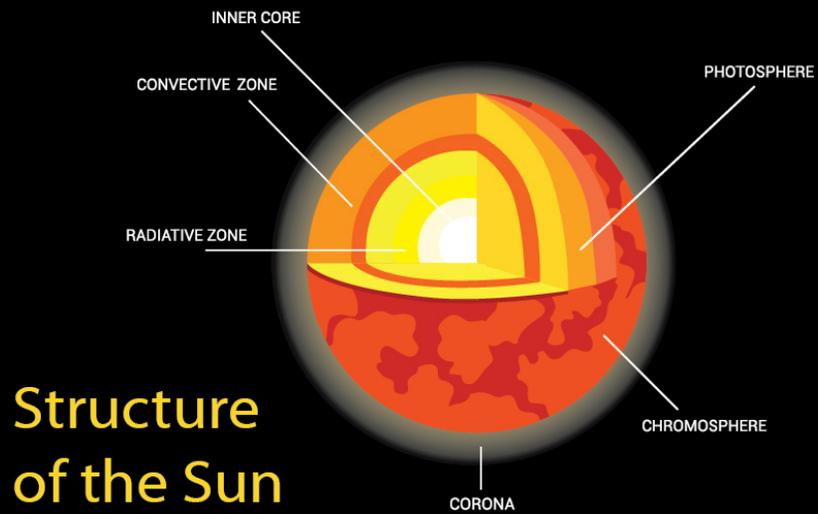


A Star is Born

- Enormous cloud of hydrogen gas and dust
- Star forming region



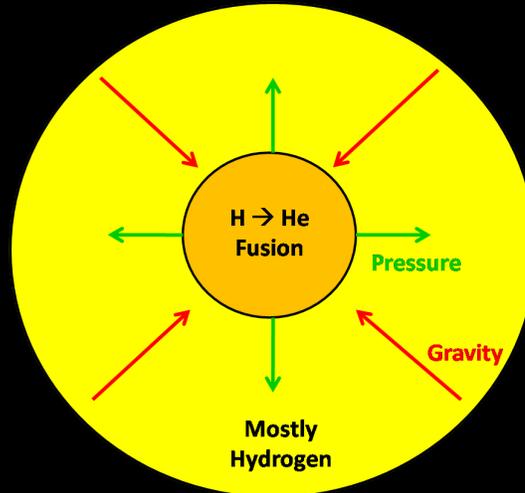
NASA, ESA & M. Livio



## Structure of the Sun

### Nuclear Fusion

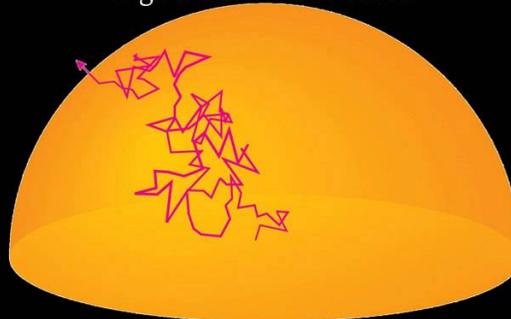
- Nuclear fusion begins in the core
- Two hydrogen atoms fuse
- Produces helium, heat and light
- Inward force of gravity = outward force of fusion

