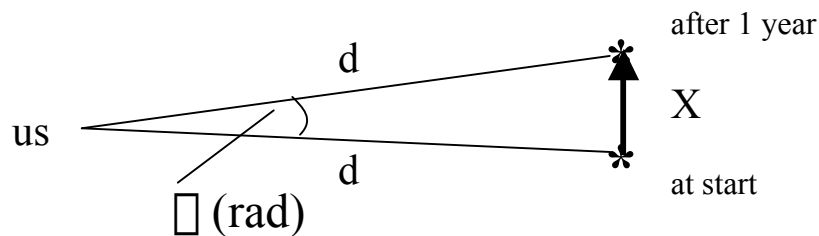


## Transverse Velocity Derivation

If you watch the star for one year and it moves across the sky by an angle  $\theta$  radians, then to find its transverse velocity  $V_{\text{trans}}$ :



Applying the long skinny triangle, we get:  $X_{\text{pc}}/1_{\text{yr}} = \theta_{\text{rad}} * d_{\text{pc}}$

So we're done, although we probably want to convert to more practical units, so let's substitute the following:

$$\theta_{\text{rad}} = \theta''/206265$$

$$X_{\text{pc}} = X_{\text{km}} / (3.1 \times 10^{13} \text{ km/pc}) \text{ and } 1 \text{ yr} = 1 \text{ s} / (3.1 \times 10^7 \text{ s/yr})$$

So now we have:

$$X_{\text{pc}}/1_{\text{yr}} = \frac{X_{\text{km}} / (3.1 \times 10^{13} \text{ km/pc})}{1 \text{ s} / (3.1 \times 10^7 \text{ s/yr})} = (\theta''/206265) * d_{\text{pc}}$$

which, after doing the arithmetic, gives:

$$\frac{X_{\text{km}}}{1 \text{ s}} = \frac{3.1 \times 10^{13}}{(3.1 \times 10^7) * 206265} \theta'' * d_{\text{pc}}$$

$$\rightarrow X_{\text{km/s}} = 4.84 * \theta'' * d_{\text{pc}}$$