September 15, 2010

Exams returned, answers posted on web page, grade histogram.

Reading, Sections 6.4, 6.5. Sections 1.2, 2.1, 2.4, 2.5 for background.
Next week, Section 6.6, Chapter 7.

Astronomy in the News?

Pic of the Day – what phase was the Moon in last night?

Goal

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

One minute exam

Why do you have to heat a nuclear fuel to make it burn?

 Charge repulsion keeps nuclei apart

 The strong nuclear force keeps nuclei apart

 To overcome the loss of neutrinos

 To make neutrons

One minute exam

What is the importance of iron in massive stars?

 It produces a great deal of energy

 It absorbs energy

 It produces neutrinos

 It combines with oxygen and produces rust

Iron core of massive star absorbs energy, collapses in about 1 second to form a ***neutron star***.

Essentially all protons and electrons are converted to neutrons with the emission of a ***neutrino***, tiny mass, no electrical charge, interacts little with normal matter, only through weak nuclear force (Chapter 1.2)

Neutron Star - mass of Sun, but size of small city, ~ 10 kilometers in radius, density of atomic nucleus.

Huge gravity - surface is now ***much closer*** to the center!

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!

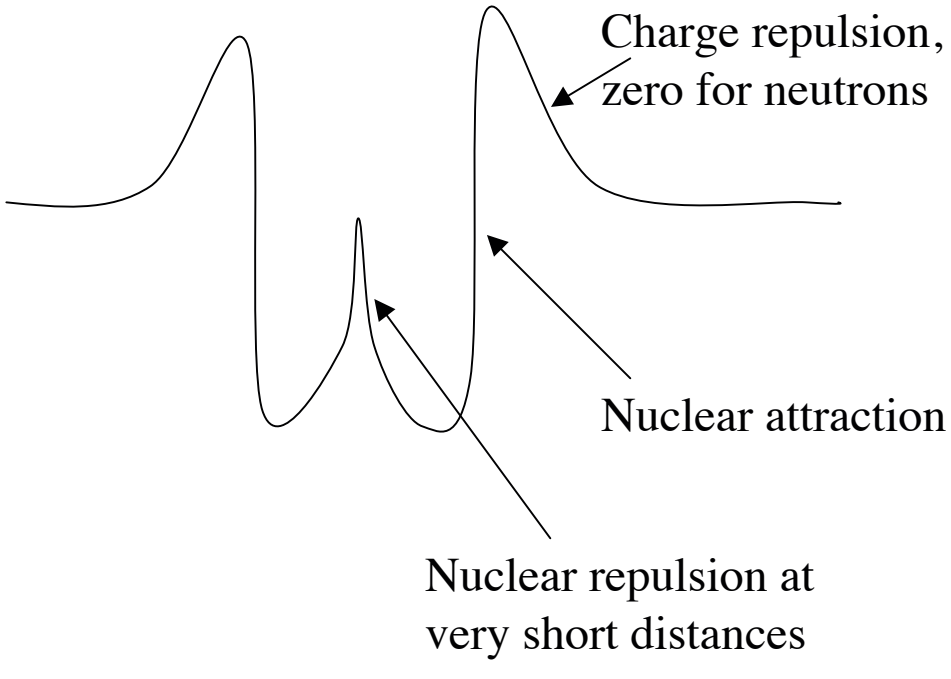
The outer parts of the star, beyond the neutron star, are ***transparent to the neutrinos***, the neutrinos flood out freely and carry off most of the energy.

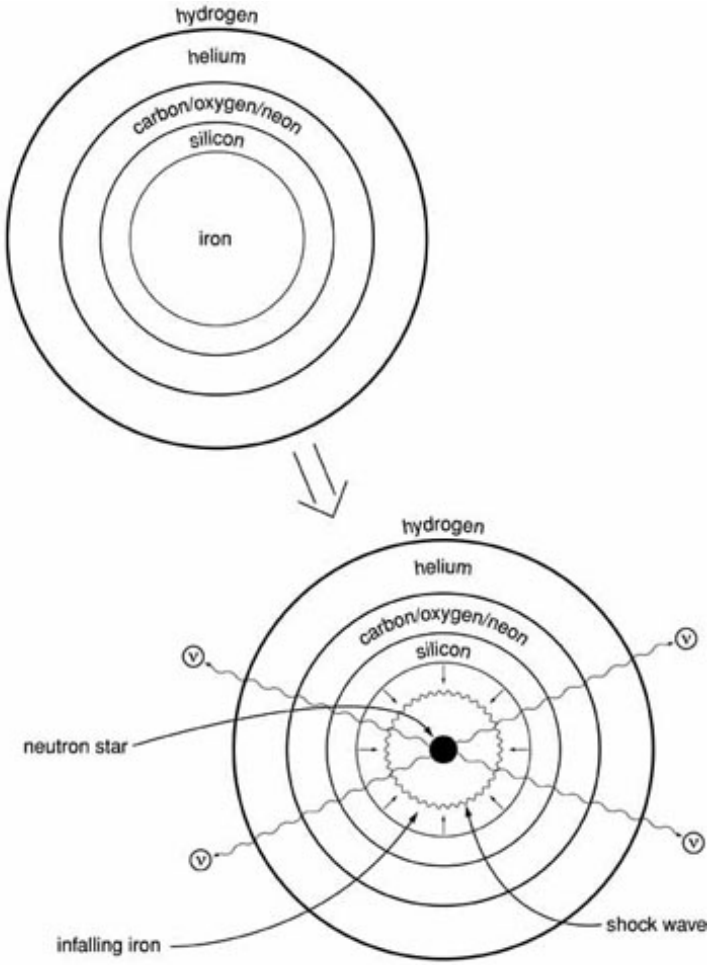
Is 1% of the neutrino energy left behind to cause the explosion?

