Exam 1 Week from Today

Review sheet, review session next Wednesday
Chapters 1 - 5

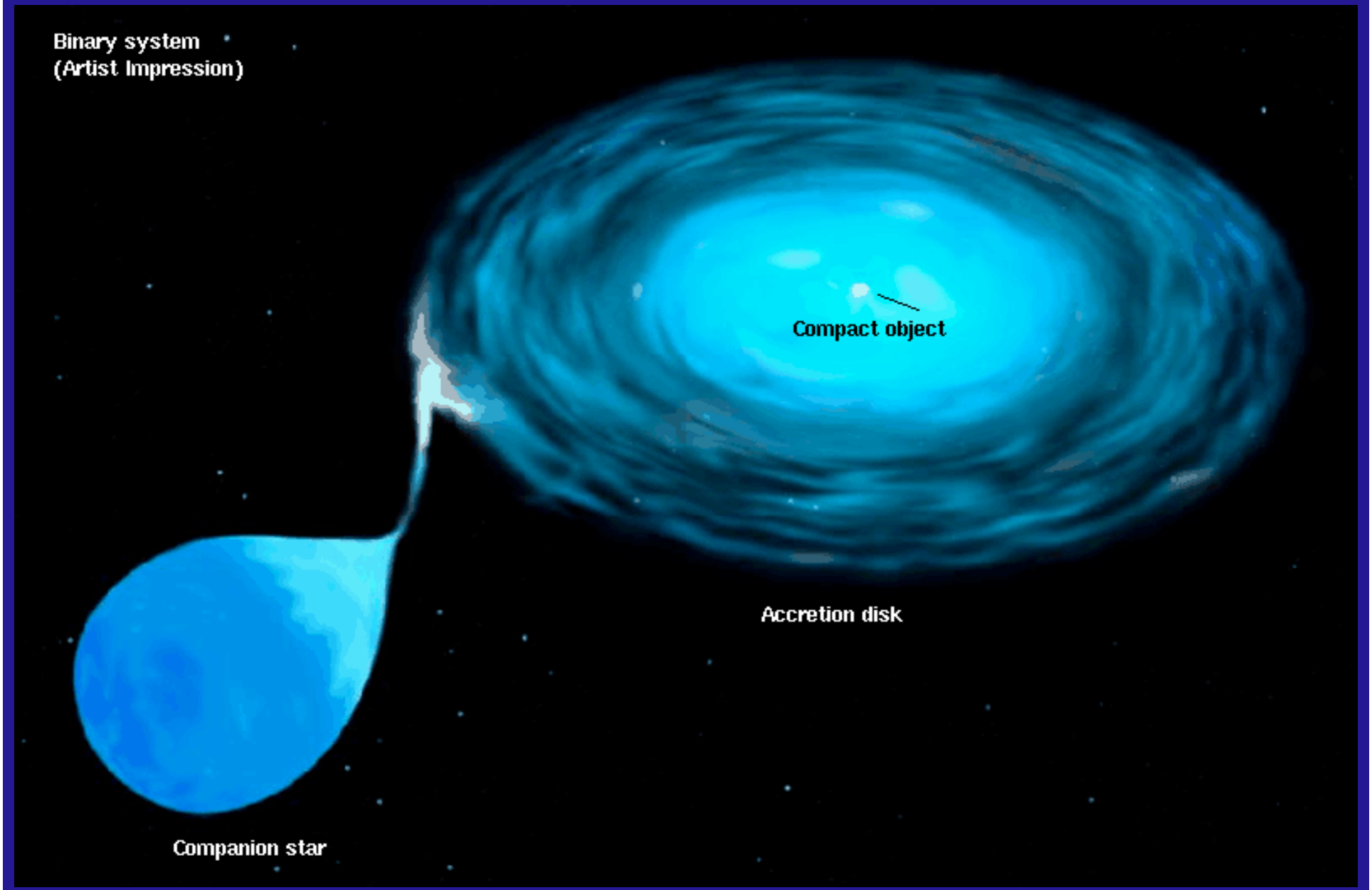
spare book

