Monday, February 17, 2014

Grades posted on Blackboard, Keys on Web site.

New exam schedule for 2, 3, 4 on MONDAYS, 3/3, 3/31, 4/14. 5th still on Friday, 5/2. Reviews will still be on previous Thursdays.

Reading for Exam 2: Sections 6.1, 6.4, 6.5, 6.6, Betelgeuse interlude.

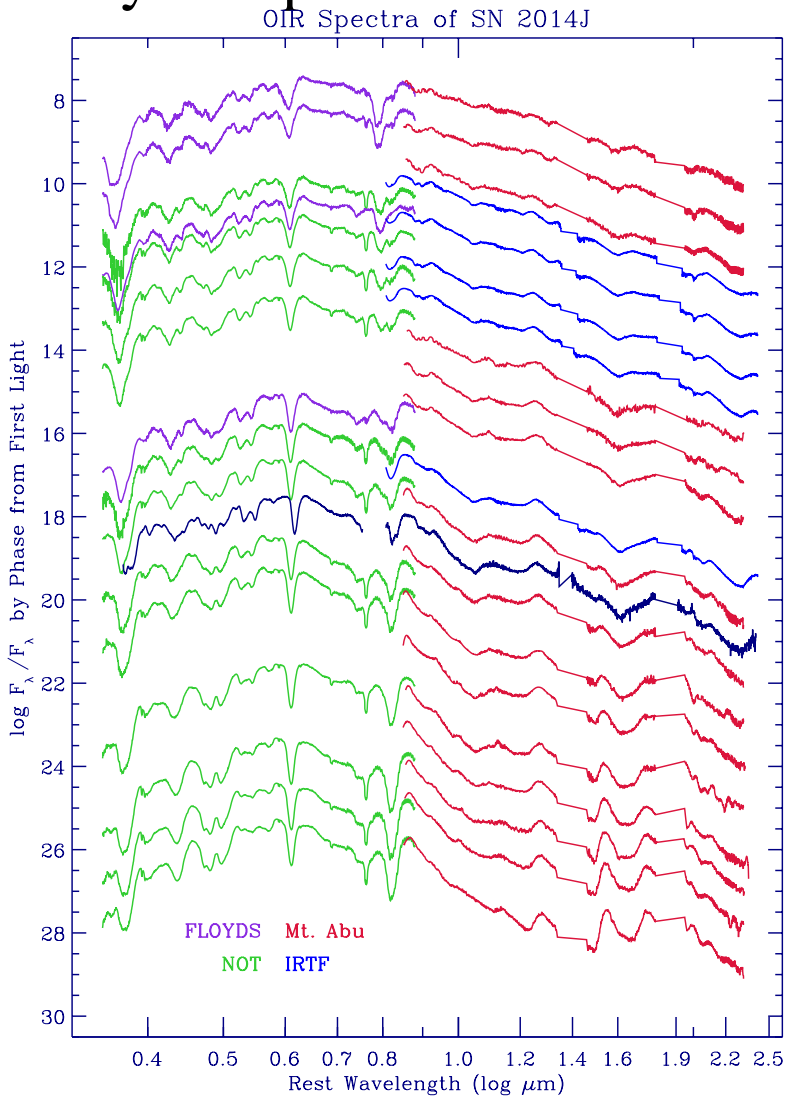
Background: Sections 1.2.1, 2.1, 2.2, 2.4, 2.5, 3.3, 3.4, 3.5, 3.10, 4.1, 4.2, 4.3, 4.4, 5.2, 5.4

Astronomy in the news:

It's warm in Sochi

Update on new “nearby” supernova SN 2014J in M82

Optical and infrared spectra. The real guts of how astronomers analyze supernovae.

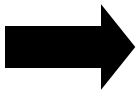


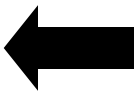
Goal

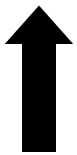
To understand what happens after a massive star forms an iron core

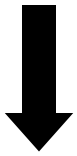
One minute exam

What is the importance of neutrinos in massive stars?

 They cause the collapse of the iron core

 They carry off most of the energy of collapse

 They convert electrons into protons

 They eject the outer envelope of the star

Iron core of massive star absorbs energy.

When iron core forms - star is doomed to collapse.

Iron core collapses in about 1 second to form a ***neutron star*** (or maybe a black hole), composed essentially of all neutrons. Neutrons are formed when protons and electrons combine.

$p + e \rightarrow n + \nu$ ***neutrino***,

Action of Weak Nuclear Force (Chapter 1.2)

One neutrino is generated for every proton that is converted, a star's worth of protons

$\Rightarrow$***lots of neutrinos***

Goal

To understand how the collapse of an iron core can trigger a supernova explosion

When a neutron star forms, get huge energy from dropping from size of Earth or White Dwarf to size of Austin.

100 times more energy than is needed to explode off the outer layers of the massive star.

That does not guarantee an explosion!

