1/28/2008

First Test, Chapters 1 - 5, Friday, February 8 (sky watch Monday)

Probably finish lectures by Wednesday, start new material that will be on second test.

MOVE SECOND TEST UP TO FEBRUARY 29, not the day before spring break….

No math, but you will have to think. Concentrate on lectures

Astronomy in the news? Asteroid close approach to Earth tomorrow. Spy satellite will crash in February. Drag will cause it to fall inward, move FASTER, more drag.

Pic of the Day - depiction of solar eclipse
in 1700's

Sky Watch

Dwarf Novae:

SS Cygni - brightest dwarf novae in the sky, but a bit too dim for naked eye. In constellation Cygnus, tough this time of year.

U Geminorum - in the constellation Gemini

Self-graded pop quiz

Draw a picture of two stars with their Roche lobes and label which star has the largest mass.
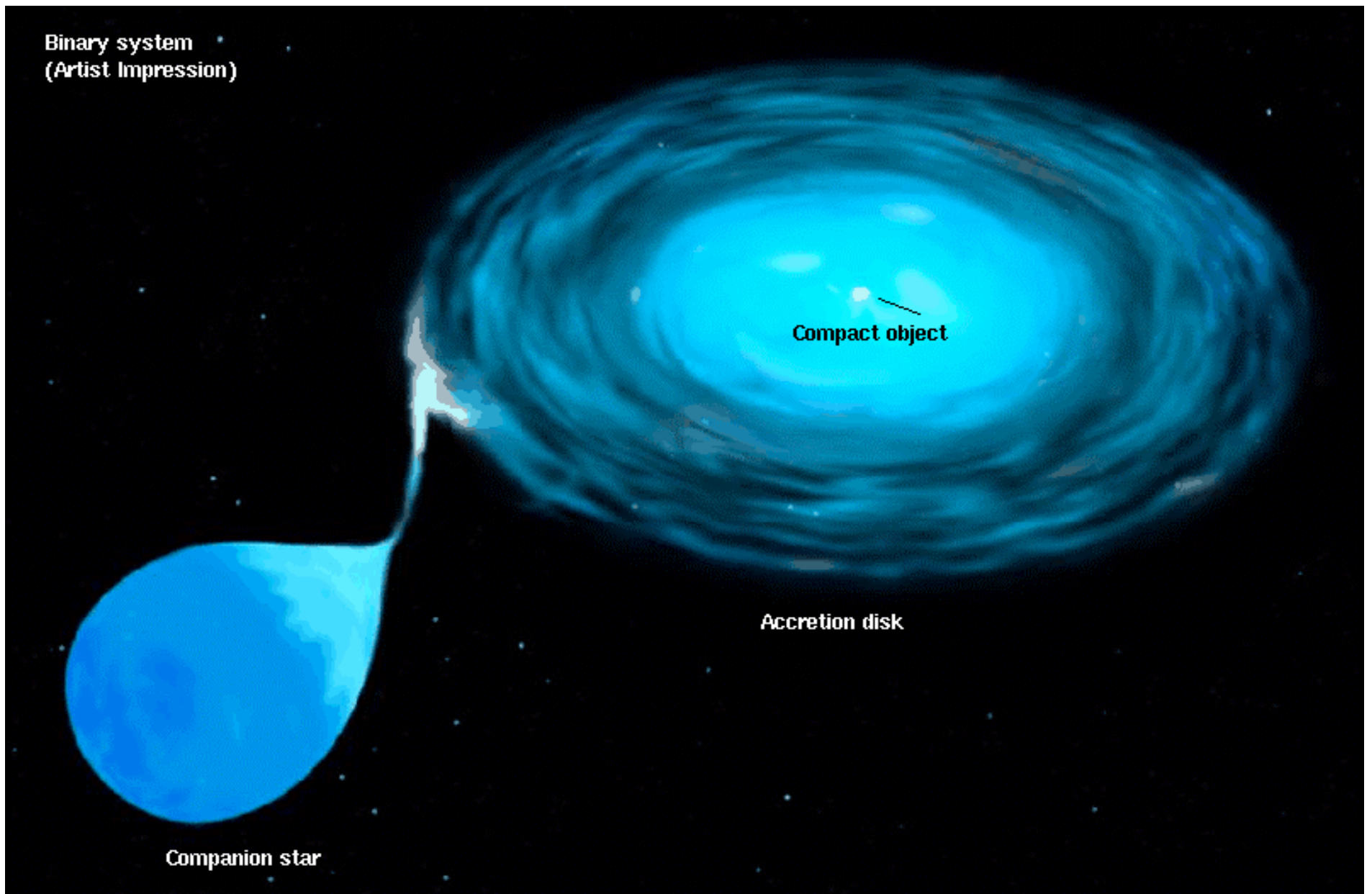
Draw a picture of a Cataclysmic Variable and label all the key parts.
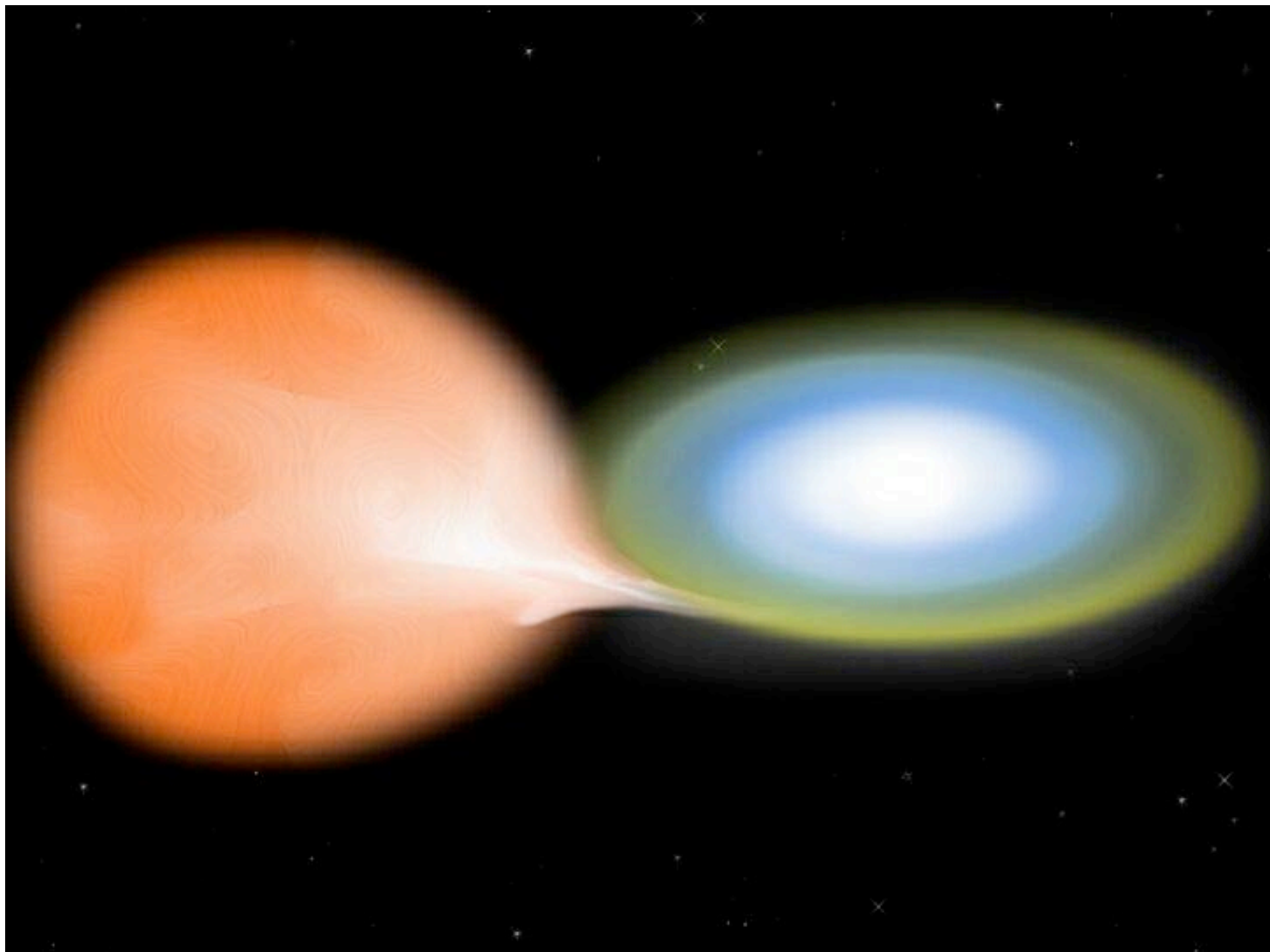
Binary system
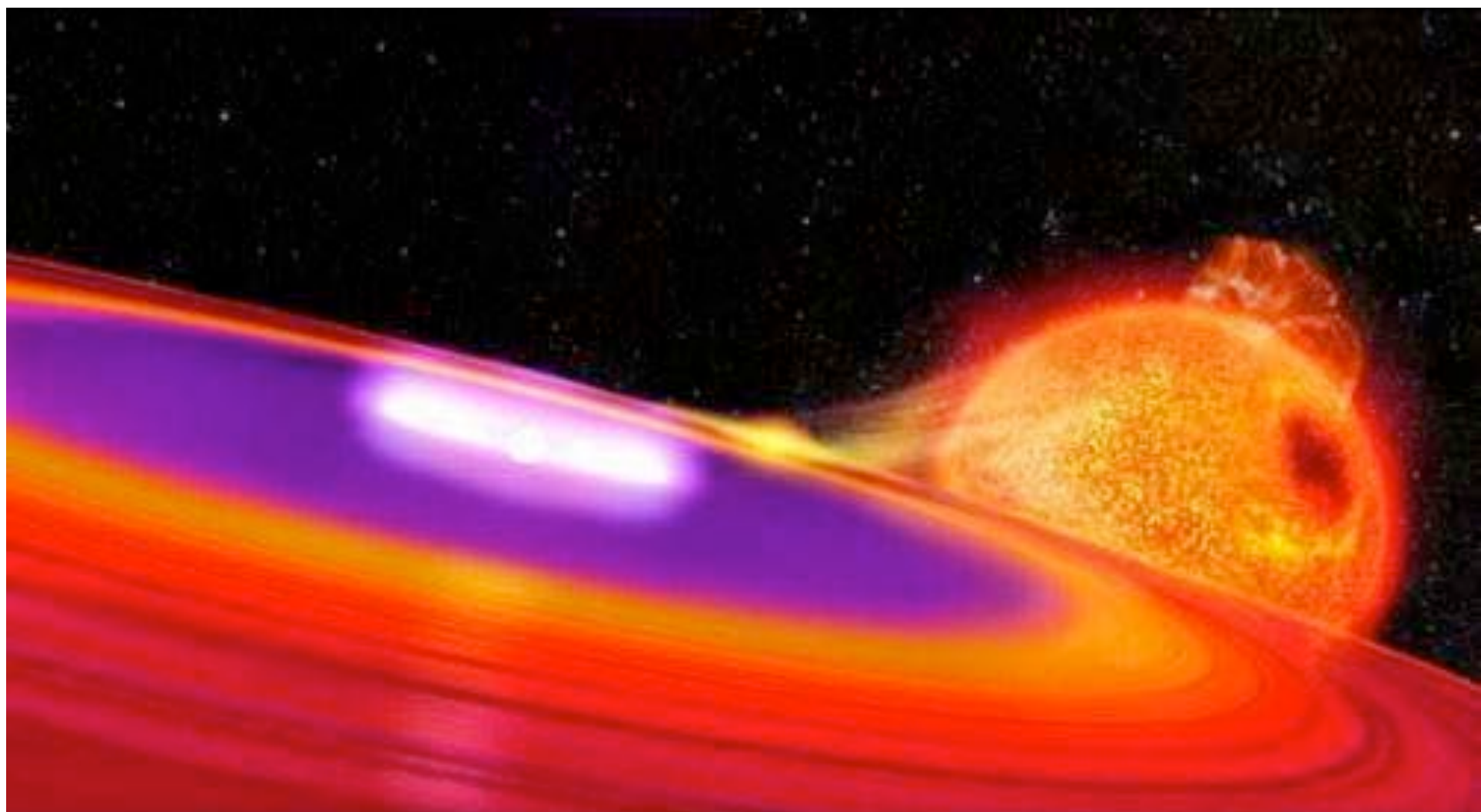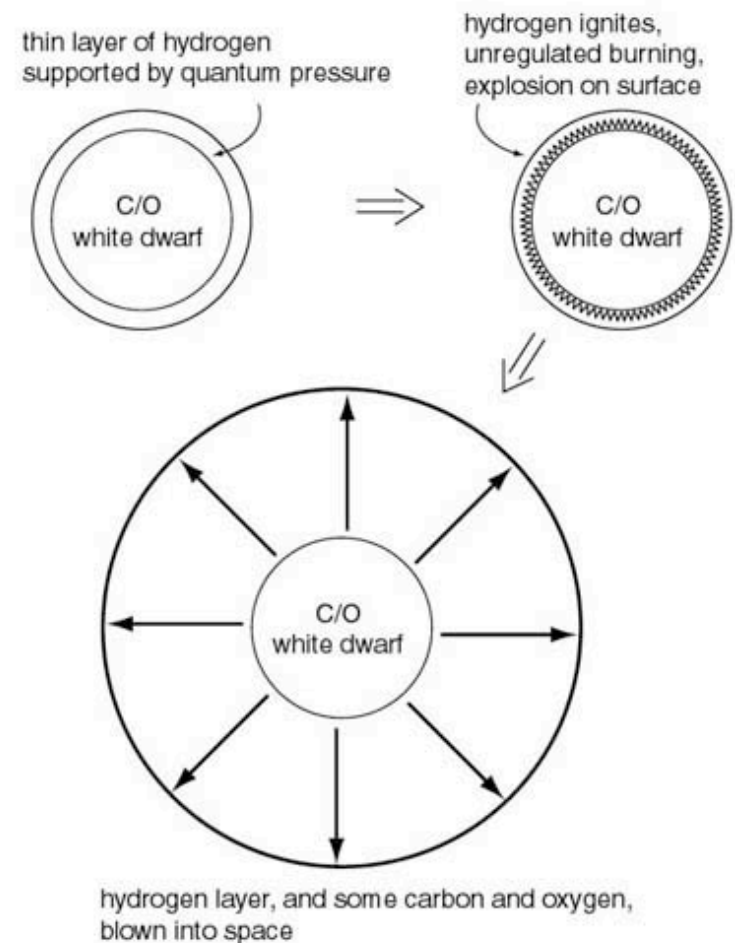(Artist Impression)