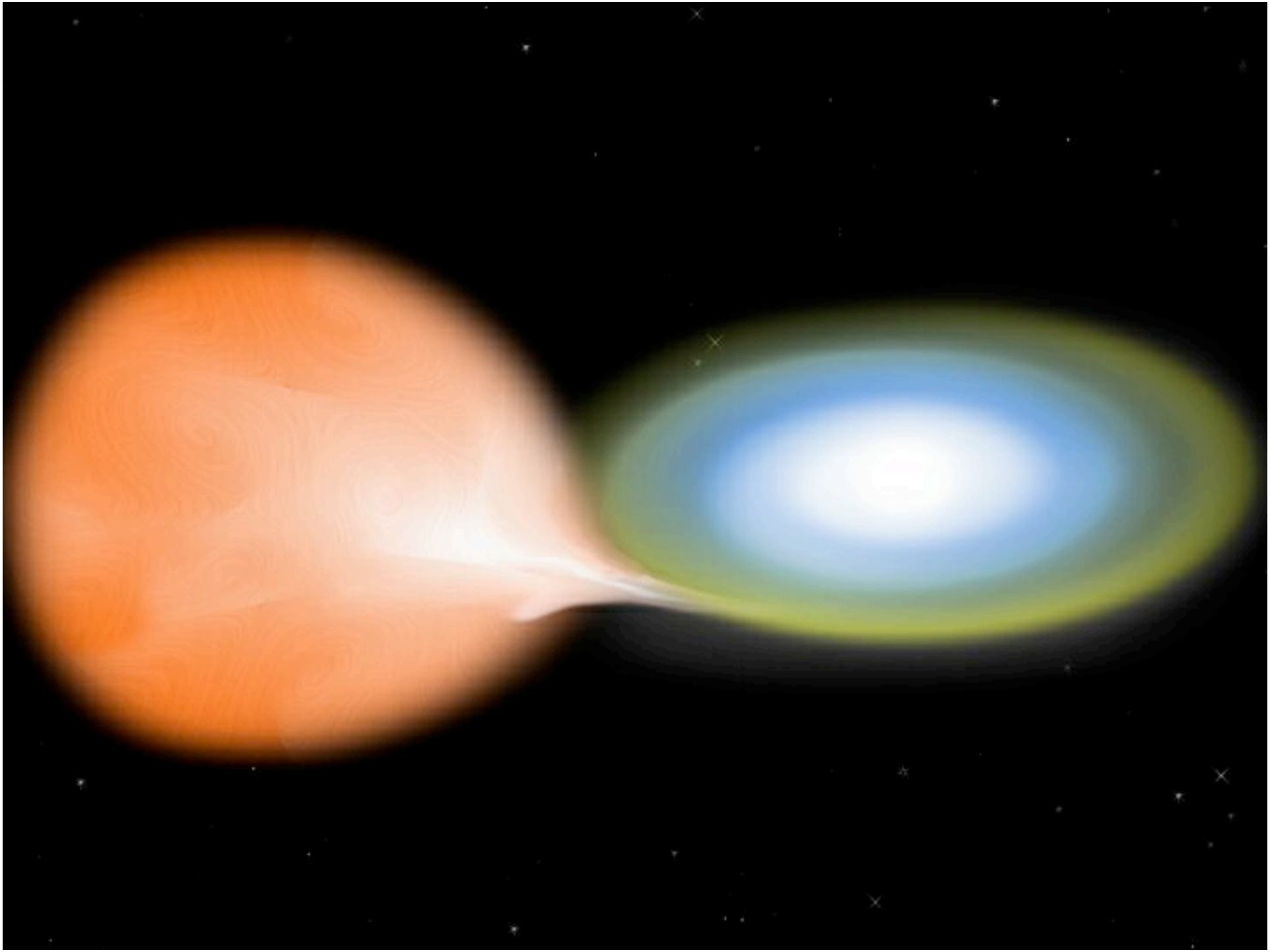
News, some of the Genesis probe may have survived.
Main oxygen generator just went out on Space Station, backups available