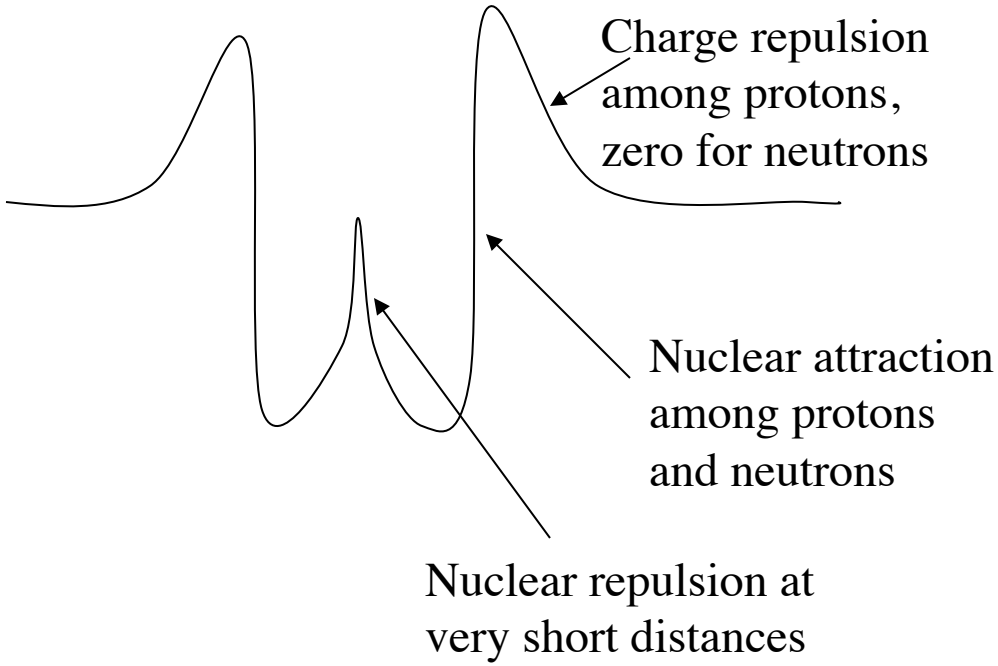
The outer parts of the star, beyond the neutron star, are ***transparent to the neutrinos***, the neutrinos flood out freely and carry off most of the energy, about 99%.

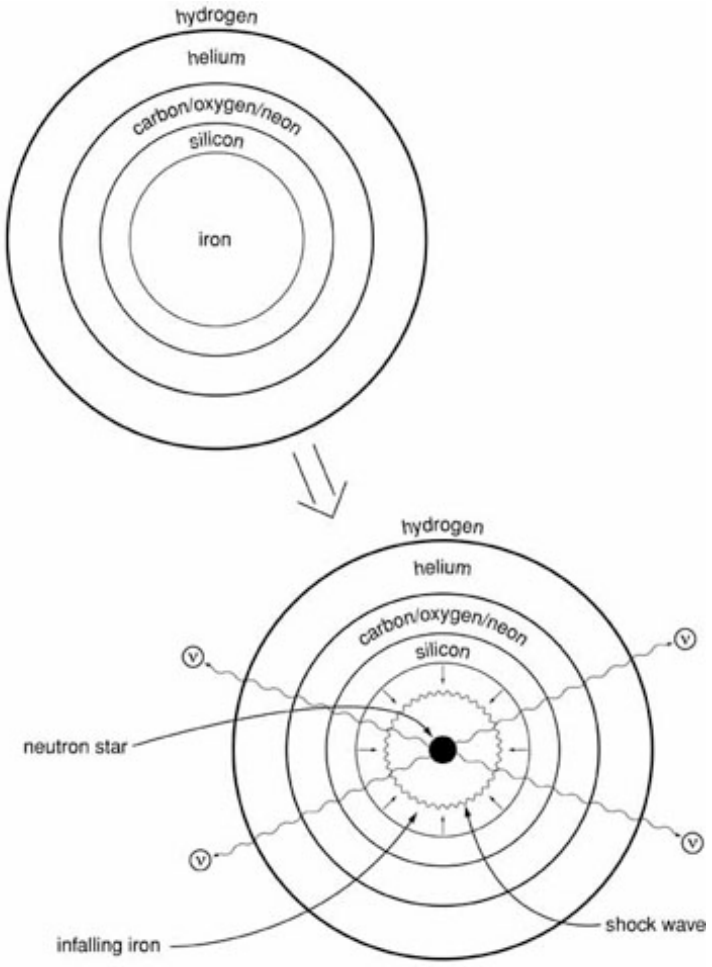
Is 1% of the neutrino energy left behind to cause the explosion?

Tough problem! 1.5% is plenty, 0.5% is too little.

Collapse of iron core to form neutron star is halted by the repulsive strong nuclear force at very close distances, high compaction of neutrons (somewhat uncertain)
+ quantum pressure of neutrons

Fig 6.1

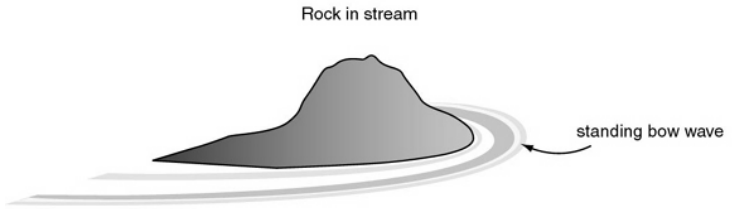




Maximum mass of a neutron star is 1.5 to 2 solar masses

New-born neutron star over compresses and rebounds - potential mechanism for explosion,

DOES NOT WORK!



Form ***standing shock***, and outer material just continues to fall in, pass through shock front and settle onto the neutron star.