Wednesday, February 26, 2014

No office hours today. Have to go wait for a cable guy. If you want to talk about exam 2, please make an appointment.

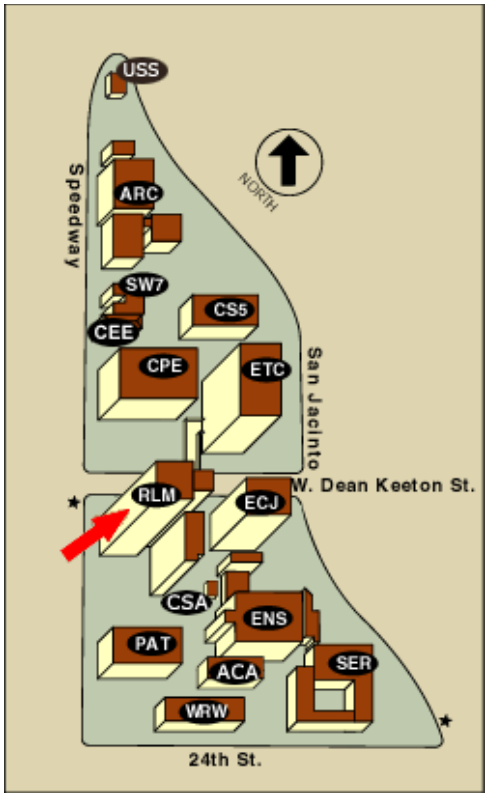
Exam 2, Skywatch 2, Monday, 3/3. Review sheet posted

Review session Tomorrow, 5 – 6 PM, RLM 7.104

Reading for Exam 2: Sections 6.1, 6.4, 6.5, 6.6, Betelgeuse interlude.

Background: Sections 1.2.1, 2.1, 2.2, 2.4, 2.5,

Astronomy in the news:



Update on new “nearby” supernova SN 2014J in M82

Data rolling in. Stay tuned.

Sky Watch Targets

Binary Stars

Sirius, if you have not already done it.

Algol, Beta Persei in Perseus

Antares, Alpha Scorpii in Scorpius

Beta Lyrae in Lyra

Rigel, Beta Orionis in Orion (triple star system)

Spica in Virgo

Sky Watch

Explosions on the surface of white dwarfs, related to Type Ia, but not full-fledged supernovae

Classical Novae:

CP Pup, toward constellation Puppis in 1942

Pup 91, another toward Puppis in 1991 (not same place in our Galaxy, just accidently off in the same approximate direction)

QU Vul, toward constellation Vulpecula, white dwarf composed of Oxygen, Neon, and Magnesium rather than Carbon and Oxygen.

GK Per toward constellation Perseus - has had both a classical nova eruption in 1901 and dwarf nova eruptions.

Sky Watch

More explosions on the surface of white dwarfs

Recurrent Novae:

U Sco in the constellation Scorpius is a Recurrent Nova,
It may be a candidate to explode as a supernova!

Might see Scorpius. Also has neutron stars and black holes.

T Pyx in constellation Pyxis.

RS Oph in Ophiuchus

Goal

To understand the process of thermonuclear explosion in a white dwarf to make a Type Ia supernova.