Pic of the day Cat's Eye Planetary Nebula plus WD

Self-graded pop quiz

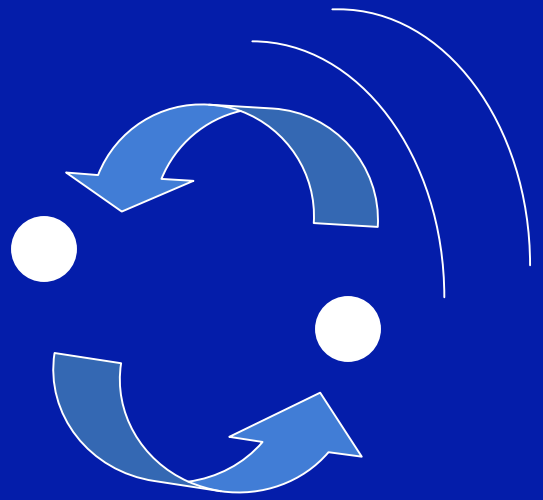
Draw a picture of two stars with their Roche lobes and label which star has the largest mass.


Binary system
(Artist Impression)
Compact object
Accretion disk
Companion star



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!

What happens when two white dwarfs spiral together?

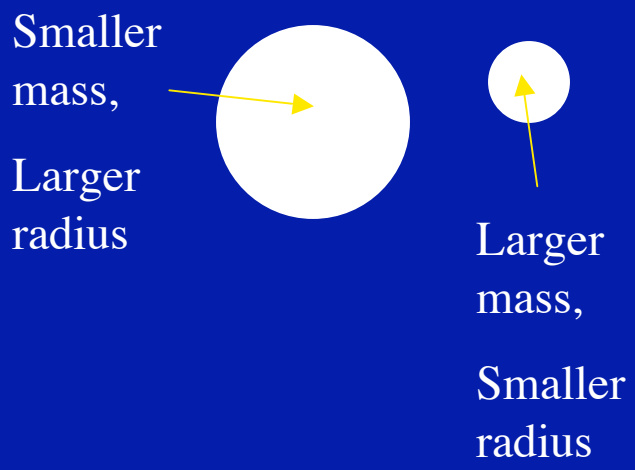
Larger mass WD has smaller radius

Which WD has the smaller Roche lobe?

The smaller mass

Which fills its Roche Lobe first?

