$$\text{flux from star } \mathrm{F}_* \quad = \quad \frac{L_*}{4\pi\, r_{\rm orb}^2}$$

$$\text{Lum of planet } \mathrm{L_p} \quad = \quad F_*\, \alpha\, \pi R_{\rm P}^2$$

$$\frac{L_p}{L_*} \quad = \quad \frac{\alpha}{4}\left(\frac{R_{\rm P}}{r_{\rm orb}}\right)^2$$

$$\mathrm{S/N} \quad \sim \quad \frac{\text{photons from star}}{\sqrt{(\text{photons from star}) + (\text{photons from sky})}}$$

$$I_*(\theta) \quad = \quad \text{number of photons from star at angular distance } \theta$$

$$\begin{aligned} \sigma_*(\theta) \quad &= \quad \text{noise of photons from star at angular distance } \theta \\ &= \quad \sqrt{I_*(\theta)} \end{aligned}$$

$$P \quad = \quad \text{number of photons from planet}$$

$$P \quad > \quad \sqrt{I_*(\theta)}$$

$$I(\theta) \quad = \quad I_0\, e^{-\theta^2/(2s^2)} \quad \simeq \quad I_0\, e^{-\theta^2/(0.36\ \mathrm{FWHM}^2)}$$

$$s \quad \simeq \quad \mathrm{FWHM}/2.35$$

$$I(\theta) \quad = \quad I_0\, e^{-2.76\,(\theta/\mathrm{FWHM})^2}$$

$$\text{star noise at } \theta, \text{ in mag} \quad = \quad -2.5\, \log_{10}\left(\frac{\sqrt{I(\theta)}}{I(\theta)}\right)$$

$$\frac{L_p}{L_*} \quad = \quad \left(\frac{R_{\rm P}}{R_*}\right)^2 \left(\frac{B_\lambda(T_{\rm P})}{B_\lambda(T_*)}\right)^4$$