Book - Coop should have more by Wednesday, new/used.

3 copies on 2 hour reserve in Undergraduate Library (UGL), one in Physics/Math/Astronomy

One-hour Science Lab Course - AST 101L HANDOUT

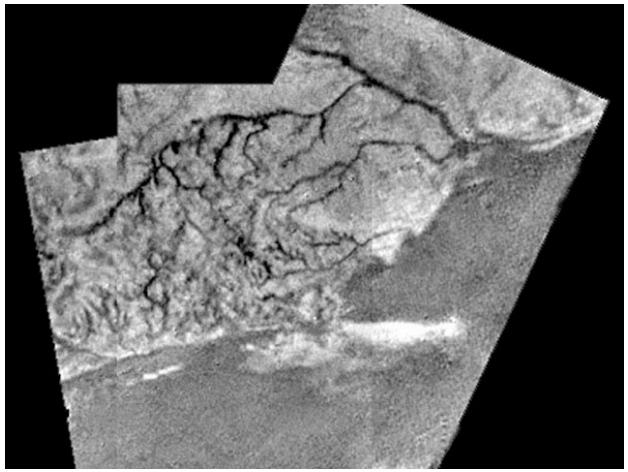
Handouts from first class - see Jen Sobeck (or Web)

Star Parties (one devoted to our extra credit project: TBD)

Astronomy in the News?

Pic of the Day - rivers/lakes

of methane on Titan



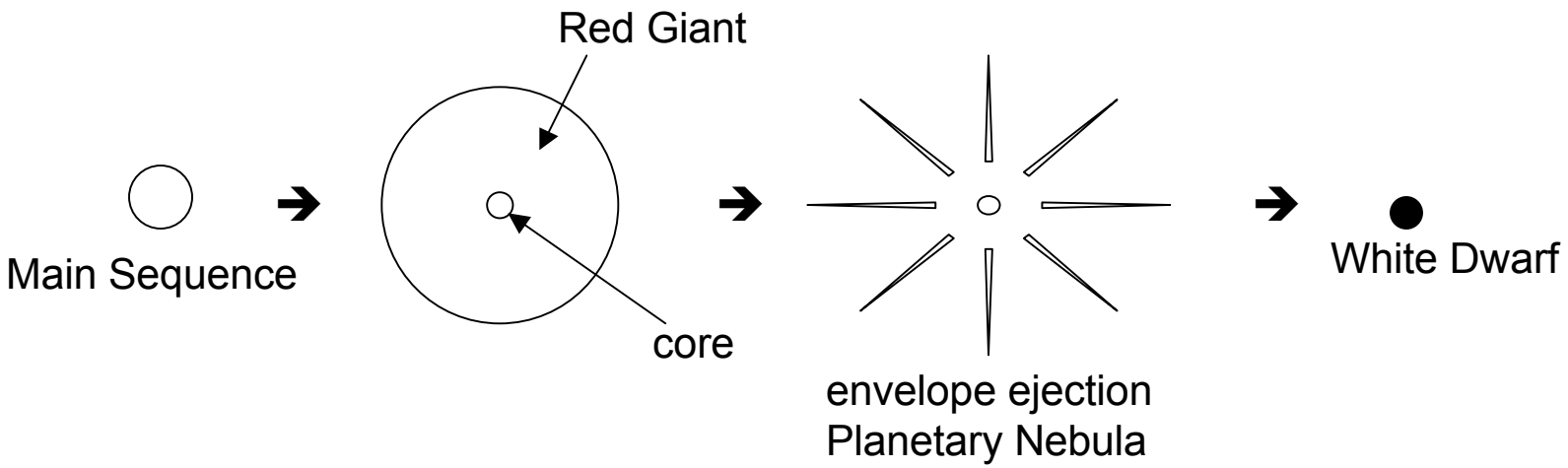
Background check

What is a main sequence star?

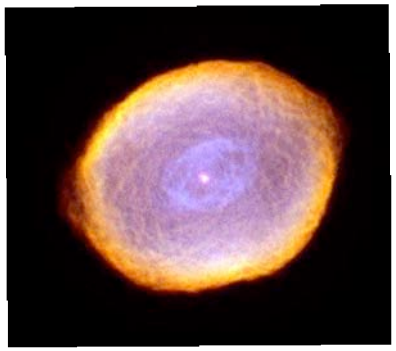
What is a red giant star?

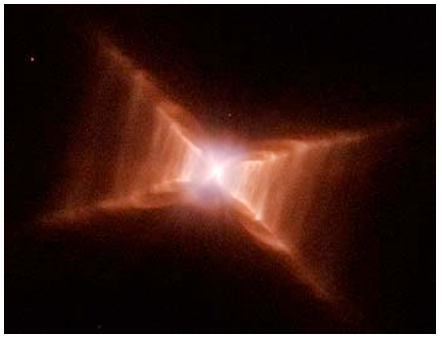
Write a few sentences, exchange with your neighbor.

White Dwarfs



Most common stellar "corpse." Come from low mass stars → plentiful.





White Dwarfs

Essentially every white dwarf formed since beginning of Galaxy is still here 10-100 billion of them (~ 100 billion stars total)

Most are dim, undiscovered, see only those nearby, none naked eye

Sirius, brightest star in the sky, has a white dwarf companion. Can't see the companion with the naked eye, too small, dim, but Sirius is easy. Find it for the extra credit project.