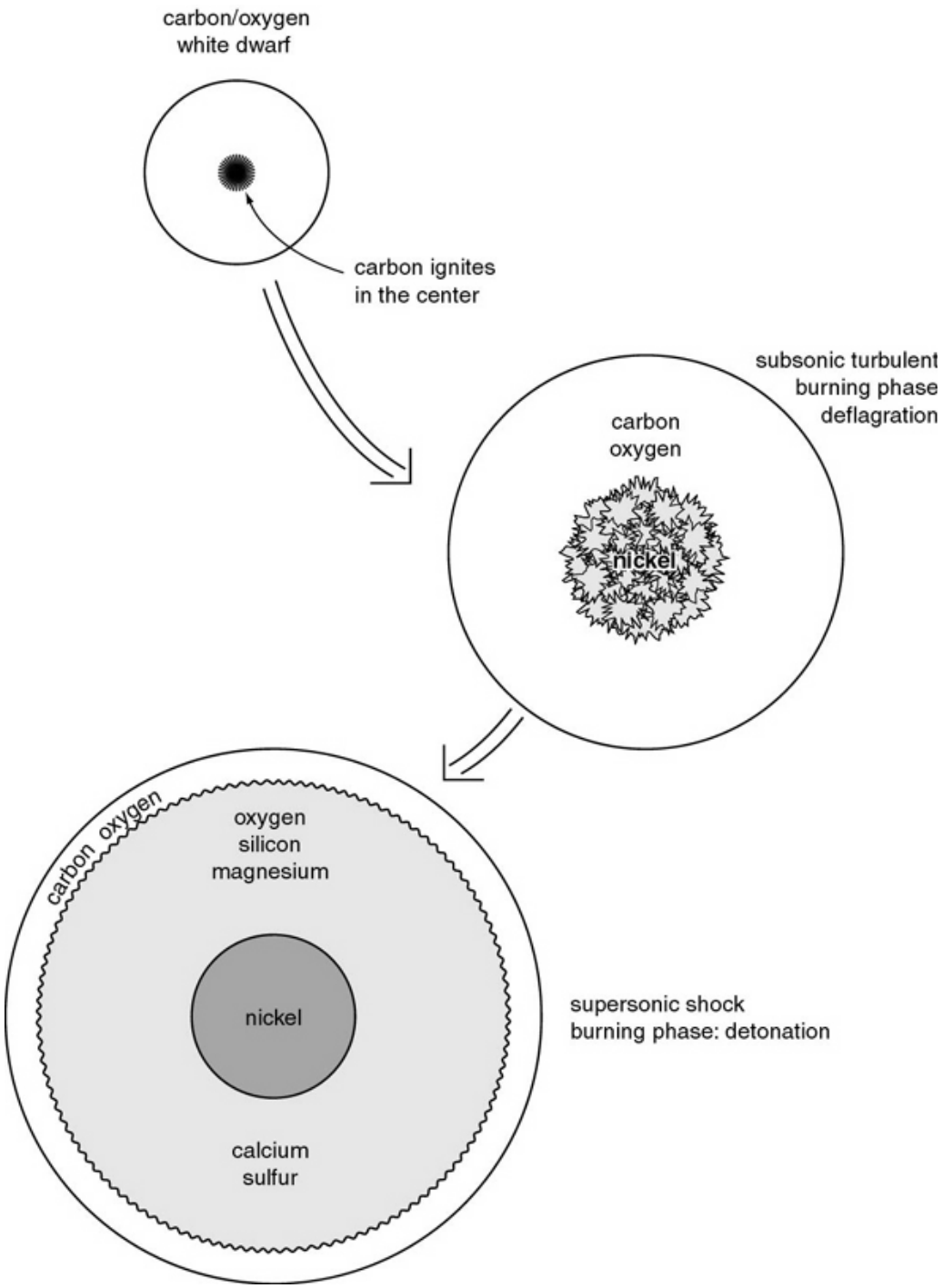
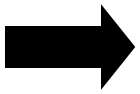


Figure 6.4

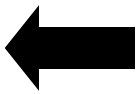
Presence of nickel, conversion of nickel to iron explained later

One Minute Exam

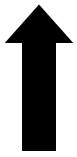
Astronomers detect Silicon when a Type Ia supernova is brightest and iron after it has faded. This means:



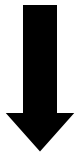
The exploded material is made of equal parts silicon and iron



The silicon is in the outer portions of the ejected matter, the iron in the inner portions



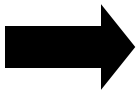
The silicon is in the inner portions of the ejected matter, the iron in the outer portions

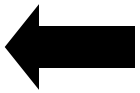


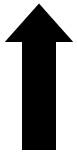
The supernovae was powered by the collapse of an iron core

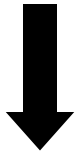
One Minute Exam

A detonation is more violent than a deflagration because:

 A deflagration involves a shock wave

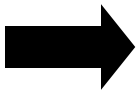
 A detonation involves a shock wave

 A detonation moves subsonically

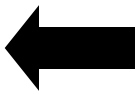
 A deflagration is self-propagating

One Minute Exam

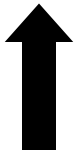
Why does a supersonic detonation alone fail to account for the observations of a Type Ia supernova?