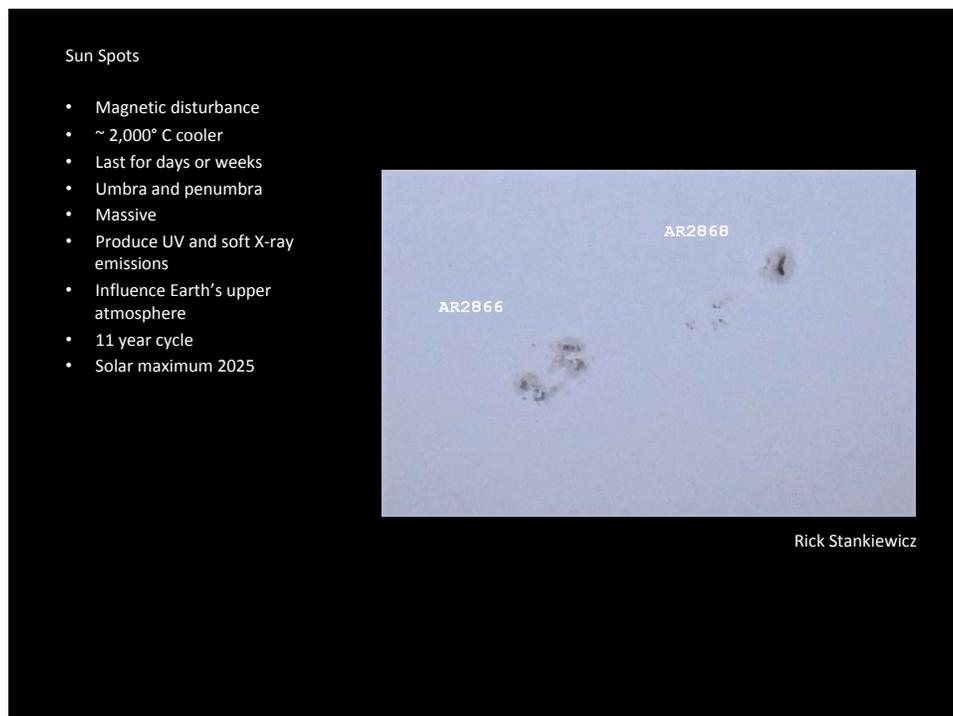
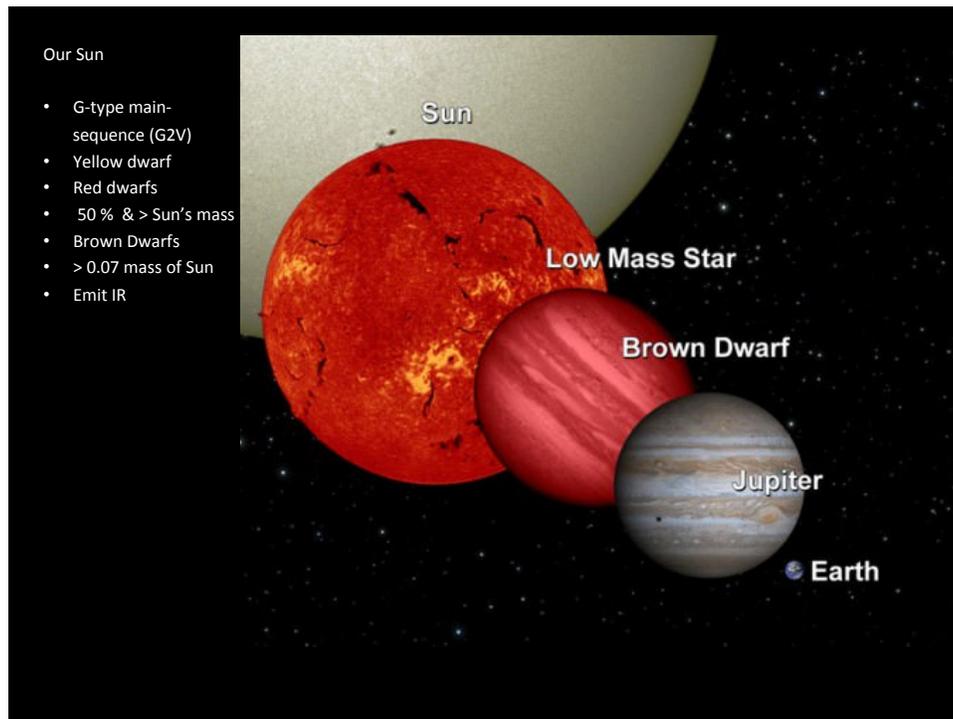


### Energy takes a long time to reach the Sun's surface

Photons "collide" with electrons and get deflected in random directions.

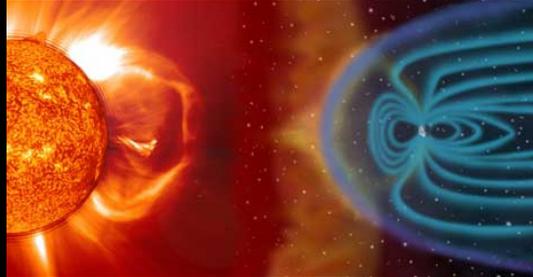
It takes hundreds of thousands of years for a photon to go from core to surface!





