Friday, February 10, 2012

Reading Chapter 6 (continued) Sections 6.4, 6.5, 6.6, 6.7
(background: Sections 1.2, 2.1, 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?

News:

Darwin Day this Sunday, February 12.

Astrobiology:

Russians tunnel into Lake Vostok, size of Lake Ontario 600 miles from South Pole, 2 miles under the Antarctic ice. Sealed from air and sunlight for 15 – 30 million years.

Is there life in Lake Vostok? What form? Extremophile.

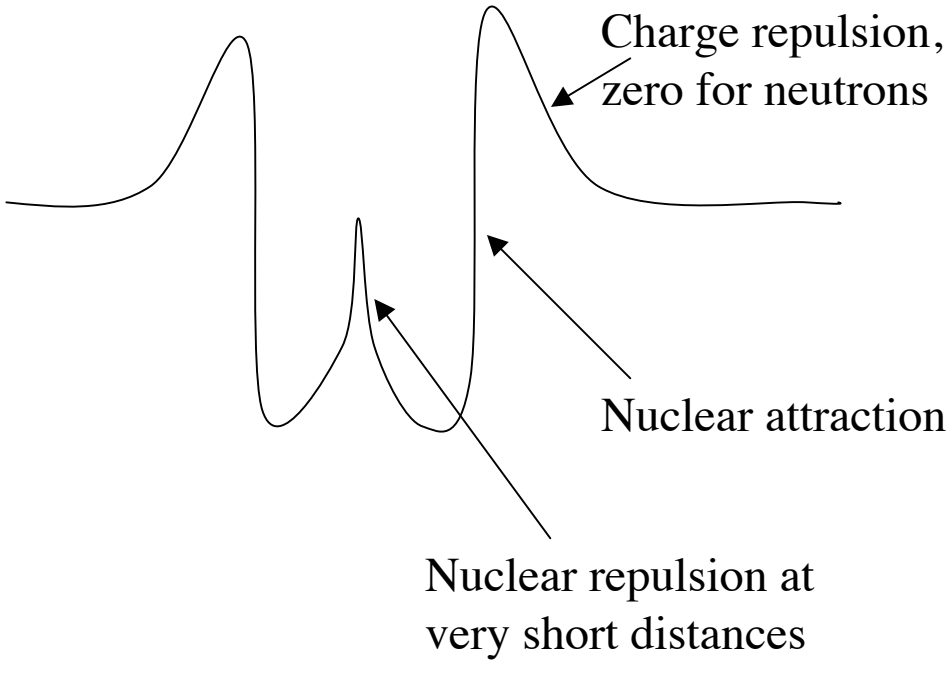
Maybe like Jupiter's moon, Europa.

