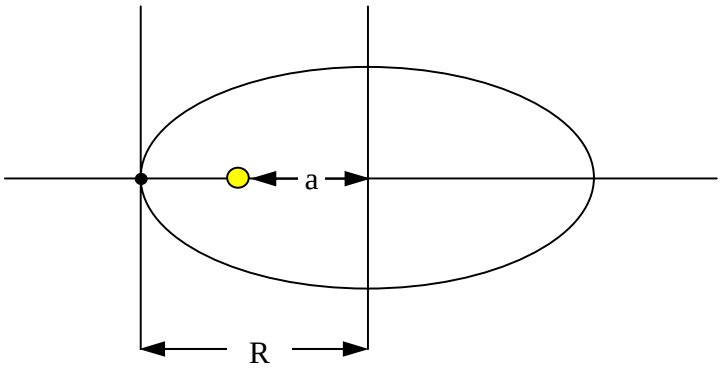
Guided reading – Earth Eccentricity



Eccentricity is defined as:

$$e = \frac{a}{R}$$

Taking a maximal eccentricity of 0.058 for earth's orbit around the sun we can calculate the distance difference between perihelion and aphelion as follows:

$$\Delta r = \left(R + a\right) - \left(R - a\right) = 2a$$

The corresponding intensity difference is however proportional to one over the distance squared:

$$\Delta I = I_{close} - I_{far} = \frac{\sigma}{4\pi\left(R-a\right)^2} - \frac{\sigma}{4\pi\left(R+a\right)^2} = \frac{\sigma}{4\pi}\left[\frac{4Ra}{\left(R^2-a^2\right)^2}\right]$$

The decrease (in percentage) with respect to zero eccentricity is:

$$\%\Delta I = \frac{\Delta I}{I_0}\cdot 100 = 100\frac{\sigma}{4\pi}\left[\frac{4Ra}{\left(R^2-a^2\right)^2}\right] \Big/ \frac{\sigma}{4\pi R^2} = \frac{4R^3 a}{\left(R^2-a^2\right)^2}\cdot 100$$

Setting $R \approx 150\cdot 10^6$ and $a \approx 0.058\cdot R$ in the last equation we get:

$$\Delta I \approx 23.35\%$$