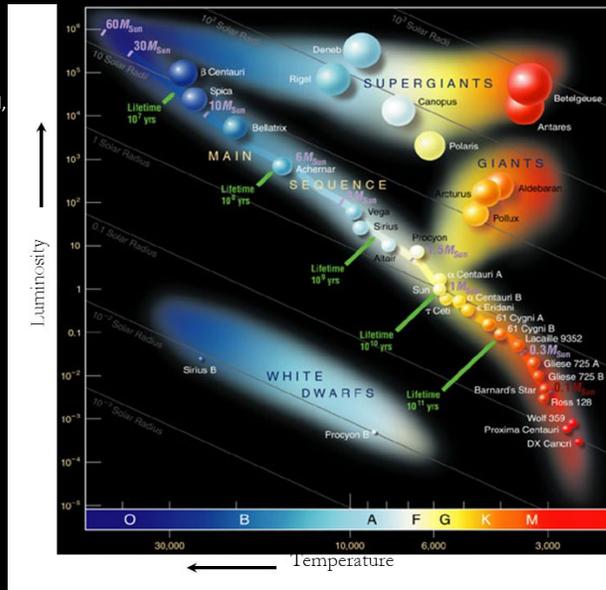
Space Weather

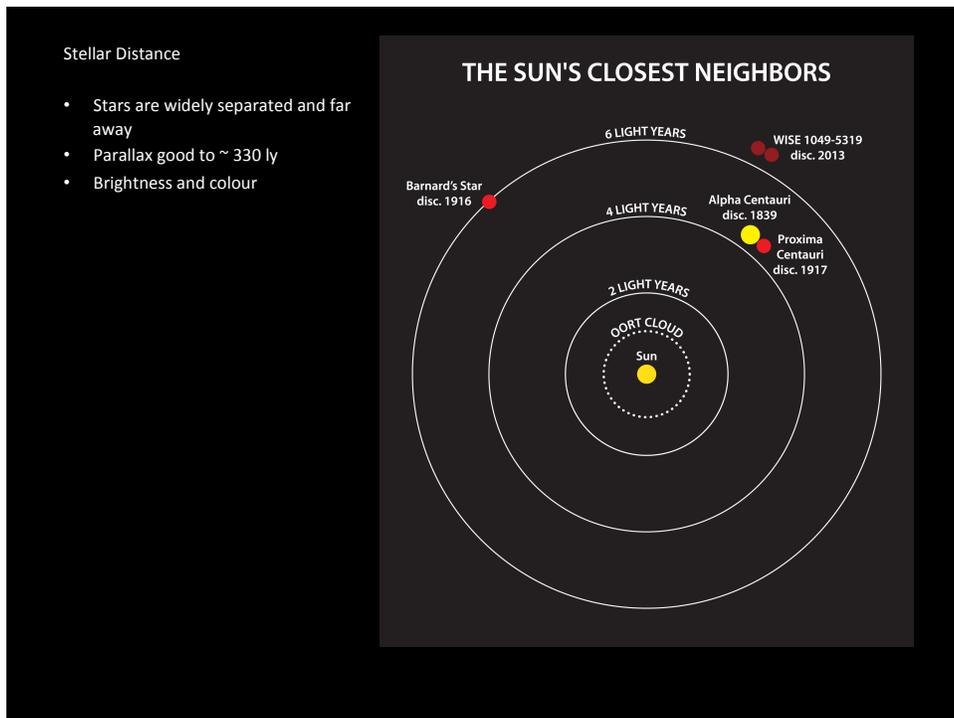
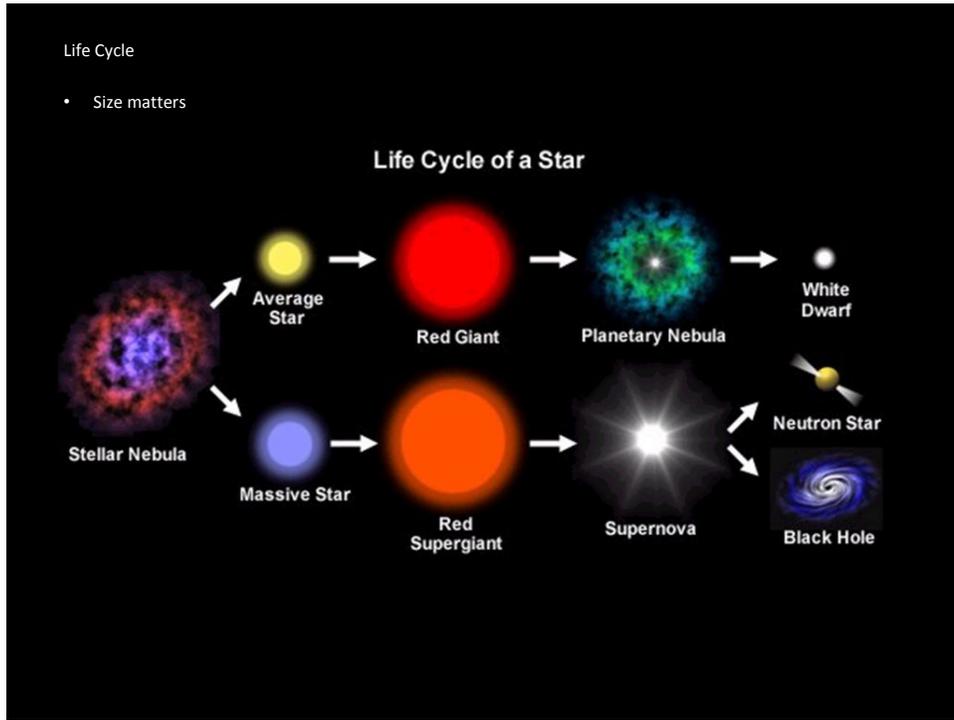
- Solar wind, flares and coronal mass ejections (CME) affect planets
- High speed magnetic and charged particles
- Implications for exoplanets
- 400 km/s
- Aurora, communication, electrical grids
- Advanced Composition Explorer (ACE)
- Parker Solar Probe
- Space weather
  - [spaceweather.com](http://spaceweather.com)

