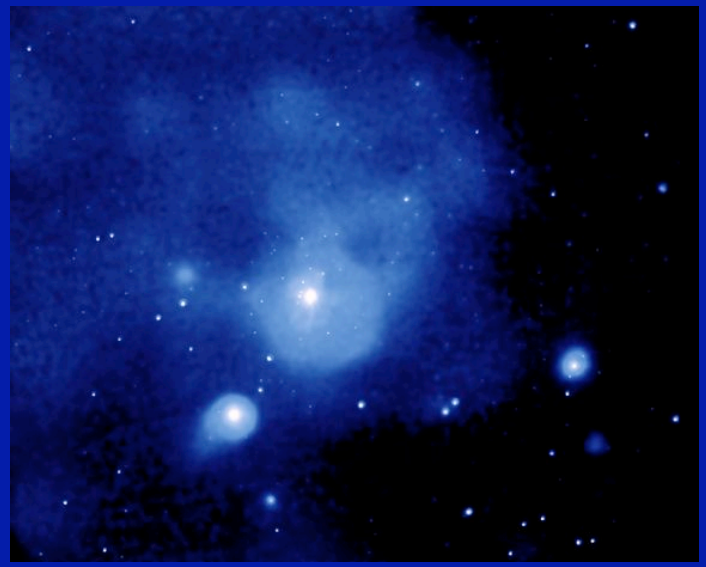
9/24/04

News? Mars Rovers just turned on after being behind the Sun

Pic of the day -

Star Cluster, massive stars



Reading:

Chapter 6 Supernovae

Also § 2.1, 2.2, 2.4 & 2.5 for background

Issues to look for in background:

Why is it necessary for a thermonuclear fuel to get hot to burn - charge repulsion § 2.1 & 2.2

Core Collapse § 2.4 & 2.5

Evolution - gravity vs. charge repulsion
§ 2.1

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

H → He → C → 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 tries to cool but gravity squeezes, core contracts and HEATS UP
overcomes higher charge repulsion, burns new, heavier fuel