What do we know about white dwarfs?

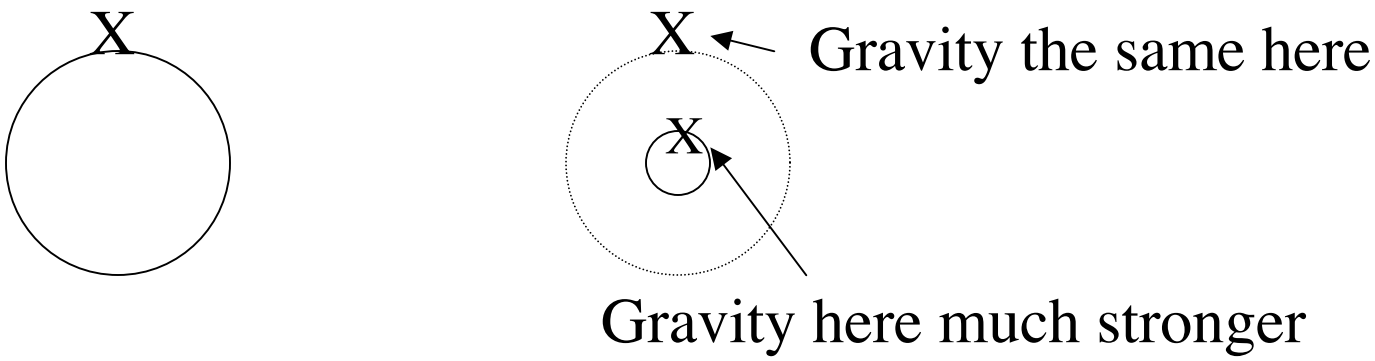
Mass ~ Sun
Most are single, $0.6\ M_{\odot}$ (solar masses)
Some in binary systems, higher mass

Size ~ Earth ~1% radius of Sun

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \rightarrow \frac{10^6 \text{ grams}}{\text{c. c.}} \sim \frac{\text{tons}}{\text{cubic centimeter}}$$

OR MORE!

HUGE GRAVITY!



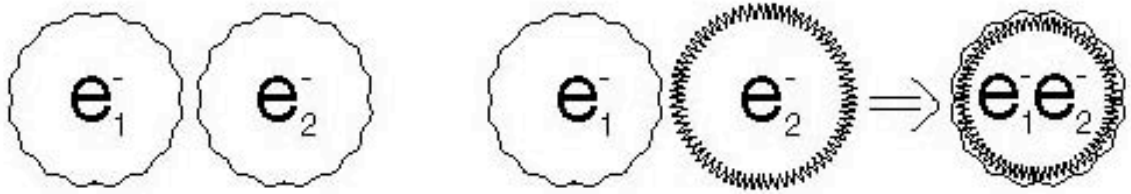
Same mass, smaller size, gravity on *surface* is larger because you are closer to the *center*.

Gravity on surface acts *as if* all mass beneath were concentrated at a point in the center -- Newton/Calculus

Huge gravity compresses star --
requires special pressure to support it (Chapter 1)

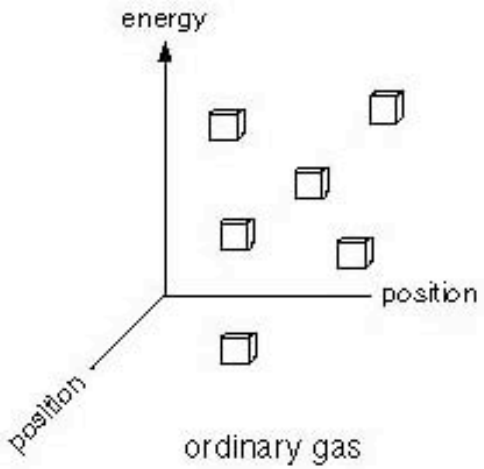
- Normal pressure -- thermal pressure
- Motion of hot particles -- Pressure depends on Temperature
- Quantum Pressure -- Quantum Theory
- Uncertainty Principle -- Can't specify position of any particle exactly
- Exclusion Principle -- No two identical particles can occupy same place with same energy

Figure 1.4

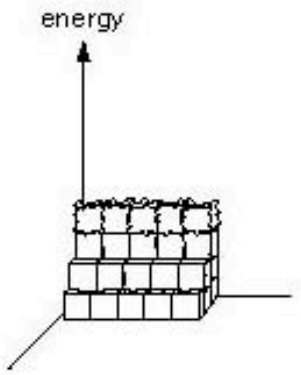


same momentum
total exclusion

different momentum



ordinary gas



gas dominated
by quantum
pressure

Quantum Pressure -- just depends on squeezing particles,
electrons for white dwarf, to very high density
-- depends on density only
-- *does not* depend on temperature

Important Implication:

Normal  Radiate energy, temperature/pressure try to drop, star compresses, gets **hotter** (and higher pressure)

White Dwarf Radiate energy, *temperature does not matter*, pressure remains constant, star gets **cooler**

Opposite behavior

Normal Star - *Regulated* put in energy, star expands, cools

White Dwarf - *Unregulated* put in energy, hotter, more nuclear burning -- explosion!