Jupiter like exoplanets

Soichiro Hattori

October 19, 2014

1 Jupiter-size transit depth and width

Transit depth

Using simple geometry(I will need to write this up with my notes later) one can roughly approximate the depth of a transit δ for a planet of radius R_p orbiting a star of radius R_s to be

$$\delta = (\frac{R_p}{R_s})^2$$

Given that a Jupiter-size transit is what is needed, it is possible to roughly approximate the transit depth by the following,

$$\delta_j = (\frac{R_j}{R_s})^2$$

where R_j is the radius of Jupiter (6.9173×10^7m), and R_s is the radius of the sun (6.955×10^8m). From the calculation,

$$\delta_j = 0.00989188$$

this is a unitless number that represents the percentage of how much the lightcurve will dip during the transit. For a Jupiter-size planet, it is roughly 1%

Transit Width

(Derivation will be written later.) The transit width T, with units in days, is given approximately by the equation

$$T = \frac{R_s P}{\pi r}$$

where R_s is the radius of the star, P is the period of the orbit of the planet in days, and r is the distance from the star to the planet. To approximate the values for the Sun and Jupiter will be used. The time it takes for Jupiter to complete a full orbit around the sun is $P = 4332.8201$ days, and the distance between the Sun and Jupiter is $r = 7.9062 \times 10^{11}$m. Plugging these numbers into the equation,

$$T = 1.21325$$

where the unit is in days. Converting to hours, it is 29.118 hours.