February 7, 2011

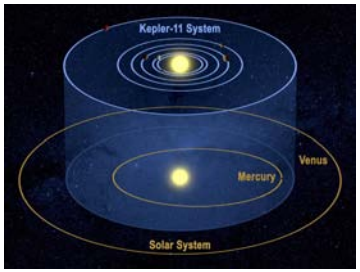
First exam Friday, February 11. Review sheet posted on class web site.

Review Thursday, 5 -6 PM Room TBD. Office hours or special appointment.

Astronomy in the news? Kepler satellite discovers 1235 new exo-planet candidates eclipsing 997 host stars. Briefing this morning by Bill Cochran, local member of Kepler team. One system with 6 planets packed within about the orbit of Venus. Another with the first "rocky" planet, density of 9 gm per cubic centimeter, maybe like Mercury, but 2 to 3 times Earth mass. 54 planet candidates in "habitable zone" that could support liquid water, and hence maybe life. Movie:

http://kepler.nasa.gov/images/videos/KeplerUpdate-Jan2011-180.mov

Pic of the day: From Feb 3, 6 planet system



One minute exam

Why do the elements carbon, oxygen, magnesium, and silicon frequently appear in the matter ejected from supernovae?

 They are built up from the element iron

 They are built up from the element hydrogen

 They are built up from the element helium

 They are built up from the element calcium

One Minute Exam

A supernova that explodes within the spiral arm of a spiral galaxy and shows no evidence for hydrogen or helium in its spectrum is probably a


Type II supernova


Type Ia supernova


Type Ib supernova


Type Ic supernova

***Type Ia***:

No Hydrogen or helium, intermediate mass elements (oxygen, magnesium, silicon, sulfur, calcium) early on, Iron later.

Not in spiral arms, do occur in elliptical galaxies -> old when blow

Peaked light curve

***All consistent with explosion in Chandrasekhar mass carbon/oxygen white dwarf in binary system, total disruption***

***Original mass on the main sequence M < 8 solar masses so that quantum pressure takes over from thermal pressure in the carbon/oxygen core that forms after the helium-burning phase.***

***Type II***: Hydrogen early, Oxygen, Magnesium, Calcium, later.

***Type Ib***: no Hydrogen, but Helium early, Oxygen, Magnesium, Calcium later. ***H envelope lost, by stellar wind or binary star transfer.***

***Type Ic***: no Hydrogen no (or *very* little) Helium early, Oxygen, Magnesium, Calcium later. ***Even more mass loss, by stellar wind or binary star transfer.***

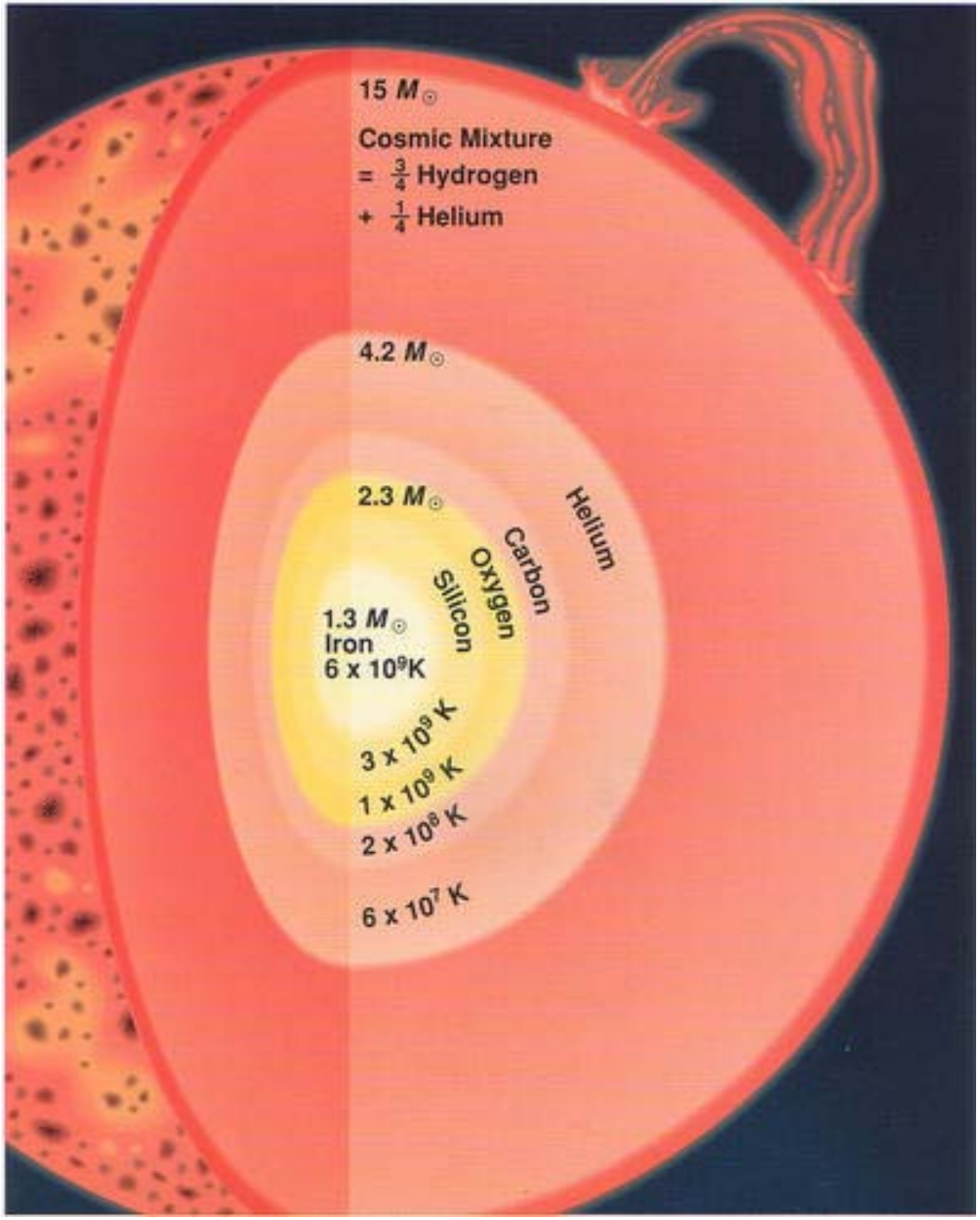
In spiral arms, never in elliptical galaxies -> short lived -> massive star -> expect core collapse, neutron star or black hole.