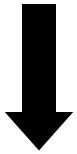
All the ejected matter would be iron.



A neutron star would be left behind.



The ejected matter would contain lots of carbon



The ejected matter would have silicon on the outside and iron on the inside

End of Material for Exam 2

Goal

To understand how stars, and Type Ia supernovae, evolve in binary systems.

Algol, Beta Perseus, second brightest star in the constellation Perseus

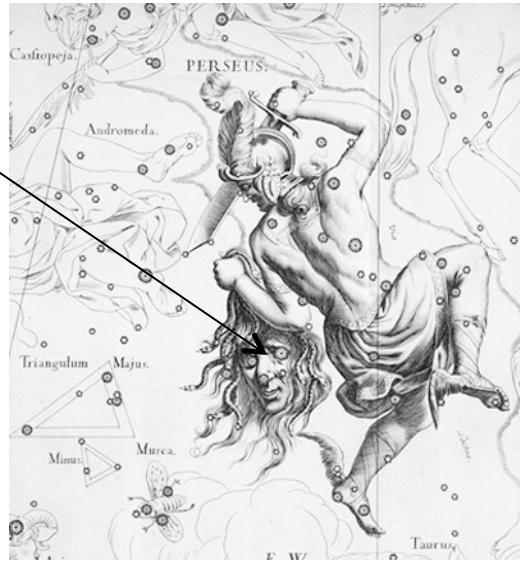
Ancient Arabs called the star **Al-Ghul**, the Ghoul

The Hebrews knew Algol as **Rosh Ha' Satan**, Satan's Head, or perhaps **Rosh Ha' Shed**, head of the devil or of a genie.

The Chinese called it **Tseih She**, the Piled-up Corpses

In Greek mythology, Algol is the head of the Gorgon Medusa that Perseus carries under his left arm.

Algol



Algol is a binary system with a red giant eclipsed by an orbiting main sequence star, giving the impression of a "blinking" red demon.

Find Algol for your Sky Watch Project.

Normal Type Ia ***are*** Chandrasekhar mass, 1.4 $M_{\odot}$, carbon/oxygen white dwarfs; many, if not all, are old.

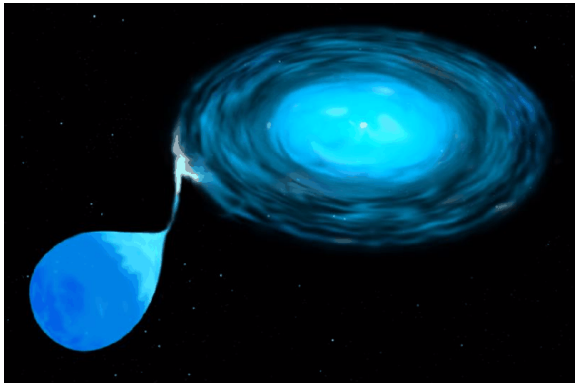
Only credible idea is to grow a white dwarf by mass transfer in a binary system.

No direct evidence for binary systems, some recent indirect hints.

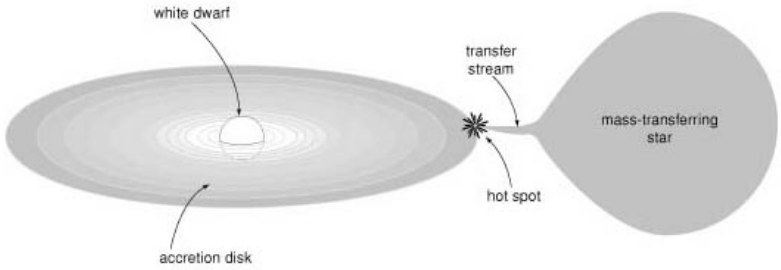
How does nature grow a white dwarf to 1.4 $M_{\odot}$?

The progenitors of Type Ia supernovae may look like this:

What's going on?



White dwarfs in Binary Systems



Binary Evolution: **Chapter 3**

Kepler's 3rd Law P^2 (squared) proportional to a^3 (cubed)

Period
Time to orbit

size of orbit

Newton: P^2 proportional to $\frac{a^3}{M_1 + M_2}$

total mass of 2 stars: method to "weigh" the system, get total, subtract "normal" star, get weight of WD, NS, BH