Astronomy is the study of objects in space and the physics of the universe as a whole. Astronomers study planets, moons, comets, the Sun, stars, gas, galaxies, clusters of galaxies, and the big picture universe.

Today will talk about the Sun.
The Sun as our star

Center of the Solar System

4.5 billion years old

2/3 of the way from the center of the galaxy

Question: how big is the Sun?!
Sun vs the rest of the solar system

109 x bigger than Earth
300,000 x more massive than Earth
Sun is average-mass star (G)
Can see Sirius and Arcturus at night right now!
Color differences are from temperature differences
Glowing b/c are hot; compare oven heating element red to arc welding lamp blue
Layers of the Sun

Inside:
- Core: 18 million °F
- Radiative zone: 9 million °F
- Convection zone: 9 million °F ~ 10,000 °F

Surface:
- Photosphere: 10,000 °F

Atmosphere:
- Chromosphere: 35,000 °F
- Corona: 3.6 million °F

Inside from modeling and (more recently) helioseismology
Outside from looking at emission lines
Shines b/c is hot, hot b/c fusion going on in core
  - all that mass on top, plasma
  - coulomb repulsion, strong force! 4 H -> 1 He plus some energy

Why is atmosphere so hot?! Mystery!
A Closer Look at the Sun

Granulation = boiling bubbling surface

Cells about the size of Texas
A Closer Look at the Sun

Sunspots
Slows convection
= cooler (2800 K), darker

Sunspot size of Earth
Material wells up from middle (umbra, darkest part), spills over in edge (penumbra, grey area), flows down around edges
Question: what happens when it runs out of fuel?!
4.5 billion years from now, core runs out of hydrogen
Sun is a balloon kept inflated by hot gas
Give NASA money so we can get off this rock!
Solar spectrum
Orange doublet = sodium doublet
sodium, magnesium, iron, calcium, copper, and zinc
HELIUM!