Must be the smaller mass

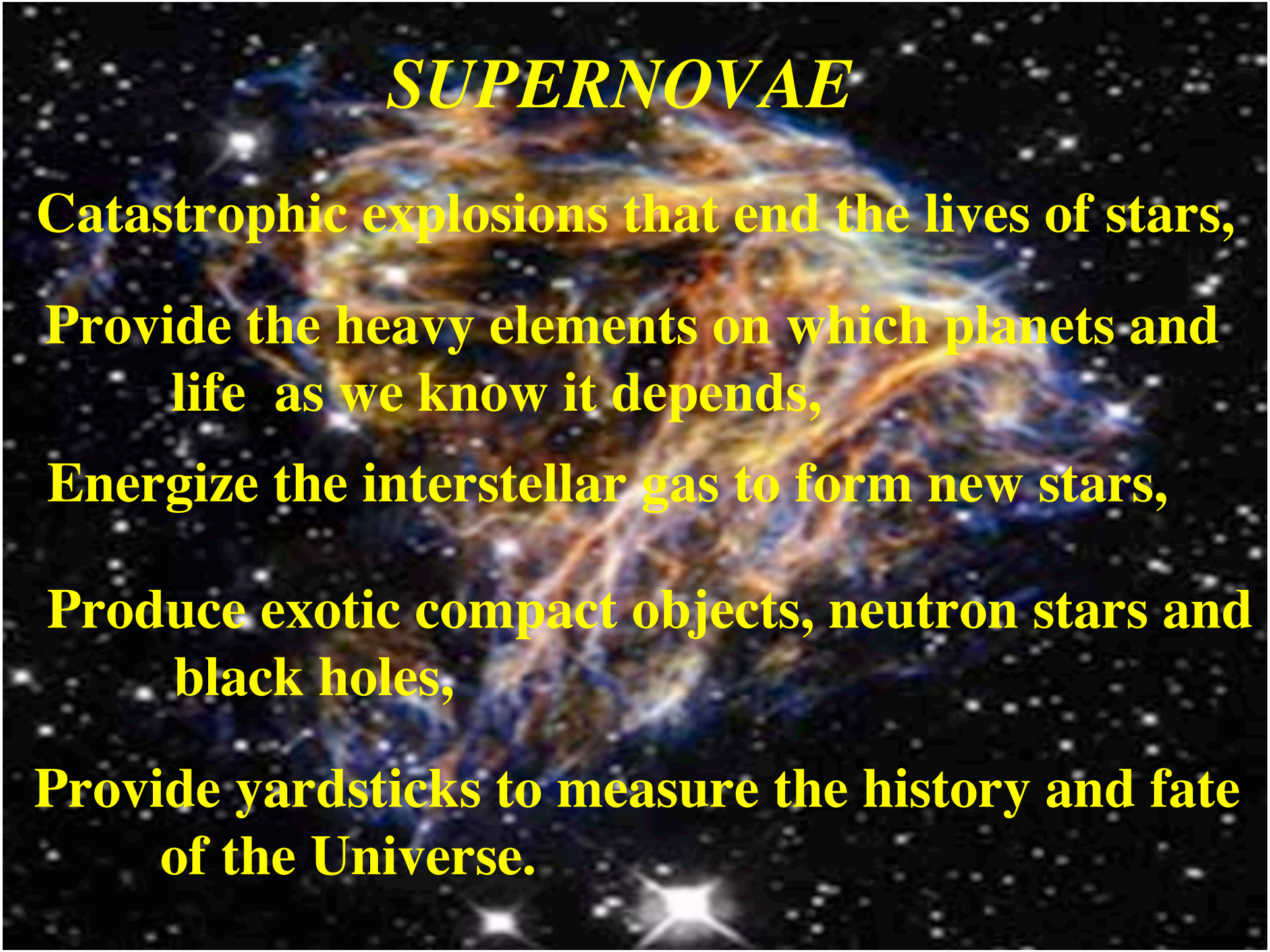


As small mass WD loses mass, its ***radius gets larger***,
but its ***Roche Lobe gets smaller***! Runaway mass transfer.

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

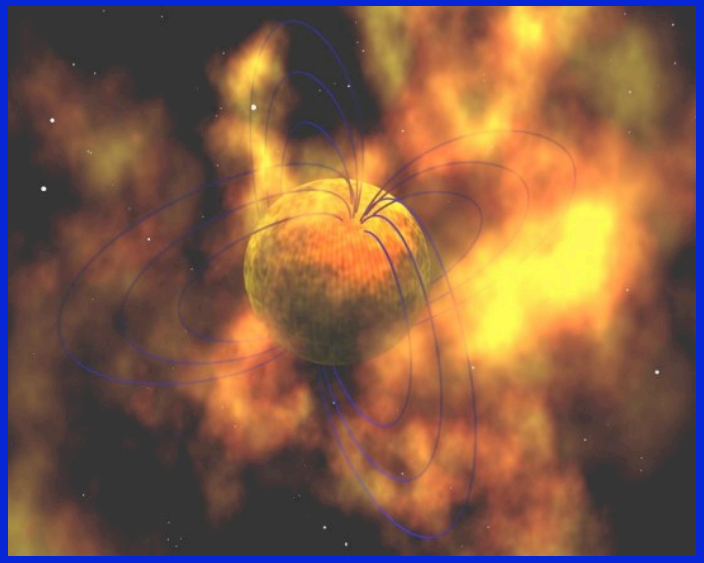
Could end up with one larger WD

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


SUPERNOVAE
Catastrophic explosions that end the lives of stars,
Provide the heavy elements on which planets and life as we know it depends,
Energize the interstellar gas to form new stars,
Produce exotic compact objects, neutron stars and black holes,
Provide yardsticks to measure the history and fate of the Universe.