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

Fig 6.1

Collapse is halted by the repulsive nuclear force (somewhat uncertain) + quantum pressure of neutrons

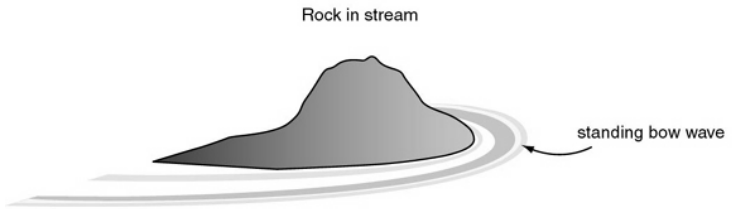




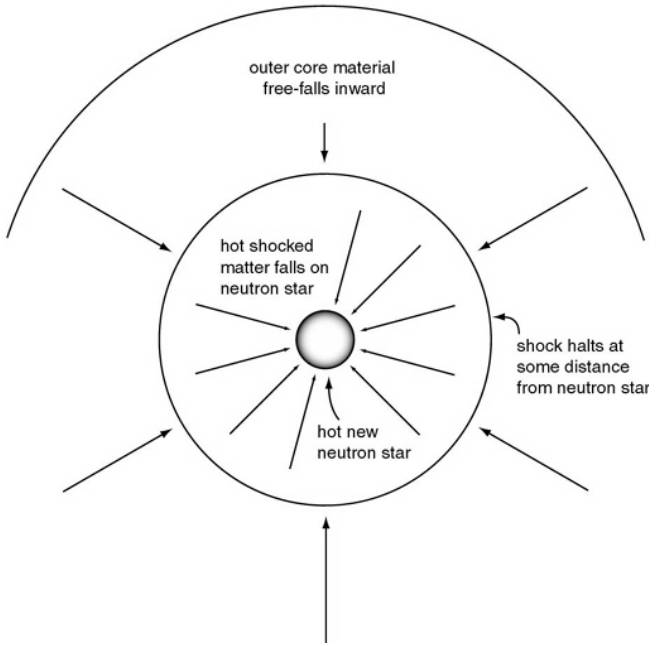
Maximum mass of a neutron star is 1.5 to 2 solar masses

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

DOES NOT WORK!



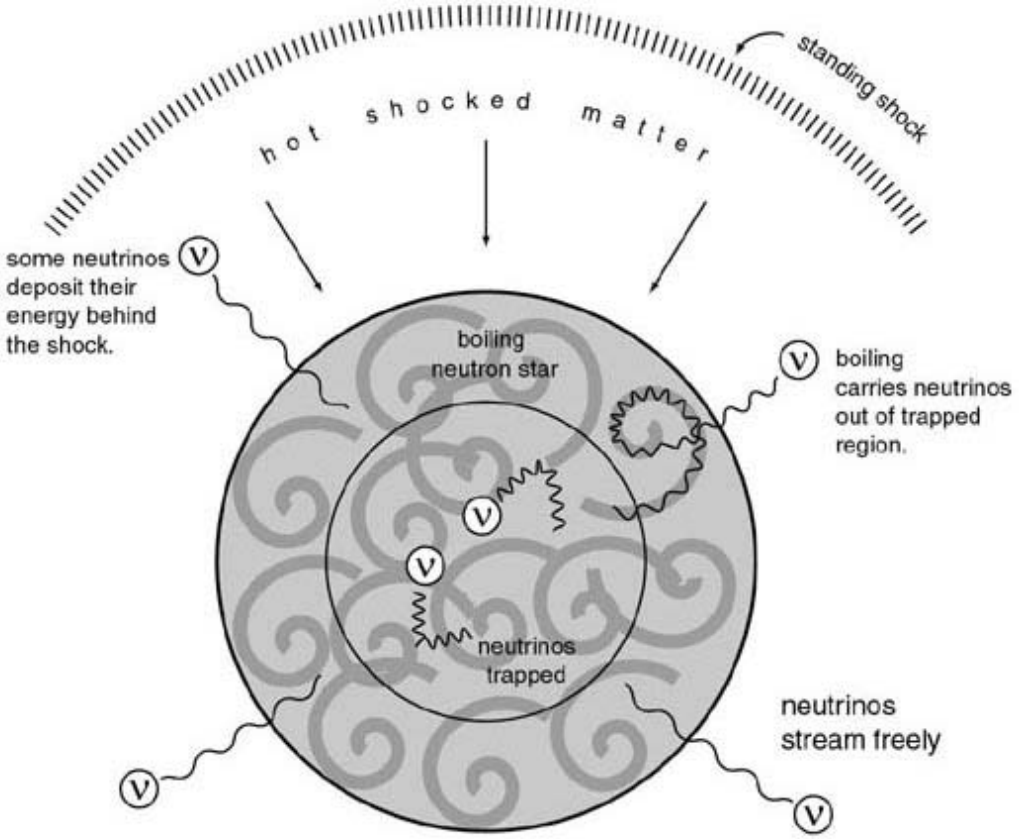
Form ***standing shock***, and outer material just continues to fall in, pass through shock front and settle onto the neutron star.



Perhaps the neutron star can boil out neutrinos at a higher rate…

Possible, but still not proven,

A bit like boiling a pot on the stove, the steam comes out, but lid just rattles, it does not explode to the ceiling.



May need a new idea…