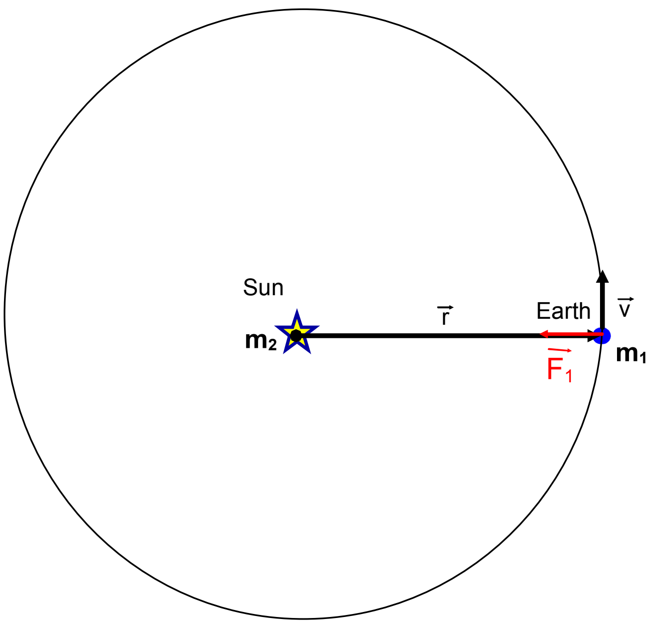
Mass of the Sun.




$$\boxed{\frac{\tau^2}{a^3} = \frac{4\pi^2}{G(m_1+m_2)}}$$

$m_1 = m_E \quad \tau = P_E$

$m_2 = M_\odot \quad a = a_E$

of course $m_2 \gg m_1$

so $m_1 + m_2 = m_2 \cong M_\odot$

$$\frac{P_E^2}{a_E^3} = \frac{4\pi^2}{GM_\odot} \longrightarrow M_\odot = \frac{4\pi^2 a_E^3}{G P_E^2}$$

G and $a_E$ must be known to get the mass of the Sun in physical units (kg, etc.)

Determining $a_E$ is also necessary to determine the absolute scale of the solar system and thereby use the parallax method to determine the true distance to nearby stars, which begins the cosmic distance scale.

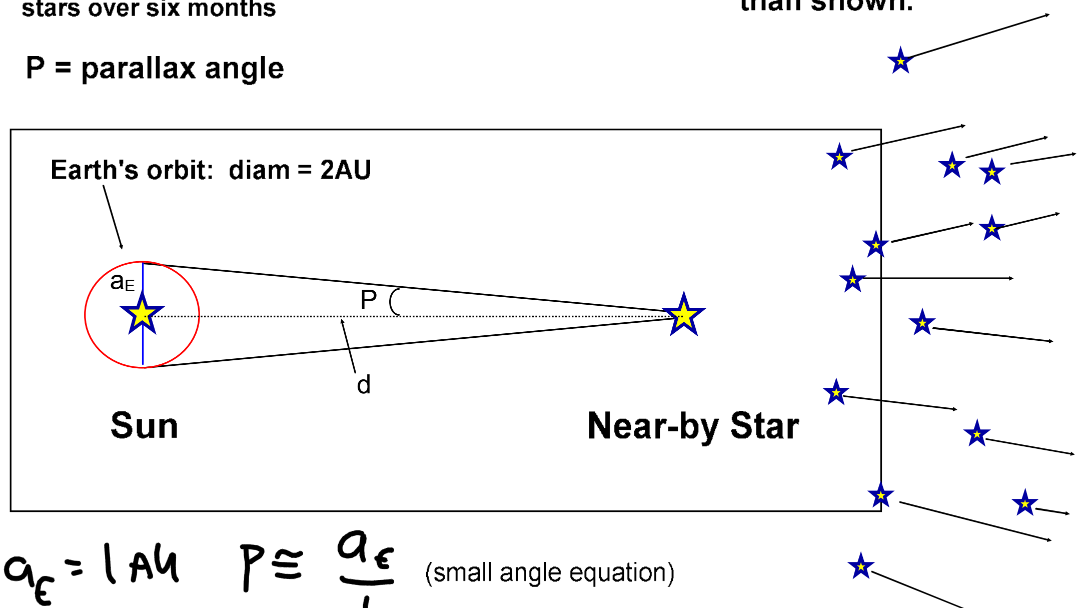
Determining the AU is "zeroth" rung on cosmic distance ladder.

Necessary for using the "first" rung on cosmic distance ladder: stellar parallax.

**2P = angle Near-by Star seems to move relative to background stars over six months**

**P = parallax angle**

**Background stars, arrows indicate much farther actual distances than shown.**




$a_E = 1\ \text{AU}$ $\quad P \cong \frac{a_E}{d}$ (small angle equation)

$d = \frac{a_E}{P}$ d & $a_E$ are in the same distance units
P in radians

Astronomical version using specialized units of "parsec":

$$\boxed{d = \frac{1}{P} \qquad \begin{array}{l} d \text{ in parsec (pc)} \\ P \text{ in arcsec ('')} \end{array}}$$

define "parsec" (parallax-arcsec)

$$d \propto \frac{1}{P} \rightarrow d = \frac{\text{const}}{P}$$

defn: 1 parsec = distance at which the measured parallax angle would be 1 arcsec

$$1\,\text{pc} = \frac{\text{const}}{1''} \qquad \text{const} = 1\,\text{pc}\,''$$