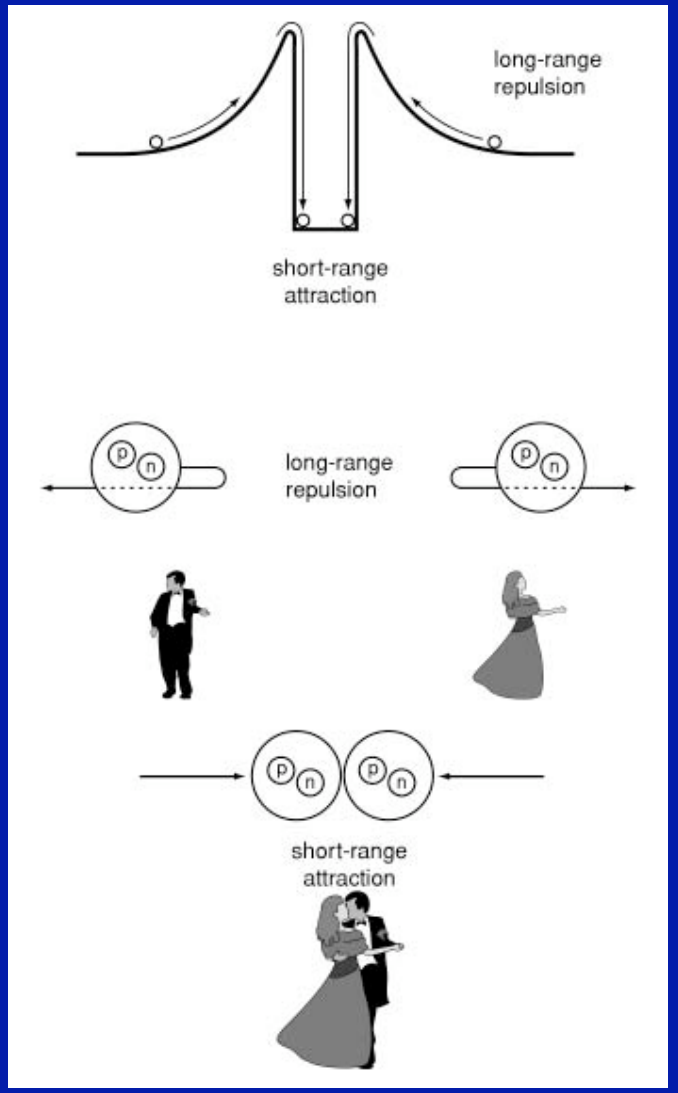


Figure 2.1

Make succession of heavier elements

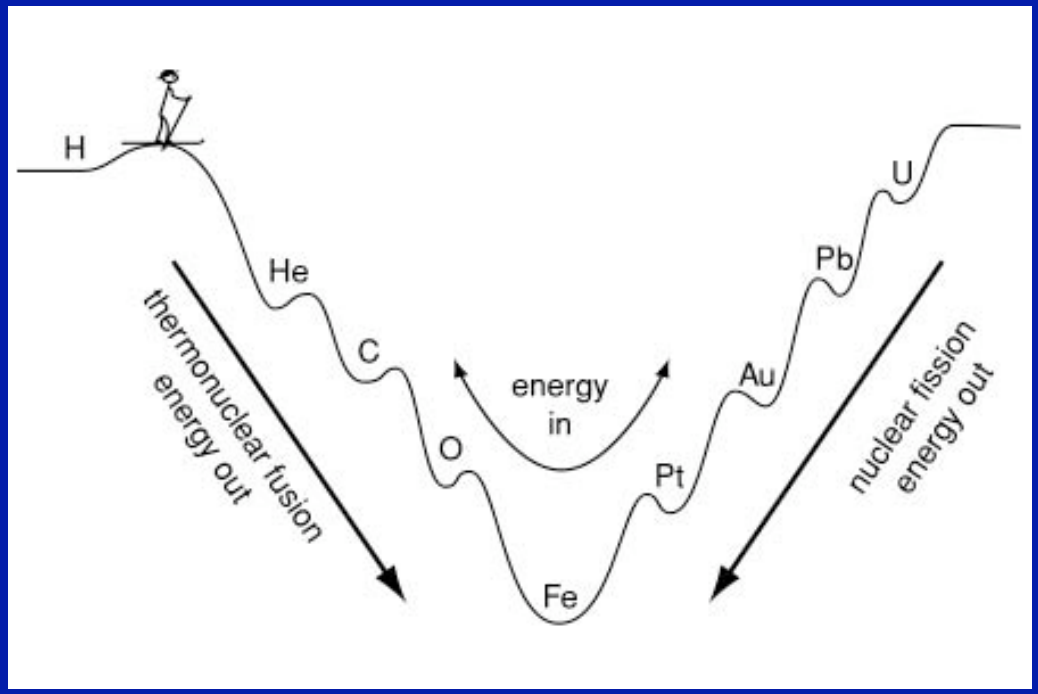


Figure 2.3

Special role of Iron - 26p, 30n

Endothermic - must put energy in to break apart into lighter elements or to forge heavier elements

When iron core forms - star is doomed to collapse, form a neutron star (or maybe a black hole), composed essentially of all n

$p + e \rightarrow n + \nu$ ***neutrino***, one ν for every p => ***lots of neutrinos***