Compact object

Accretion disk

Companion star

Classical Nova

Hydrogen from transfer accumulates
on surface of white dwarf composed
(usually) of Carbon/Oxygen
(burning He → C/O in core of red
giant before envelope is ejected as a
planetary nebula)

H is supported by **Quantum Pressure**
H gets denser, hotter begins to burn
(to make He)
Burning is **unregulated** - explode
surface layer of H

C/O core essentially undisturbed,
although a little mass is ripped from
the surface of the core

thin layer of hydrogen
supported by quantum pressure

C/O
white dwarf

hydrogen ignites,
unregulated burning,
explosion on surface

C/O
white dwarf

C/O
white dwarf

hydrogen layer, and some carbon and oxygen,
blown into space

Sky Watch

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.

Recurrent Nova

Mechanism uncertain

Probably variation of Classical Nova with mass of white dwarf especially near *Chandrasekhar mass*

At *Chandrasekhar mass*, may get a Supernova (will discuss specific mechanism later, Chapter 6)

 U Sco in the constellation Scorpius is a Recurrent Nova,

 It may be a candidate to explode as a supernova!

 Might see Scorpius just before sunrise. Also has neutron stars and black holes. T Pyx in constellation Pyxis.

One Minute Exam

In dwarf nova systems, the activity causing the outburst occurs

A In the mass transferring star

B In the accretion disk

C On the surface of the white dwarf

D At the inner Lagrangian point

§5.3 Origin of Cataclysmic Variables

Cataclysmic variables often have a ***main sequence companion transferring mass*** -- how can this be?
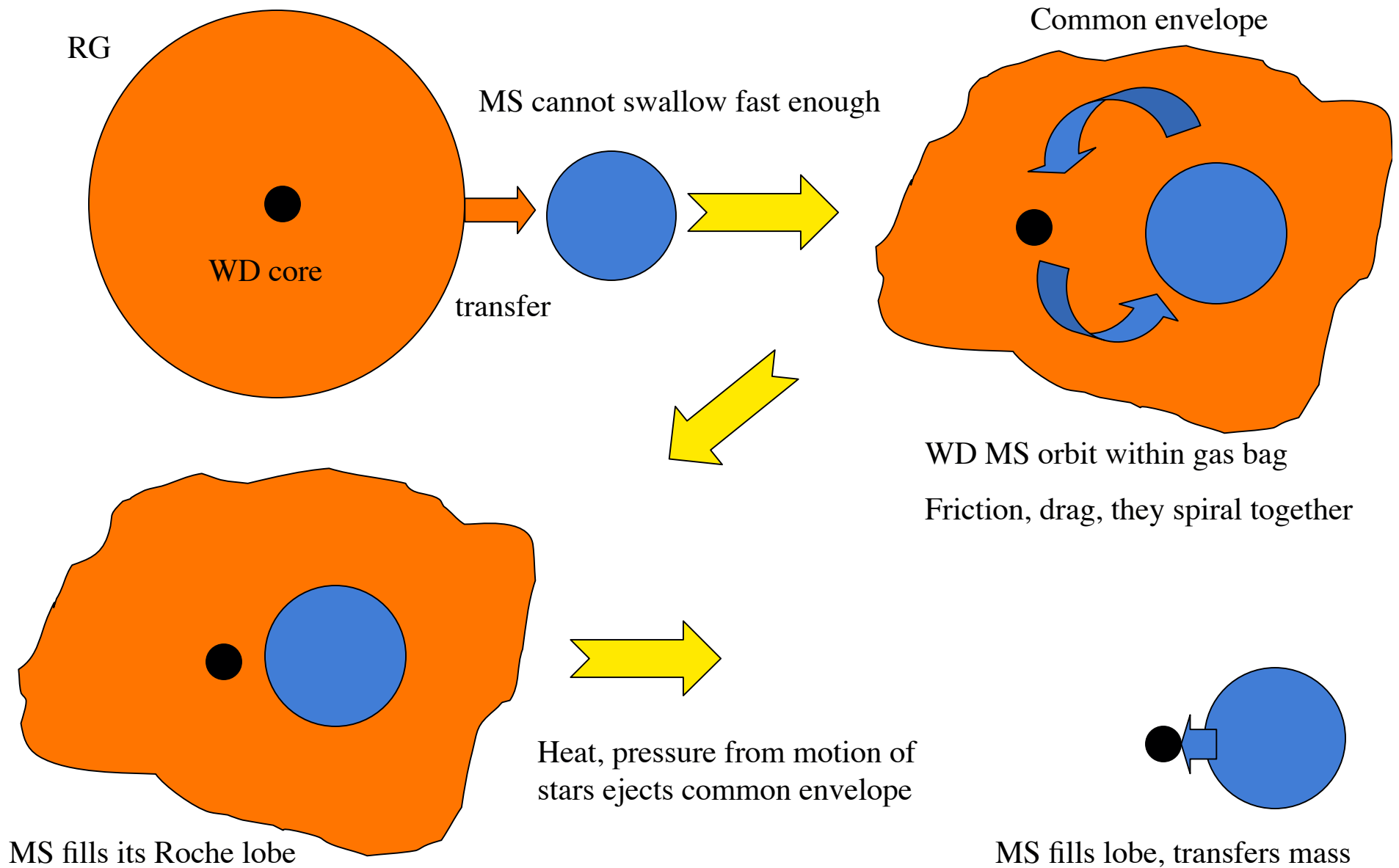
