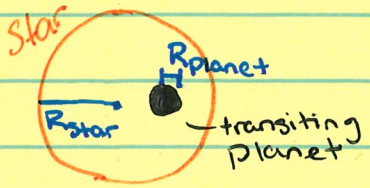
Transit Depth (Example 21.1)



How much light will a planet block when transiting?

Area of a circle: $A = \pi R^2$

How much area blocked?

$A_{star} = \pi R_{star}^2$ $A_{planet} = \pi R_{planet}^2$

$$\frac{\text{Area blocked}}{\text{Total Area}} = \frac{\pi R_{planet}^2}{\pi R_{star}^2} = \left(\frac{R_{planet}}{R_{star}}\right)^2$$

This gives fraction of light blocked

If aliens were to see a transit of Jupiter:

$R_{star} = 695,700\ km$ $R_{Jupiter} = 71,400\ km$

Blocked light: $\left(\frac{71,400\ km}{695,700\ km}\right)^2$ ← *don't forget to square

$= 0.01$

$\times 100\% = 1\%$

Jupiter blocks 1% of the Sun's light during transit

Need sensitive detectors to measure that change

For Earth $R_{Earth} = 6378\ km$ (especially for Earth-like)

Blocked: $\left(\frac{6378\ km}{695,700\ km}\right)^2 \times 100\% = 0.0084\%$!!