Monday, February 9, 2015

Multiple Choice Grades posted.

Exams, Sky Watch returned on Wednesday

Astronomy in the news?

Launch of DISCOVR (Deep Space Climate Observatory: “GoreSat”) to monitor Earth (full Sun-lit face), Sun (flares, space weather), atop SpaceX Falcon 9. Second attempt to land first-stage booster on floating barge for re-use. Postponed yesterday, tracking radar glitch, scheduled for 5:07 this evening.

Material for Second Exam

Reading:
Chapter 6 Supernovae §6.4, 6.5, 6.6, 6.7, Betelgeuse
Background:
Chapter 1 Introduction §1.2.1, 1.2.3, 1.2.4
Chapter 2 Stellar Death §2.1, 2.3, 2.4, 2.5

Issues to look for in background:

What are thermal and quantum pressure and how do they work? Chapter 1 §1.2.3, 1.2.4, Chapter 2 §2.3

Why is it necessary for a thermonuclear fuel to get hot to burn? - charge repulsion Chapter 2 §2.1, 3

Why is iron important? Chapter 2, §2.4, 2.5

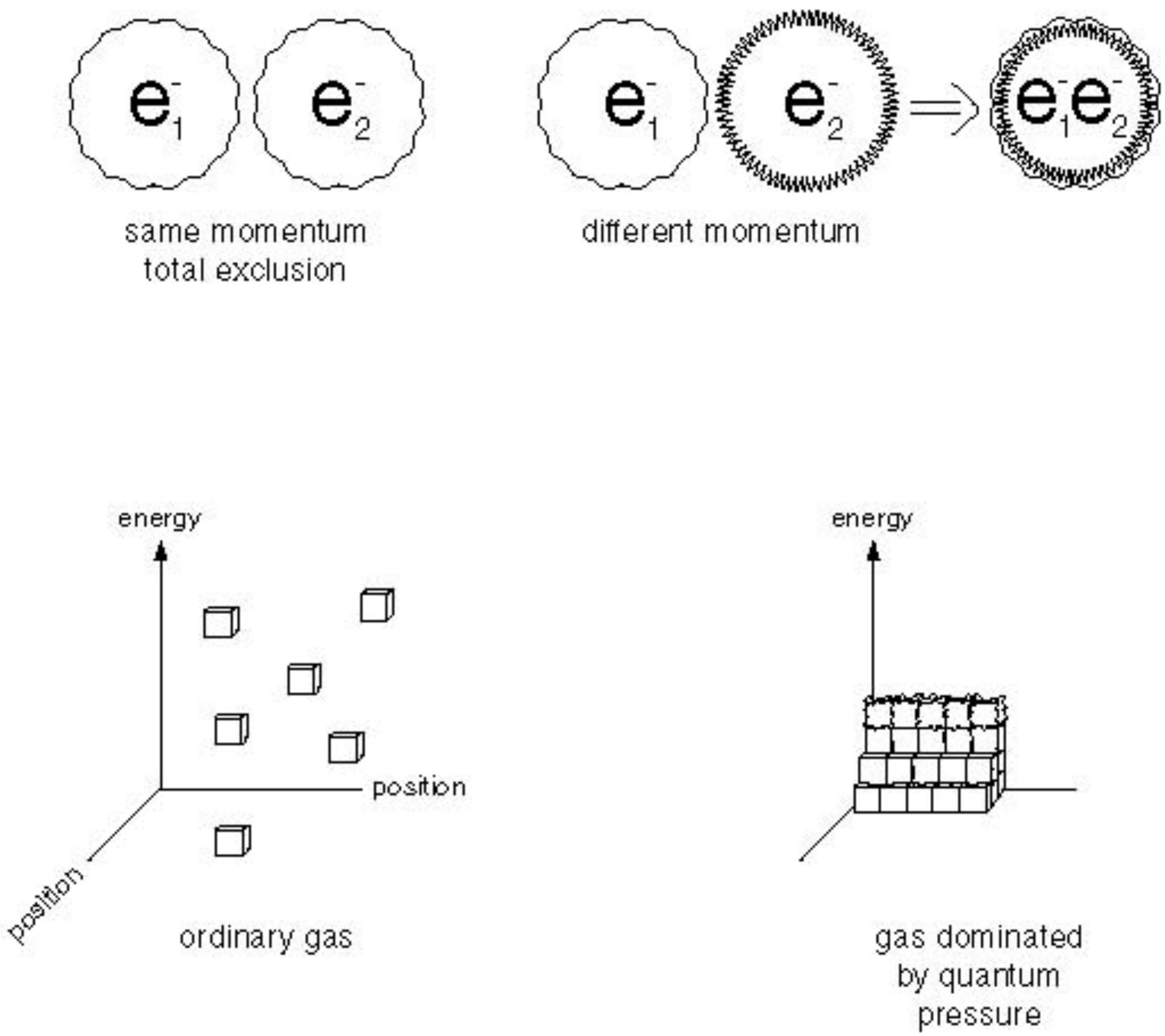
Goal:

To understand how pressure is created in stars, how thermal pressure controls the evolution of normal stars, and why quantum pressure makes white dwarfs liable to explode in some circumstances.

Huge gravity compresses a white dwarf --
requires special pressure to support it
(Section 1.2.4, Section 2.3)

- ***Normal pressure*** -- thermal pressure
  - Motion of hot particles -- ***Pressure depends on Temperature***
- ***Quantum Pressure*** -- Quantum Theory, particles as waves
  - Uncertainty Principle -- Can't specify position of any particle exactly. If you squeeze and "locate" a particle more precisely, its energy gets more uncertain, and larger on average.
  - Exclusion Principle -- No two identical particles (electrons, protons, neutrons) can occupy same place with same energy, but they can if one has more "uncertainty" energy.
  - ***Pressure depends only on density, not on temperature***

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

Demonstration thermal pressure, quantum pressure - need volunteeers.

Same mass in all three cases

One Minute Exam: Where is gravity strongest?

A.

B.

C.

Insufficient information

Discussion point:

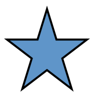
How does the different form of the pressure, thermal or quantum, affect the behavior of stars?

What happens if the star puts in excess nuclear energy?

What happens if the star loses excess energy to space?

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 excess energy, pressure tries to drop, star contracts under gravity, and gets **hotter** (and higher pressure)

White Dwarf Radiate energy, *temperature does not matter*, pressure, size, remain 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!