The two stars must once have been far apart to allow the originally more massive star to make a red giant with a white dwarf core.

Need room!!

The stars are observed now to be close together with the main sequence star filling its Roche lobe.

The main sequence star has not expanded to become a red giant, how come it is filling its Roche lobe?

Answer: § 3.9 Common Envelope Evolution

RG

WD core

MS cannot swallow fast enough

transfer

Common envelope

WD MS orbit within gas bag

Friction, drag, they spiral together

MS fills its Roche lobe

Heat, pressure from motion of stars ejects common envelope

MS fills lobe, transfers mass

One Minute Exam

In most dwarf nova systems, the star transferring mass is a main sequence star. This means:

A The main sequence star was once a red giant, but lost mass

B The main sequence star used to be further away from the white dwarf

C The main sequence star and the star that made the white dwarf were born close together.

D The main sequence star has more mass than the white dwarf

§ 5.4 Final Evolution of Cataclysmic Variables

Some CVs have managed to reach large masses
$M_{wd} \sim M_{ch}$ Chandrasekhar mass, 1.4 solar masses, like U Sco

If get close enough to M_{ch}, attain high density,
 ignite carbon in center
Quantum Deregulated $\rightarrow$ violent explosion
Supernova (Chapter 6)

What CVs have white dwarfs that reach M_{ch}?
      Not classical novae
      explosion of surface H shell also rips off a bit of the
      white dwarf mass - we see excess carbon & oxygen in
      ejected matter
      white dwarf shrinks in mass rather than grows.

Likely outcome in this case - 2nd star finally burns out H, tries to form
red giant, likely makes a 2nd common envelope => *Two WDs!*