Wednesday, February 8, 2017

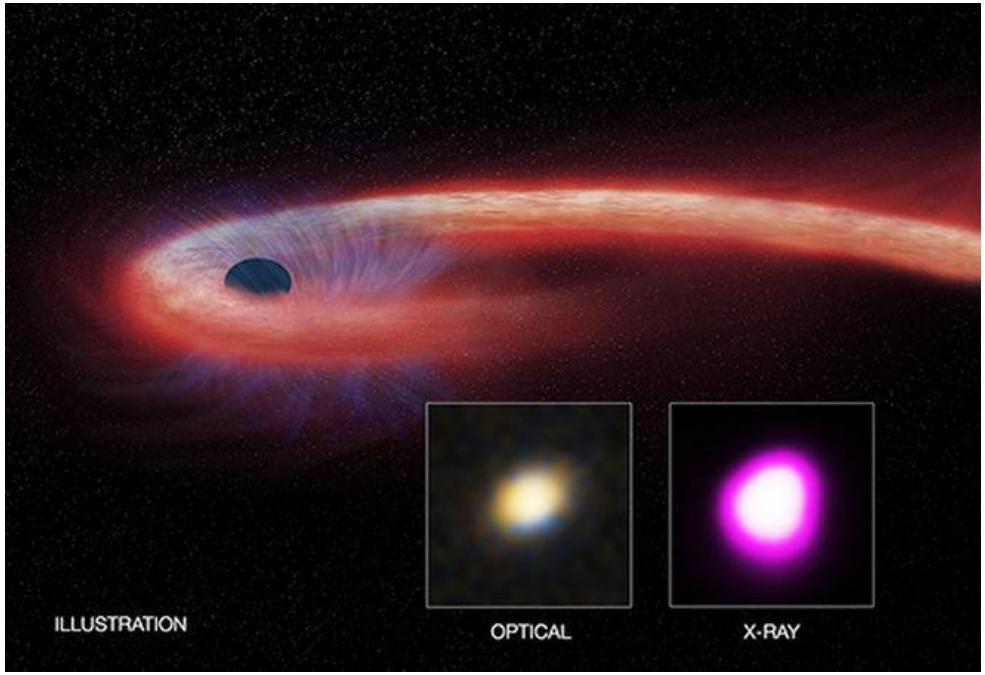
Grades posted. Key posted. Exams, Sky Watch returned.

Little confusion over extra credit. Each question on exam is worth 1 percentage point, not one exam question (3.03 points apiece). Grades have been adjusted.

JCW has been in a workshop on theoretical astrophysics, behind on response to emails.

Astronomy in the news?

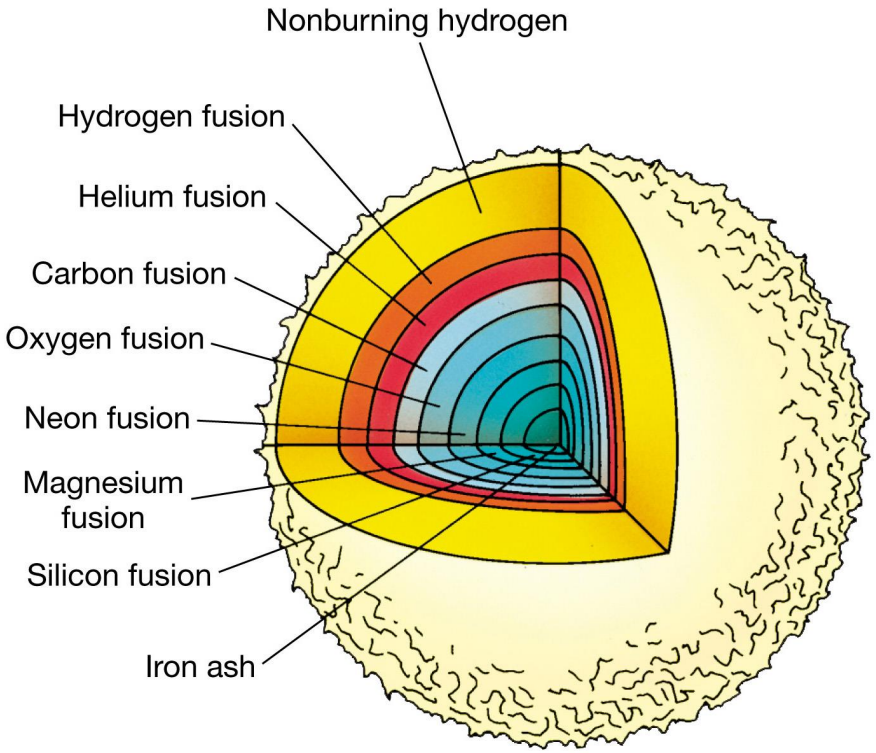
New discovery appears to be a star ripped apart by the black hole, a tidal disruption event, with the black hole feeding on the star for a decade.