***Original mass on the main sequence M > 8 solar masses, so that thermal pressure always dominates.***

# End of Material for Test 1

Goal

To understand how a massive star gets from hydrogen to iron, and why iron?




Origin of Type II, Ib. Ic

How does a massive star get from hydrogen to iron, and why iron, and what then?

Discussion point:

What do you know about iron?

Evolution - gravity vs. charge repulsion
§ 2.1

Discussion point: 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, ***until get to iron***

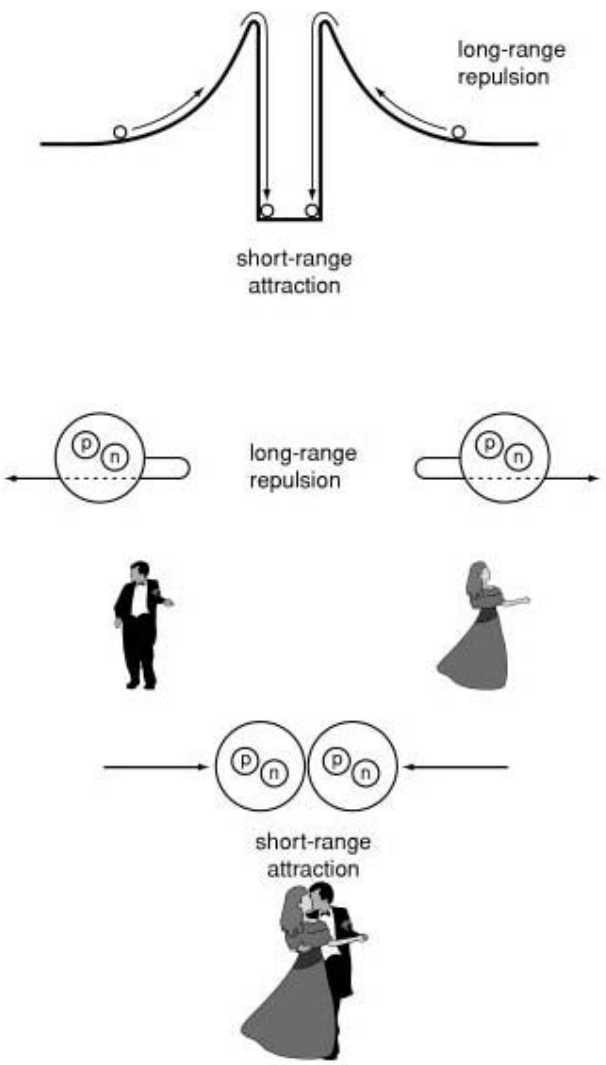



Figure 2.1