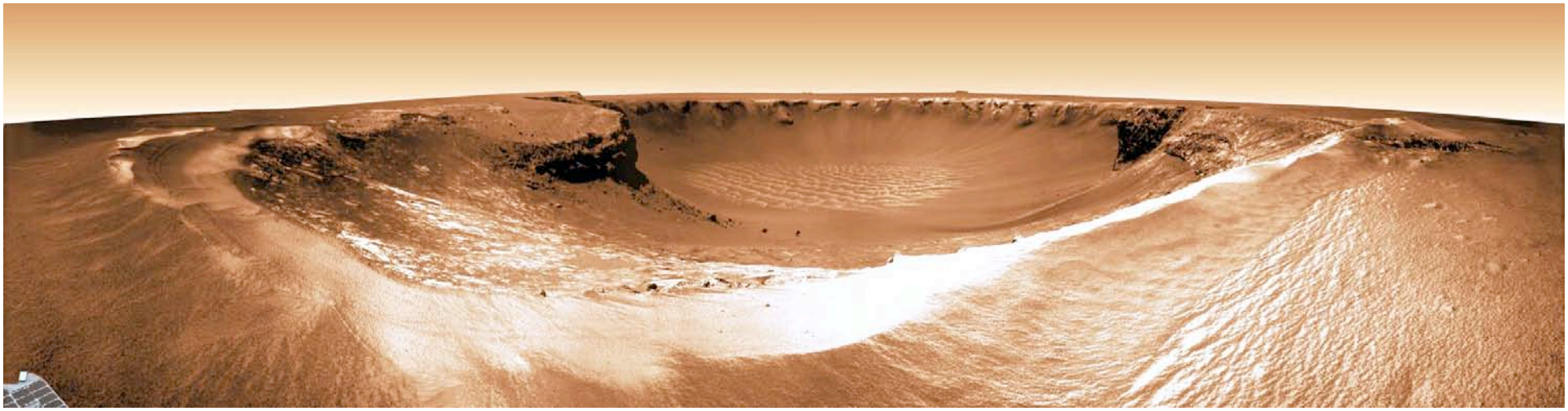
10/2/06

News?

Pic of the day - Mars Rover Opportunity at Victoria Crater



One minute exam

What is the importance of iron in massive stars?

A) It produces a great deal of energy

B) It absorbs energy

C) It produces neutrinos

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

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 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!

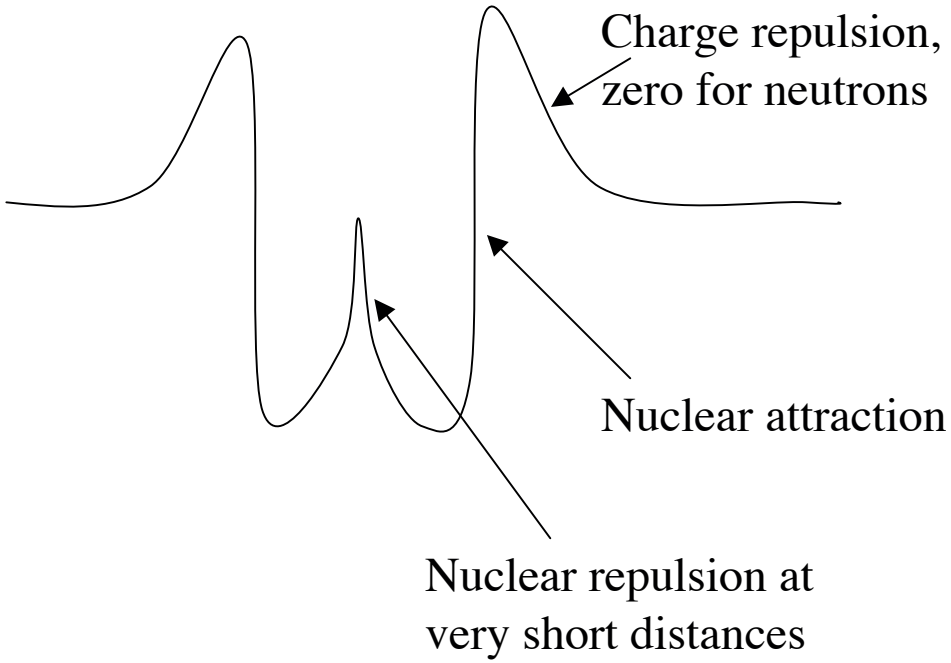
The outer parts of the star, beyond the neutron star, are ***transparent to the neutrinos***, the neutrinos flood out freely and carry off most of the energy.

