Tuesday, September 8, 2009

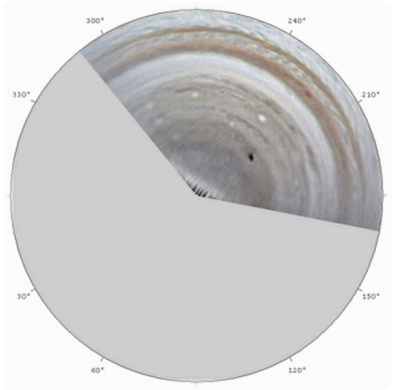
Jupiter - can be seen around/after sunset even under a streetlight on campus.

Distance to Moon, Jupiter - very hard to estimate casually, just by looking at them.

Flu in the news - be careful

Astronomy in the News? One of the astronauts currently on the International Space Station, is Tim Kopra who went to Jr. High at McCallum in Austin. His mother still lives here.

Pic of the Day - leftover turmoil of the collision of a small comet with Jupiter two months ago can still be seen (but not in this still, check the original APOD animation).



Sky Watch

Objects mentioned so far:

Ring Nebula, planetary nebula in constellation Lyra

Sirius - massive blue main sequence star with white dwarf companion

Algol - eclipsing binary system in Perseus

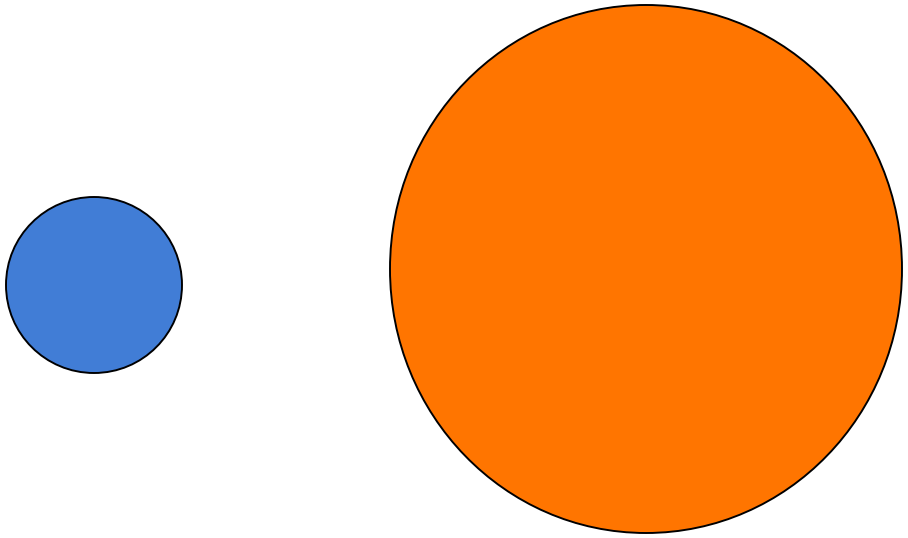
Other suggestions:

Altair, Deneb, Vega, the summer triangle - massive blue main sequence stars. Altair and Vega are expected to make white dwarfs, Deneb a supernova.

Betelgeuse, Aldebaran - red giants

Other examples of these sorts of objects…

Algol paradox: Algol is a binary star system with a Red Giant orbiting a blue-white Main Sequence companion.



Red Giant ~ 0.5 $M_\odot$ - but more evolved
Blue-white Main Sequence star ~ 2-3 $M_\odot$ - but less evolved

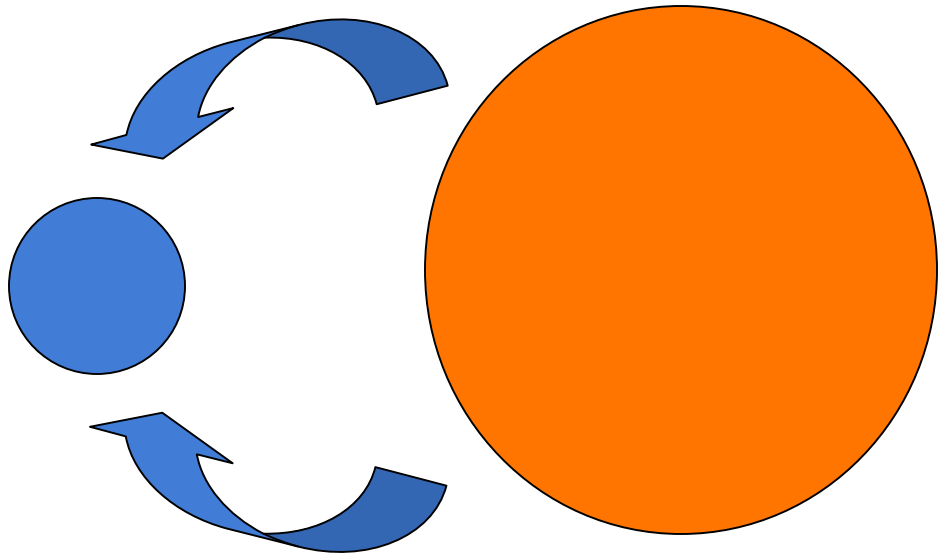
Blue star partially eclipses the brighter red star every 68.75 days, giving the impression it is a red, blinking, winking eye - demon, ghoul etc.