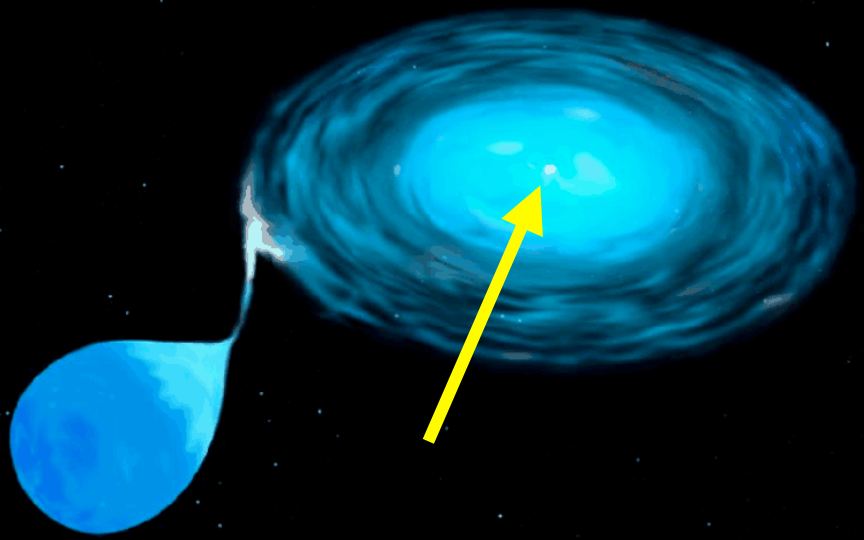
One type of supernova is powered by the ***collapse*** of the core of a massive star to produce

a ***neutron star***, or perhaps a ***black hole***

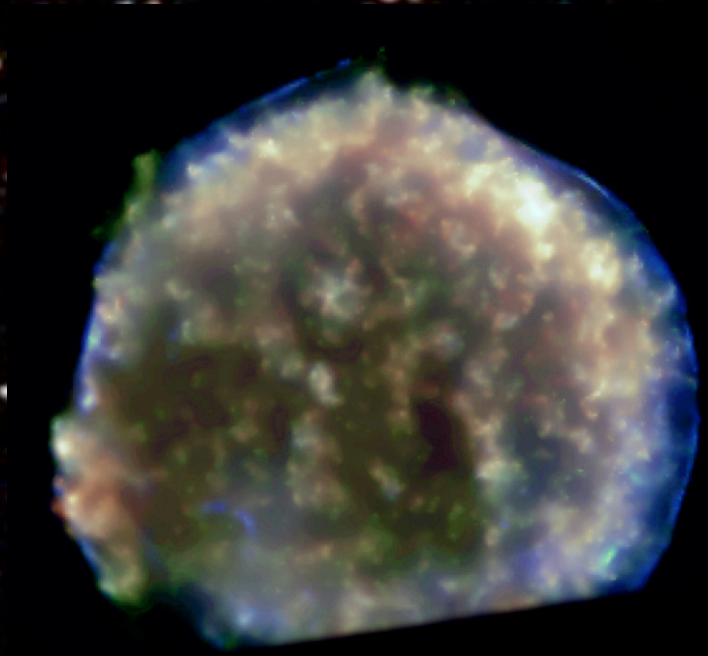


The mechanism of the explosion is still a mystery.

The other type of supernovae (Type Ia) is thought to come from a white dwarf that grows to an explosive condition in a binary system.



Chandra X-ray Observatory image
Of Tycho's supernova of 1572



These explode completely, like a stick of dynamite, and leave no compact object (neutron star or black hole) behind.

Chapter 6 Supernovae

Historical Supernovae - observed with naked eye over 2000 years especially Chinese (preserved records), but also Japanese, Koreans, Arabs, American Indians, finally Europeans.

SN 386	earliest record	NS, jet?
SN 1006	brightest	No NS
SN 1054	Crab Nebula	NS, jets
SN 1181	(Radio Source 3C58)	NS, jets
SN 1572	Tycho	No NS
SN 1604	Kepler	No NS
~1680	Cas A	NS? jets
SN 1987A	nearby galaxy	NS? jets
Vela	10,000 years ago	NS, jets