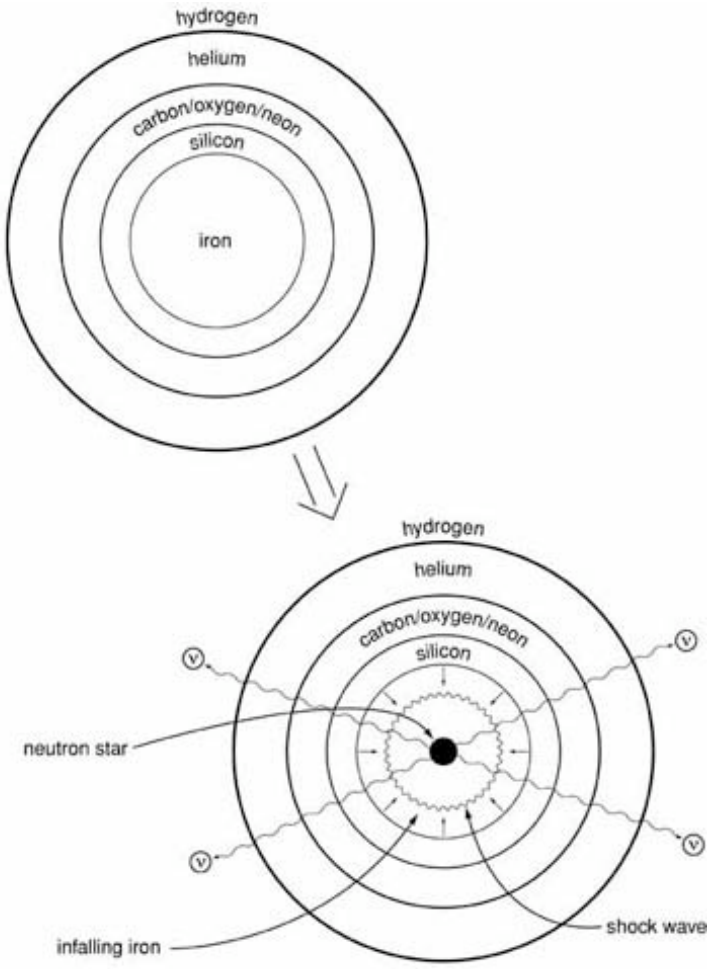
Is 1% of the neutrino energy left behind to cause the explosion?

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

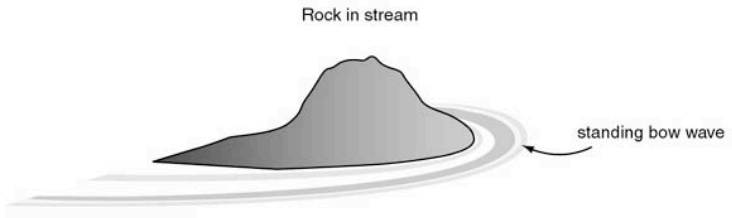




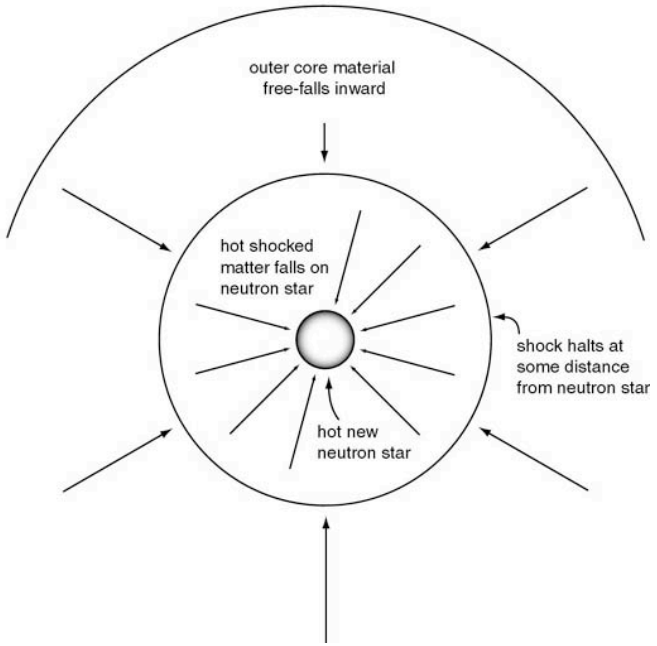
Maximum mass of a neutron star is 1.5 to 2 solar masses