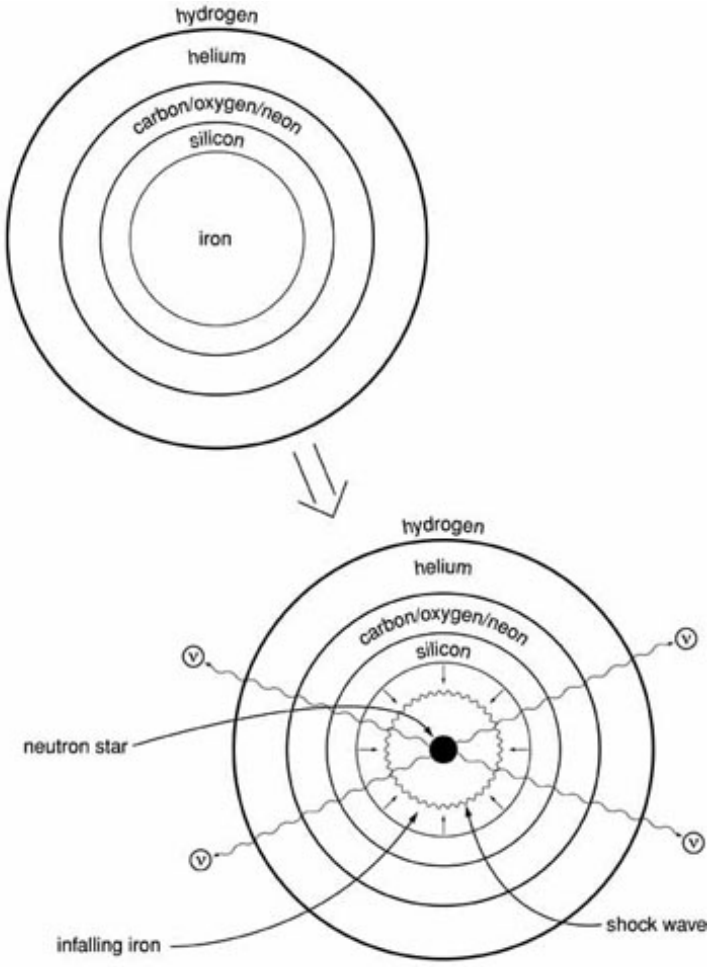
Goal

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

Fig 6.1

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

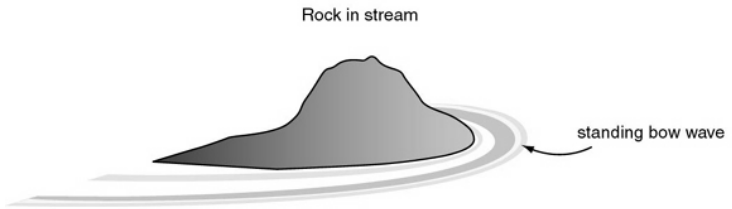




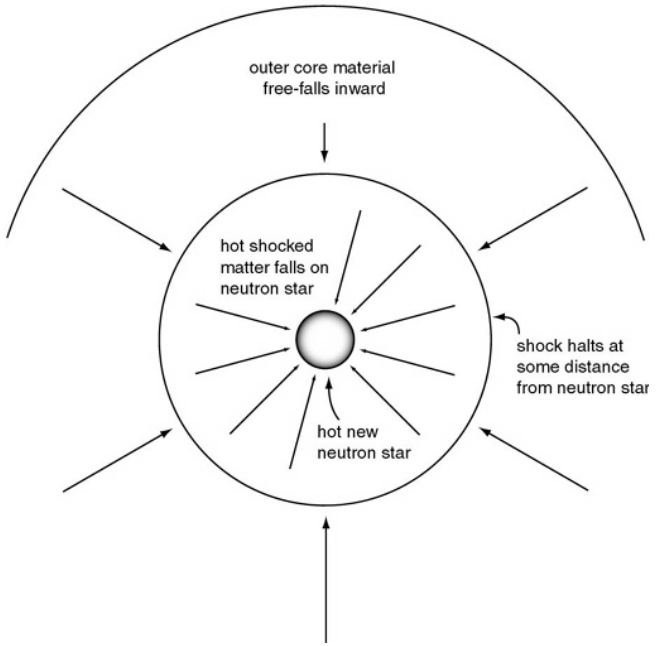
Maximum mass of a neutron star is 1.5 to 2 solar masses

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

DOES NOT WORK!



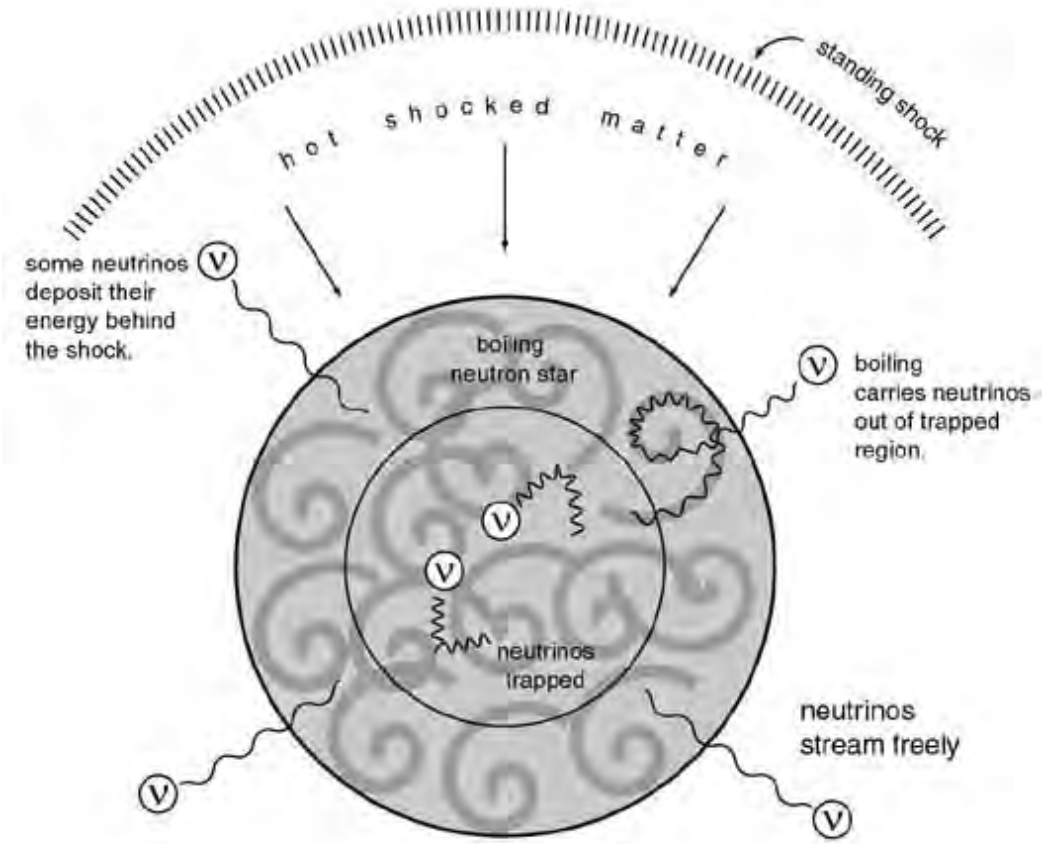
Form ***standing shock***, and outer material just continues to fall in, pass through shock front and settle onto the neutron star.



