Book - got ‘em? (second edition)

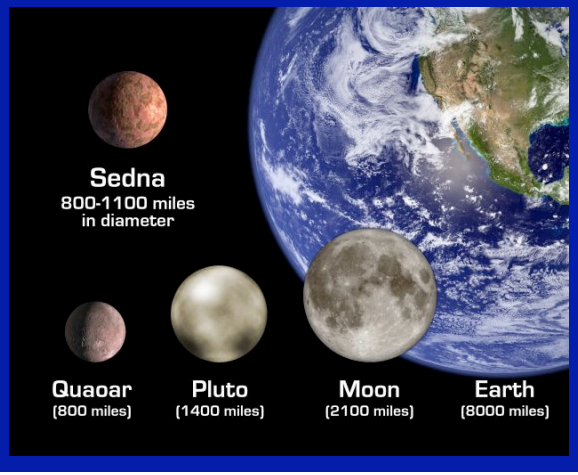
Extra credit, now link on class web site

One-hour Science Lab Course - AST 101L HANDOUT

Handouts from first class - see Mike Dunham

Astronomy in the News?

Pic of the Day - planets/moons



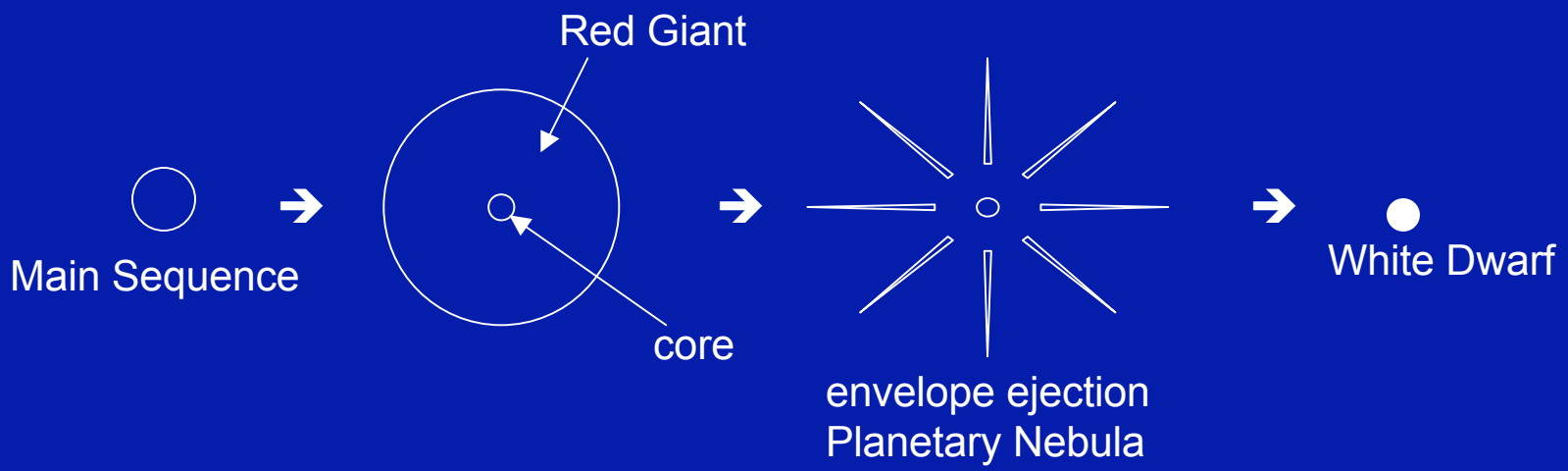
Background check

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 WD 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 → WD companion

What do we know about white dwarfs?

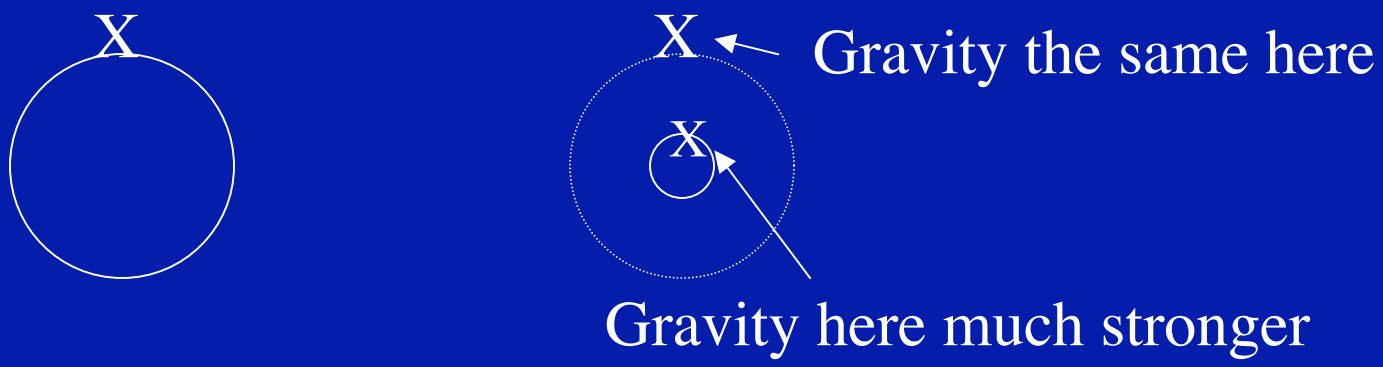
Mass ~ Sun
Most single 0.6 $M_\odot$ (solar masses)
Some in binary systems, higher mass

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!