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

DOES NOT WORK!



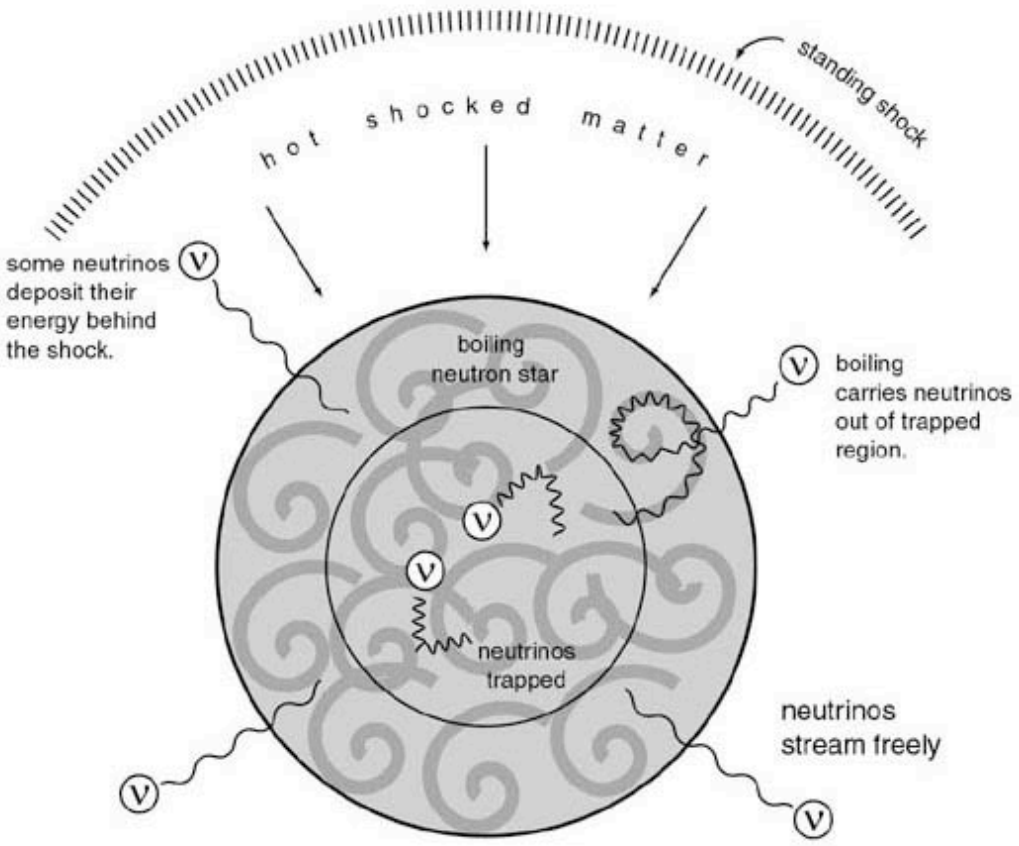
Form ***standing shock***, and outer material just continues to fall in, pass through shock front and settle onto the neutron star.