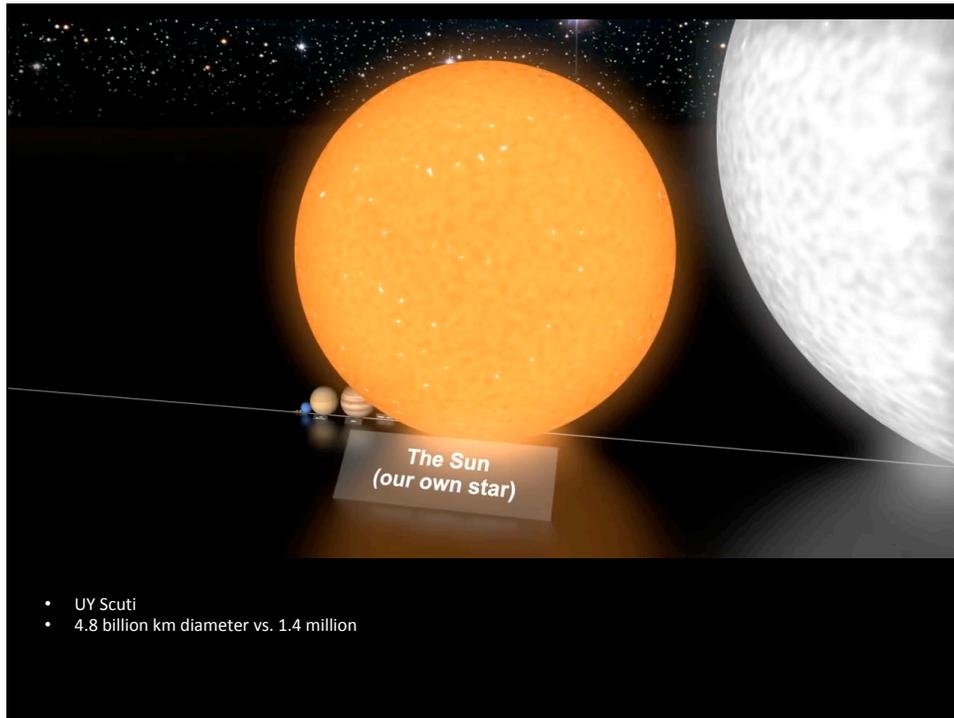


Stellar Evolution

- Hertzsprung-Russell Diagram
- Relates a star's temperature and luminosity
- OBAFGKM: Oh, Be A Fine Girl/Gal, Kiss Me







