2/1/06

Exam 1: Week from Friday

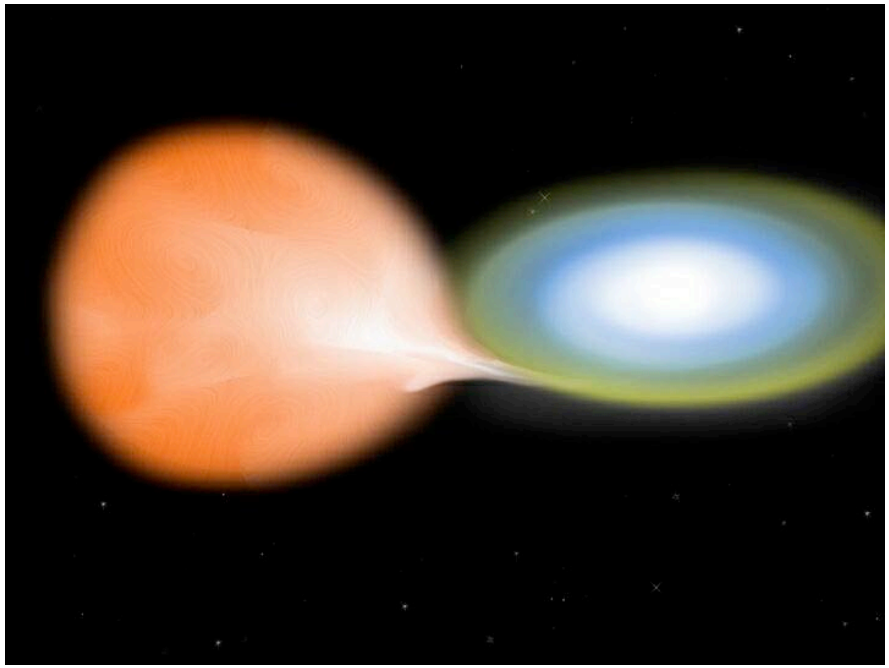
Chapters 1 - 5, Friday, February 10, 30 multiple-choice questions

Review sheet will be posted on web site next week

Review session Thursday 5 PM RLM 4.102 [NOTE different room than help sessions].

Astronomy in the news? No mention of Mars, Moon, NASA in State of the Union

Pic of Day - Venus after Sunset



One Minute Exam

We expect classical nova systems to end up making two white dwarfs orbiting one another because:

A The first white dwarf loses mass and hence cannot grow and explode

B The first white dwarf will accrete mass until it reaches the Chandrasekhar limit

C The main sequence star transferring mass must eventually make a white dwarf

Quantum Pressure -- just depends on squeezing particles, electrons for white dwarf, to very high density
-- depends on density only
-- *does not* depend on temperature

Important Implication:

Normal ☆ Radiate energy, temperature/pressure try to drop, star compresses, gets **hotter** (and higher pressure)

White Dwarf Radiate energy, *temperature does not matter*, pressure remains constant, star gets **cooler**

Opposite behavior

Normal Star - *Regulated* put in energy, star expands, cools

White Dwarf - *Unregulated* put in energy, hotter, more nuclear burning -- explosion!

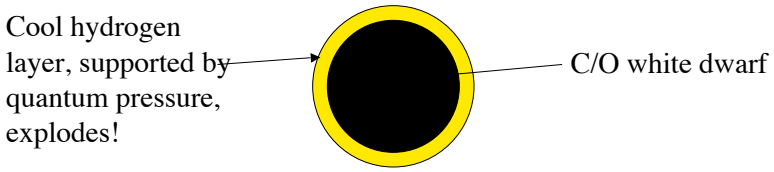
Hydrogen transfers from a main sequence star to a white dwarf in a binary system.

Modest rate of transfer, hydrogen has a chance to radiate and cool as it is added to the surface of the white dwarf, ends up cool but dense, supported by the ***quantum pressure***. If the hydrogen begins to burn the result is:

Unregulated hydrogen burning, an explosion --> ***Classical Nova***

White dwarf loses mass, cannot grow to Chandrasekhar mass

Second star eventually makes its own white dwarf --> 2 WD



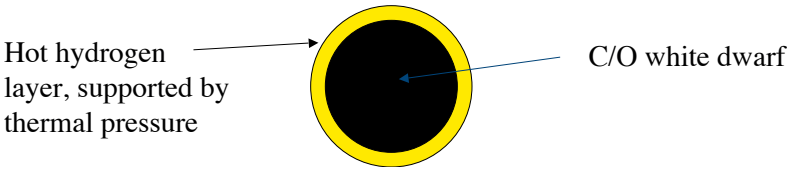
Hydrogen transfers from a main sequence star to a white dwarf in a binary system.

Higher rate of transfer, hydrogen does not have a chance to radiate and cool as it is added to the surface of the white dwarf, it stays hot and is supported by the ***thermal pressure***. If the hydrogen begins to burn the result is:

Regulated burning, bright flash, but no hydrogen explosion --> ***Recurrent Nova***

White dwarf gains mass, can grow to near Chandrasekhar mass

Eventually may ignite carbon in the center, quantum deregulated, explode whole star as a ***supernova***

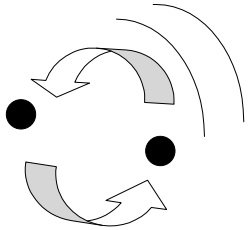


We do observe 2 WDs in orbit in some cases - is that the end?

No: ***gravitational radiation*** (§ 3.10)

ripples in curved space-time

like paddle on surface of pond



remove energy from orbit - acts as drag

If you try to slow down an orbiting object what happens?

Falls inward, speeds up,
Get more gravitational radiation, more inspiral

Given enough time (billions of years) 2WD must spiral together!

One Minute Exam

Name three situations where we have talked about friction and drag causing orbiting stuff to fall inward and ***move faster***.

Flow of gas in accretion disk

Two stars orbiting in a common envelope

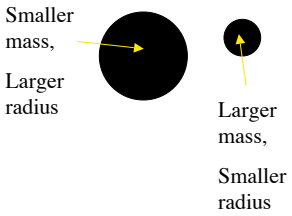
Two orbiting white dwarfs losing energy to gravitational radiation

What happens when two white dwarfs spiral together?

Larger mass WD has smaller radius

Which WD has the smaller Roche lobe?

The smaller mass



Which fills its Roche Lobe first?

Must be the smaller mass

As small mass WD loses mass, its ***radius gets larger***,
but its ***Roche Lobe gets smaller***! Runaway mass transfer.

Small mass WD transfers essentially all its mass to larger mass WD

Could end up with one larger WD

If larger mass hits M_{ch} → could get explosion => Supernova

End of Material for Test 1