Goal: to understand the origin of Type II, Ib, Ic

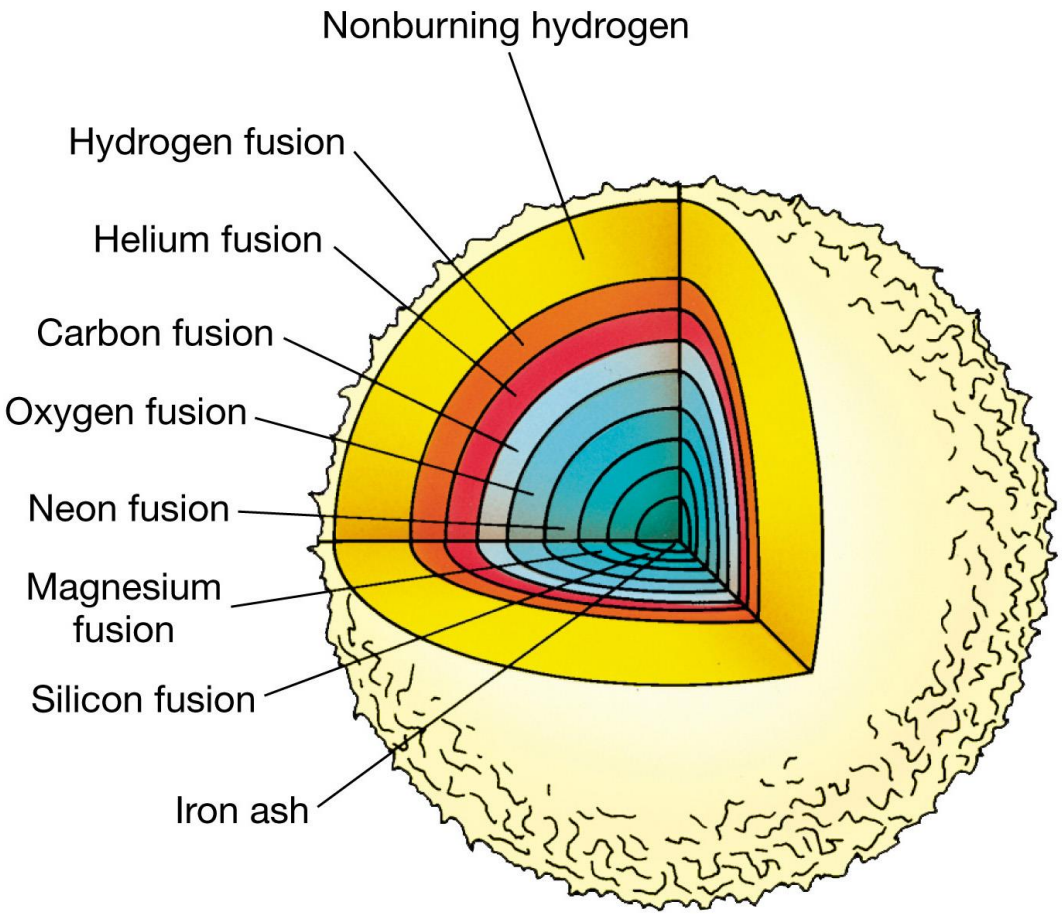
How does a massive star get from hydrogen to iron, and why iron, and what then?

Reading: Chapter 1, Section 2.1 (forces, neutrinos), Chapter 2, Section 2.1, 2.4, 2.5, Chapter 6, Sections 6.4, 6.5 (jets, but not polarization), Betelgeuse interlude, end of Chapter 6.



Goal:

To understand the roles of thermal pressure, charge repulsion, and the strong nuclear force in controlling the way massive stars evolve.



Nuclear physics:

Protons and neutrons attract each other.

The **strong nuclear force** (Section 1.2.1) binds protons and neutrons together in atomic nuclei.

Short range force, acts only when protons and neutrons are nearly touching.

Protons have positive electrical charge. They repel one another at large distances.

The strong nuclear force can, and does overwhelm the charge repulsion if the protons and neutrons are close enough together.

Evolution of Stars - gravity vs. charge repulsion § 2.1

Discussion point: Why do you have to heat a fuel to burn it?

