally discovered around a nearby star via the transit method. Kepler 93 (the star) is very similar to our Sun, about 92% the Sun's radius and 91% the Sun's mass. Radial velocity (Figure 1) and transit (Figure 2) observations of this star are shown below. Note that, for the radial velocity observations, the velocity is plotted as a function of "phase," where one complete phase represents one complete orbit.
    a) What is the mass of this planet?
    b) What is the radius of this planet?
    c) What is the density of the planet (in units of g/cm^3)?
    d) Given the information you deduced in parts a-c, is the planet more Earth-like or Jupiter-like? (*Hint: See Cosmic Perspective, Appendix E*)
    e) Do you think that this planet could harbor life like what we find on Earth? Why or why not?

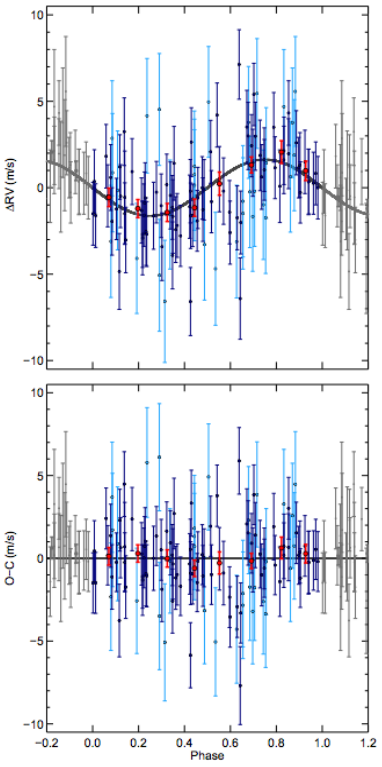


Figure 1: Radial Velocity Observations: Top: Change in radial velocity vs. phase (one "phase" is 4.727 days) Bottom: Residuals to the radial velocity vs. phase fit (Dressing et al. 2015)

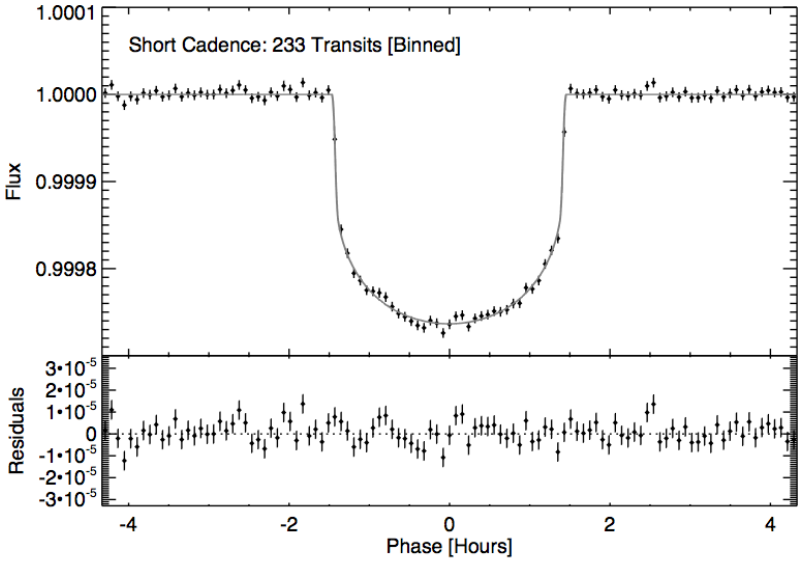


Figure 2: Transit Observations: Change in Flux vs. time in hours. (Ballard et al. 2014)