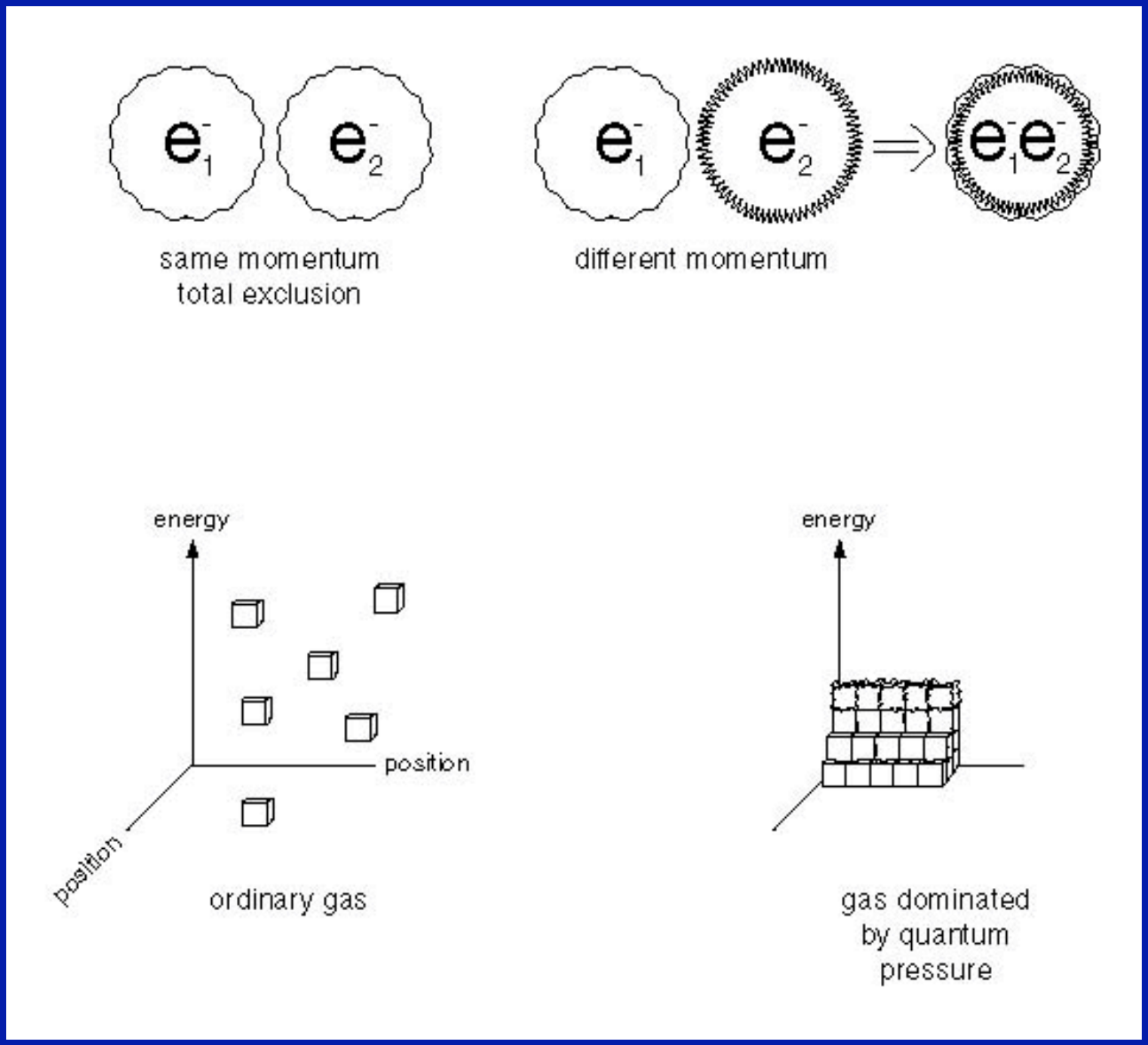
Same mass, smaller size, gravity on *surface* is larger because you are closer to the *center*.

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

- 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


e_1^-
e_2^-
same momentum
total exclusion
e_1^-
e_2^-
$e_1^- e_2^-$
different momentum
energy
position
position
ordinary gas
energy
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, pressure tries to drop, star 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!