Binary & Multiple Star Systems

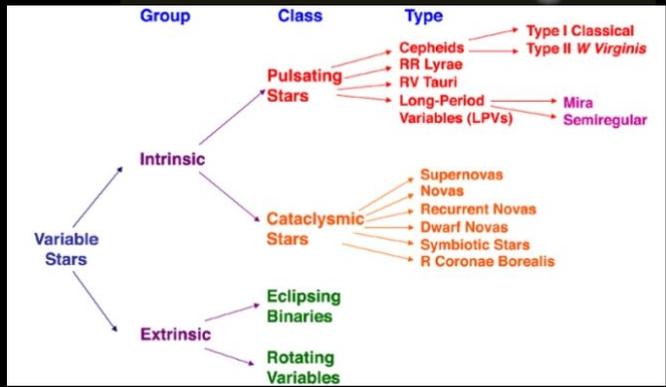
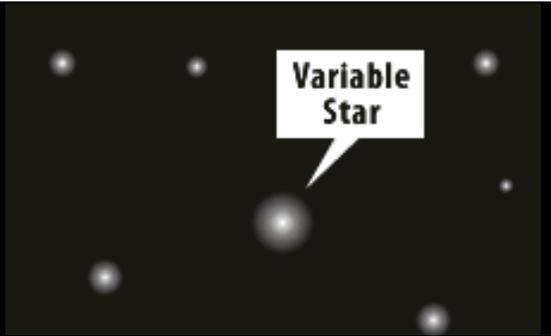
- Most stars are born in groups
- Binary & multiple star systems
  - Position angle (degrees)
  - Separation (arc seconds)
  - Orbital period
- Eclipsing binaries
- Spectroscopic doubles
- Optical double stars (line-of-sight)



Stefan Binnewies/Josef Pöpsel/Capella Observatory

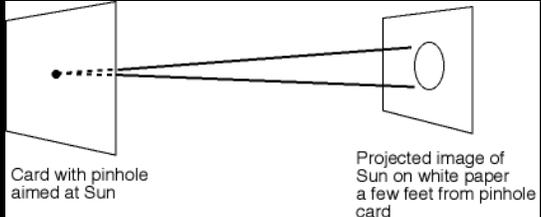
Variable Stars

- Variable stars fluctuate in brightness
- Intrinsic & extrinsic causes
- Short period & long period variability
- Amateur scientific observations
  - Photometry
- American Association of Variable Star Observers (AAVSO)



Solar Observing

Warning!



Solar Eclipse



Rick Stankiewicz

Totality



Rick Stankiewicz

Totality



Rick Stankiewicz

Planetary Transits

- Mercury & Venus



Sean Dunn



Build Your Own Sundial

Liftoff to Space Exploration  
<http://liftoff.msfc.nasa.gov/>

a Space Sciences Project

cut this gnomon out.

fold here

don't cut past here

don't cut past here

Instructions: Northern Hemisphere

**Part I: Gnomon**

1. Cut out your gnomon shown to the left.
2. Cut the three dotted lines at one end of the gnomon.
3. Folder the gnomon in half and then fold the folded gnomon in half.

**Part II: Sundial**

1. Cut along the dotted lines on each end of the sundial page but don't cut all the way across. Stop at the stop marks.
2. Fold the remaining dashed lines - - -
3. Fold each ramp side along the line which is closest to your latitude. (You can look this up on our web page.)
4. Tape the folded ramps to the back side of the folded paper so that the side labeled "ramp" is vertical.
5. Depending on the time of the year, you tape the gnomon on different sides of the sundial face. If it is after the Spring Equinox, you tape it on the numbered side. If it is after the Fall Equinox, you tape it on the back or un-numbered side.
6. When taping the gnomon on, you match the tabs with the sundial face.
7. Aim your sundial North.

Novice Astronomy Class #4  
The Solar System  
May 6, 2022