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…

One Minute Exam:

Most of the energy liberated in the formation of a neutron star is emitted in the form of:

Neutrons

Protons

Neutrinos

Photons

One Minute Exam

What happens to the ***shock wave*** produced when an iron core collapses to form a neutron star and bounces?

 It fades away

 It propagates out through the star and causes an explosion

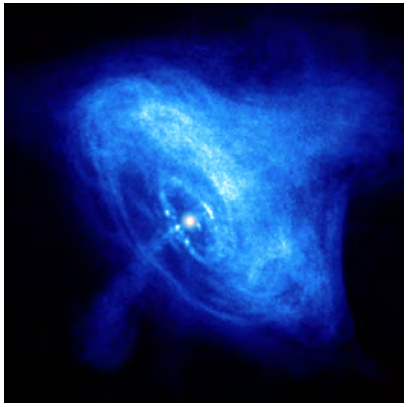
 It stalls at some distance from the neutron star

 It traps neutrinos

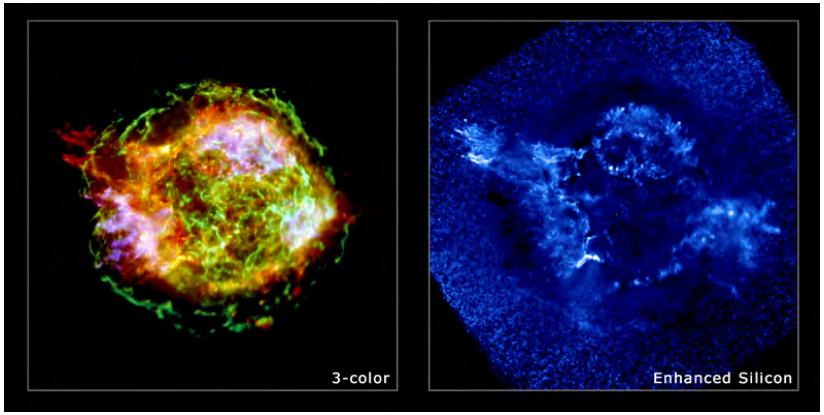
Goal

To understand how jets may trigger a core –collapse supernova explosion

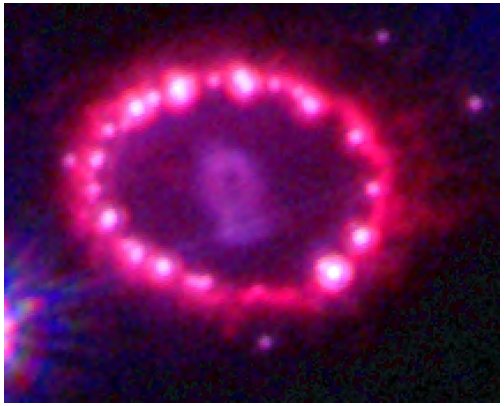
New possibility - Jet-induced supernova (Ch 6, p. 94)



Crab Nebula



Cassiopeiae A



SN 1987A

Are jet-like flows typical? Are they important?

Studies (last 10 years) show that all Core Collapse Supernovae (massive stars: Type II, Ib, Ic) are out-of-round.

Perhaps combination football, frisbee, or something else.
Death Star Explosion (YouTube)

Supernovae show shapes consistent with (but not necessarily proving) jet-like flow.

Calculations show jets emerging from newborn neutron star can explode the star, make it out-of-round.

Predict a jet/torus “bagel and breadstick” shape

What jets do -

Bagel and breadstick, jet/torus shape “natural.”