# Important Factors to Note

- 1 AU ≡ distance of the Earth to the sun ≈ 1.5×10^8 km. *This is the scale of distances within the solar system.*

- light-year ≡ the distance light travels within one year ≡ 9.5×10^{12} km. *Stars in the neighborhood of the the sun are separated from each other over these distances.*

- 1 parsec ≡ the distance at which an object will have a *parallax* of 1 arcsecond ($1/3600^{\text{th}}$ of a degree) when Earth moves from one side to the other of its orbit ≡ 3.26 light-years.

Not to scale

Distant stars

Sun

Earth's orbit around sun
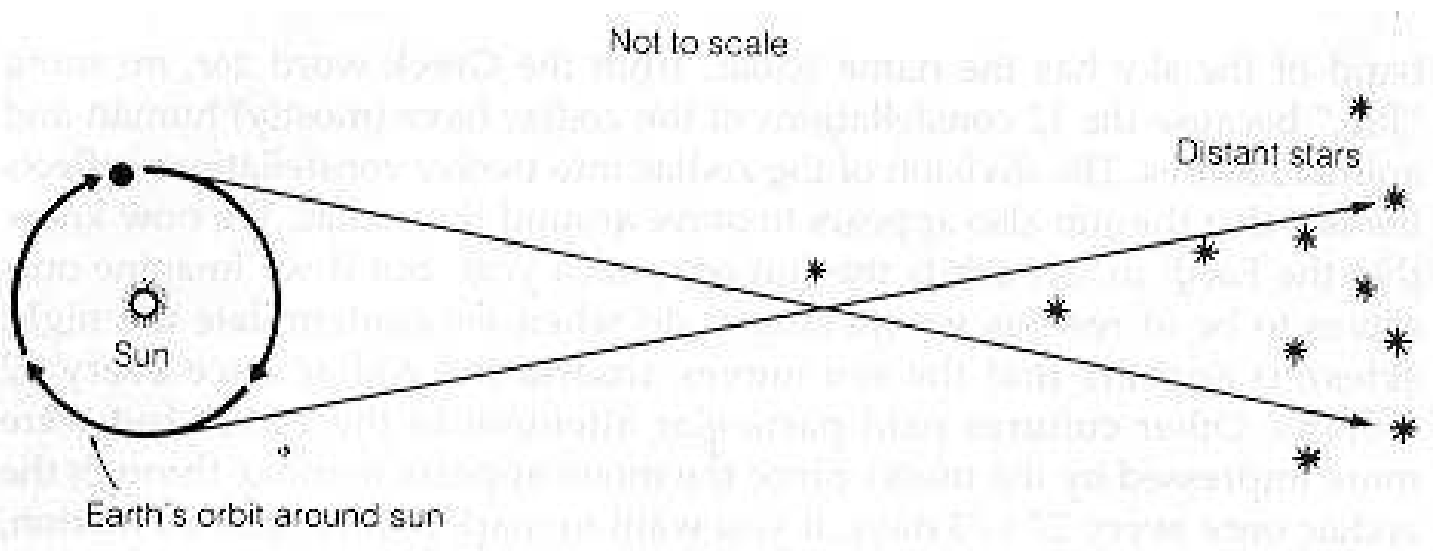
- 1 $L_\odot$ ≡ the total power output by the sun ≡ 4×10^{26} Watts.

- Size of the Milky Way galaxy ≈ 25 kpc ≈ 8×10^{17} km.

- Radius of the sun $R_\odot$ ≈ 7×10^5 km, mass of the sun $M_\odot$ ≈ 2×10^{30} kg.

- Radius of the earth $R_\oplus$ ≈ 6000, mass of earth $M_\oplus$ ≈ 5×10^{24} kg.

- one galactic year ≡ the time it takes for the sun to move about the galaxy center ≈ 220 million years.

- 1 Gyr ≡ 1 billion years (1 "Giga year").

Densities

- **Number Density** has units of 1/volume $\equiv L^{-3}$, where L denotes a length. It has symbol ρ.

- **Mass Density** has units of mass/volume $\equiv ML^{-3}$, where M denotes a mass. It also has symbol ρ.

- **Areal Number Density** has units of 1/area $\equiv L^{-2}$. It has symbol σ.

- **Areal Mass Density** has units of mass/area $\equiv ML^{-2}$. It has symbol σ.

Note: Except where noted as such, I will continue to use "density" for *number density* and "areal density" for *areal number density*.

One can also calculate the average separation between objects from a number density by dimensional analysis:

- In *three dimensions*, the average separation $\ell = \rho^{-1/3}$.

- In *two dimensions*, the average separation $\ell = \sigma^{-1/2}$.