

What is the transit depth (a unitless ratio that the textbook calls $\delta F/F$)?

measured with a ruler it is 0.007 reading off the y-axis; given the "arbitrary offset"

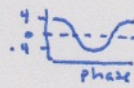
I'm interpreting that as $\frac{\delta F}{F} = 0.007$ \therefore NOT dividing by the value on the y-axis. I think they've all been shifted from 1.00

What is the radius of KELT1b in meters and in Jupiter radii?

given $\frac{\delta F}{F} = 0.007 = \left(\frac{R_p}{R_s}\right)^2$ we have $R_p/R_s = 0.084$
 $\therefore R_s = 1.47 R_{\text{sun}}$ (from page 1 of worksheet) $= 1.0 \times 10^6 \text{ km}$
so $R_p = 8.4 \times 10^4 \text{ km}$ (and $R_J = 7.0 \times 10^4 \text{ km}$) $R_p = 1.2 R_J$.

What is the mass of KELT1b?

$$M = \left(\frac{M^2 P V^3}{2\pi G} \right)^{1/3}$$

$P = 1.22 \text{ d} = 1.05 \times 10^5 \text{ s}$
 $M = 1.34 M_{\text{sun}} = 2.68 \times 10^{30} \text{ kg}$
 $V = 4.0 \text{ km/s}$ from the phased RV curve on p. 3 

$$m = \left(\frac{2.68^2 \cdot 1.05 \cdot 4.0^3}{2\pi \cdot 6.67 \cdot 10^{-11}} \right)^{1/3} = 4.9 \times 10^{28} \text{ kg}$$

$\therefore 1.9 \times 10^{27} \text{ kg} / M_{\text{Jup}}$
 $= 26 M_{\text{Jup}}$

Is KELT1b a planet, a brown dwarf, or a star?

since $M_{\text{KELT1b}} > 13 M_J$ it is a brown dwarf, not a planet
(but since $< 80 M_J$ it is not a star)

What is the density of KELT1b?

$$\rho = \frac{M}{\text{Vol}} = \frac{3M}{4\pi R^3} = \frac{3 \cdot 4.9 \times 10^{28}}{4\pi (8.4 \times 10^4)^3} = 2.0 \times 10^4 \text{ (20x water)}$$

That's quite dense (26x jupiter's mass but only $1.2^3 = 1.7$ times its volume)

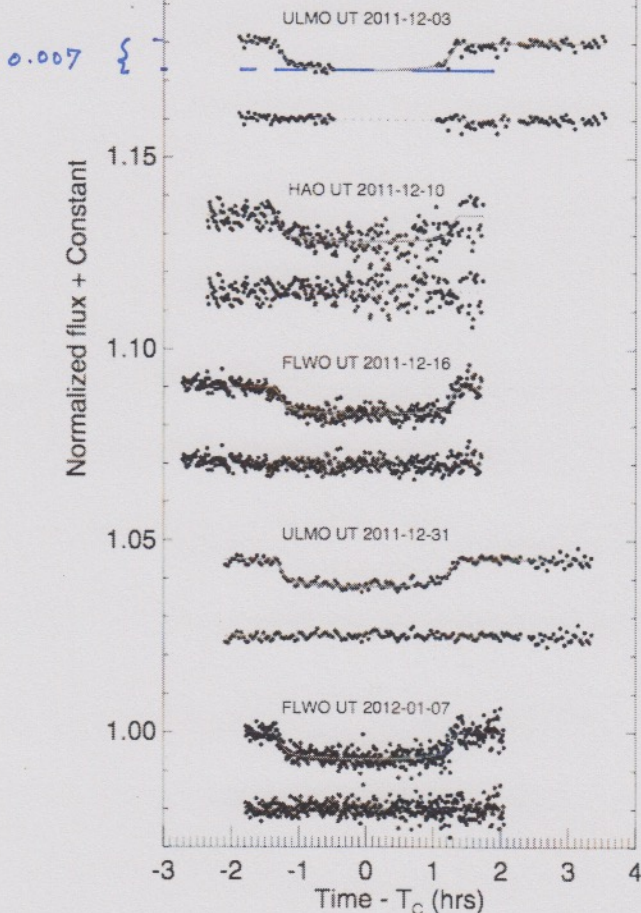


Figure 5. Points show the relative flux as a function of time from transit (T_C) for the six sets of follow-up observations of transits we analyze here. The data sets are labeled and summarized in Table 2. The data are normalized by the fitted out-of-transit flux, and a linear trend with air mass has been removed (see Section 5.2). In addition, an arbitrary offset has been applied to each light curve for clarity. For each observation, we plot the data above and the residuals below. In all cases, the solid lines show the model fit from the analysis in Section 5.2.