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…

One Minute Exam

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

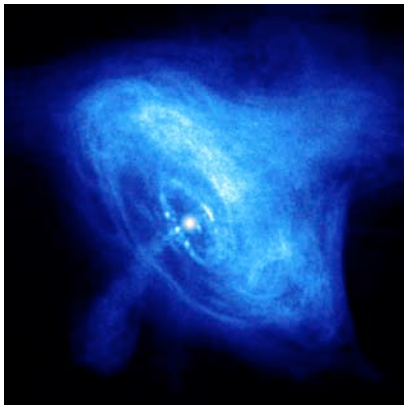
A) Neutrons

B) Protons

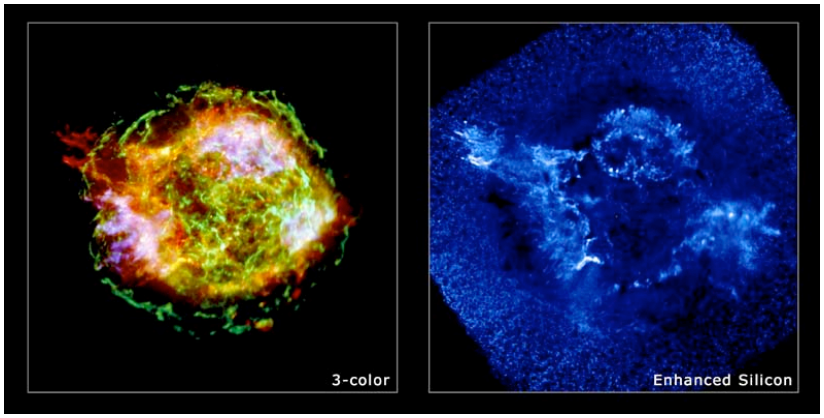
C) Neutrinos

D) Photons

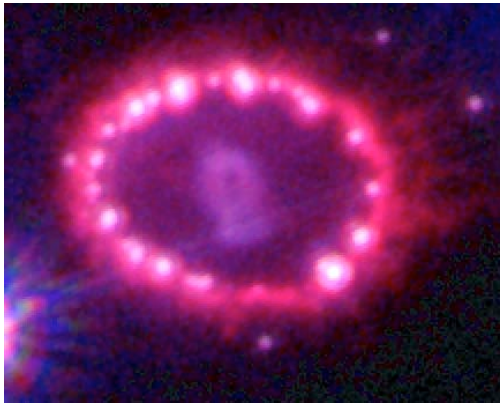
New possibility - Jet-induced supernova (Ch 6, p. 94)



Crab Nebula



Cassiopeiae A



SN 1987A

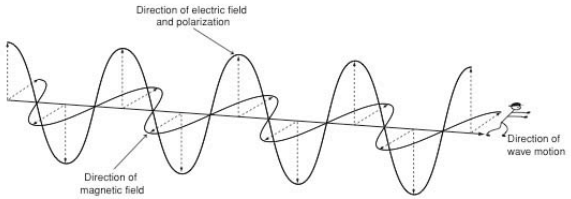
Are jet-like flows typical? Are they important?

What is the shape of a routine, extragalactic, core collapse supernova?

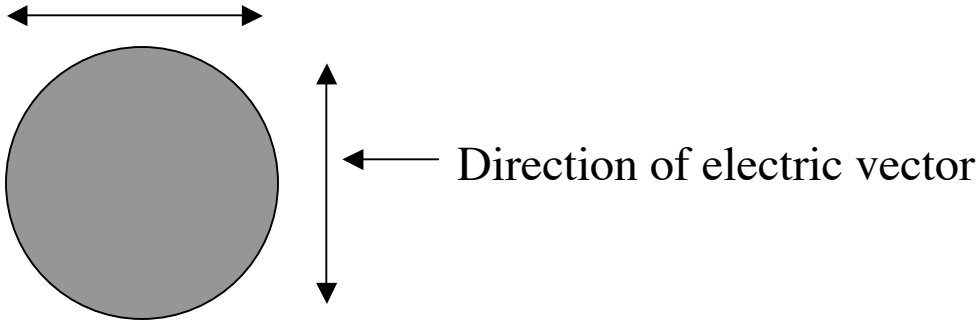
Ball, Football, Frisbee?

How do you measure that for a distant supernova that only appears as a dot of light in even the most powerful telescopes?

Polarization - orientation of the electric component of the electromagnetic waves (light) that comes from the surface of the star.



Polarization = 0: intensity the same in orthogonal directions, photosphere is circularly symmetric, supernova is spherically symmetric (or special viewing angle)



P ≠ 0: intensity different in orthogonal directions, photosphere is not circularly symmetric,
supernova is asymmetric