$H \rightarrow He \rightarrow C \rightarrow O$
more protons, more charge repulsion, must get ever hotter to burn ever "heavier" fuel

Just what massive stars do!
Support by thermal pressure.
When fuel runs out, **core loses energy**, but gravity squeezes, core contracts and HEATS UP
overcomes higher charge repulsion, burns new, heavier fuel, ***until get to iron***

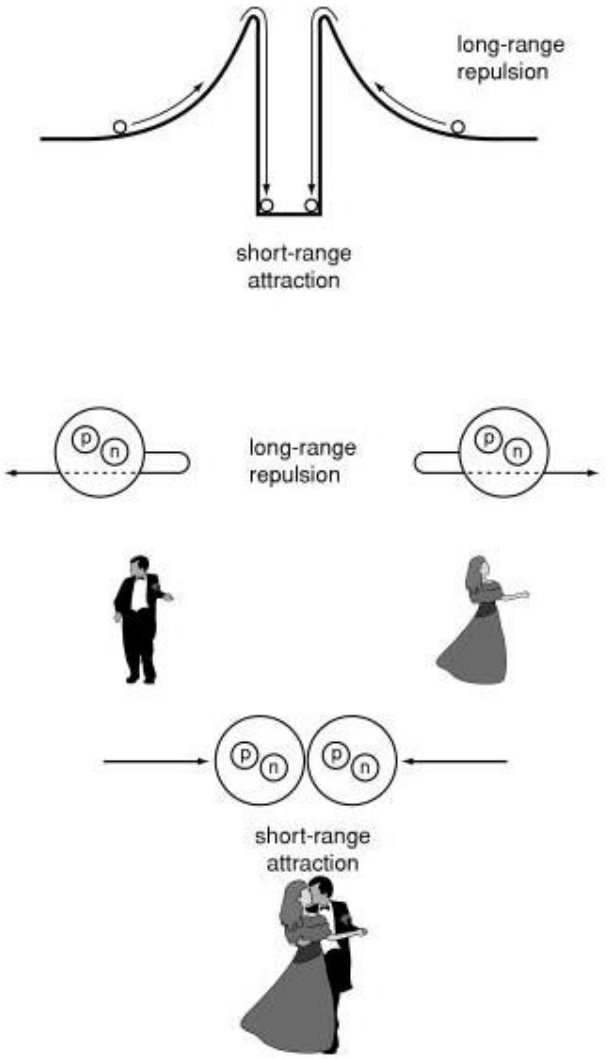


Figure 2.1

Massive stars make a succession of heavier elements

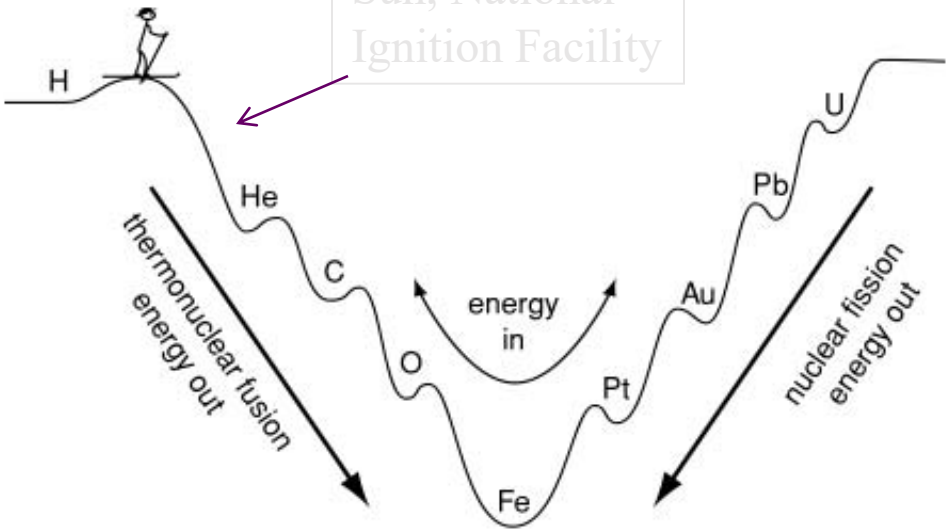


Figure 2.3 measure of binding energy of protons and neutrons in the atomic nucleus

Special role of Iron - 26p, 30n, most tightly bound arrangement of protons and neutrons.

Endothermic - must put energy in to break iron apart into lighter elements or to forge heavier elements. **Iron absorbs energy**, lowers pressure, core contracts, iron absorbs more energy, more contraction…

=> The iron core quickly collapses! Catastrophic death of the star.