99%of energy of collapse is carried off by neutrinos

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

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

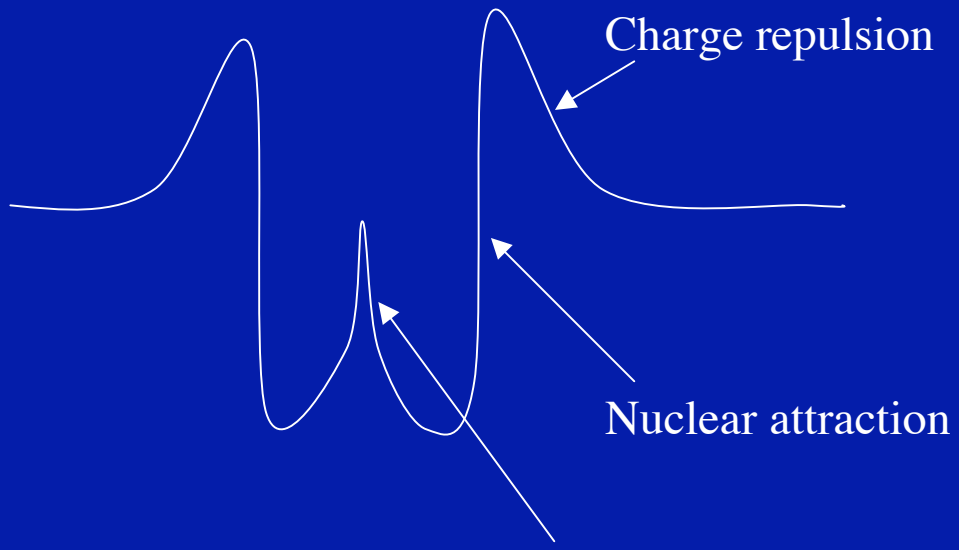
The outer parts of the star, beyond the neutron star are ***transparent to the neutrinos***, the neutrinos flood out freely and carry off most of the energy

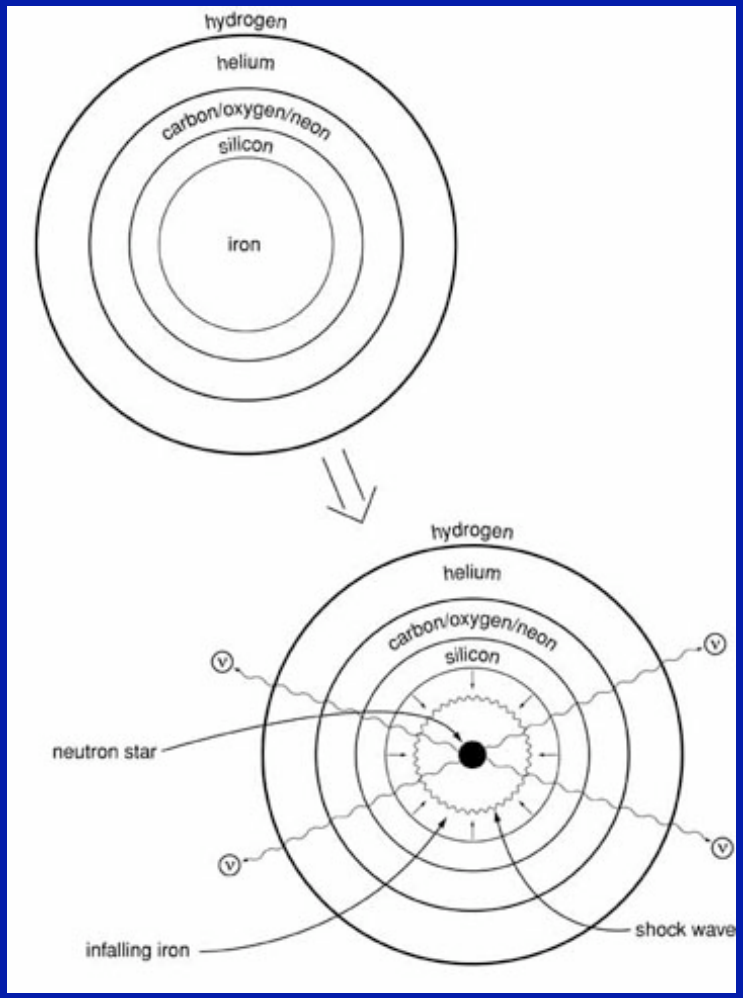
Is 1% of the neutrino energy left behind to cause the explosion?

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 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.