Solution

Mass Transfer

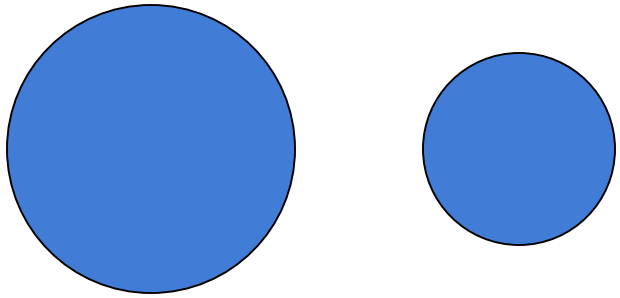
The red giant swells up, fills then overfills its Roche lobe and transfers mass to the companion.

The star that will become the red giant starts as the more massive star, but ends up the less massive.



One Minute Quiz

Two stars orbit one another in a binary system



Which star has the largest Roche lobe?

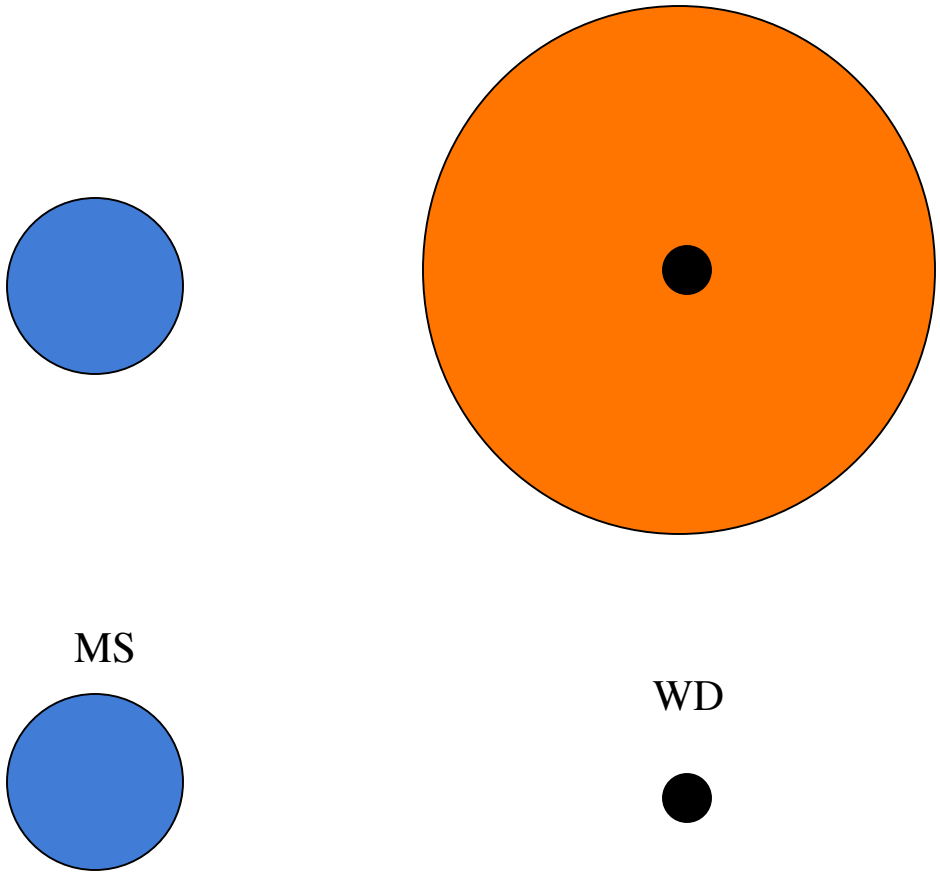
A the one on the left

B the one on the right

C insufficient information to answer the question

Which star is the most massive?

In common circumstances, all the hydrogen envelope is transferred to the companion (or ejected into space), leaving the core of the red giant as a white dwarf orbiting the remaining main sequence star

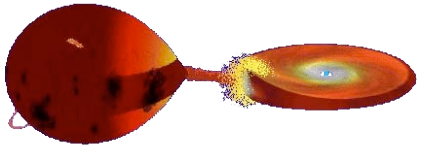


First star evolves, sheds its envelope, leaves behind a white dwarf.

Then the second star that was ***originally*** the less massive evolves, fills its Roche Lobe and sheds mass onto the white dwarf.

The white dwarf is a tiny moving target, the transfer stream misses the white dwarf, circles around it, collides with itself, forms a ring, and then settles inward to make a flat disk.

Matter gradually spirals inward, a process called ***accretion.***

$\Rightarrow$ the result is an ***Accretion Disk*** (Chapter 4). 

An accretion disk requires a transferring star for supply and a central star to give gravity, but it is essentially a separate entity with a structure and life of its own.

One Minute Exam:

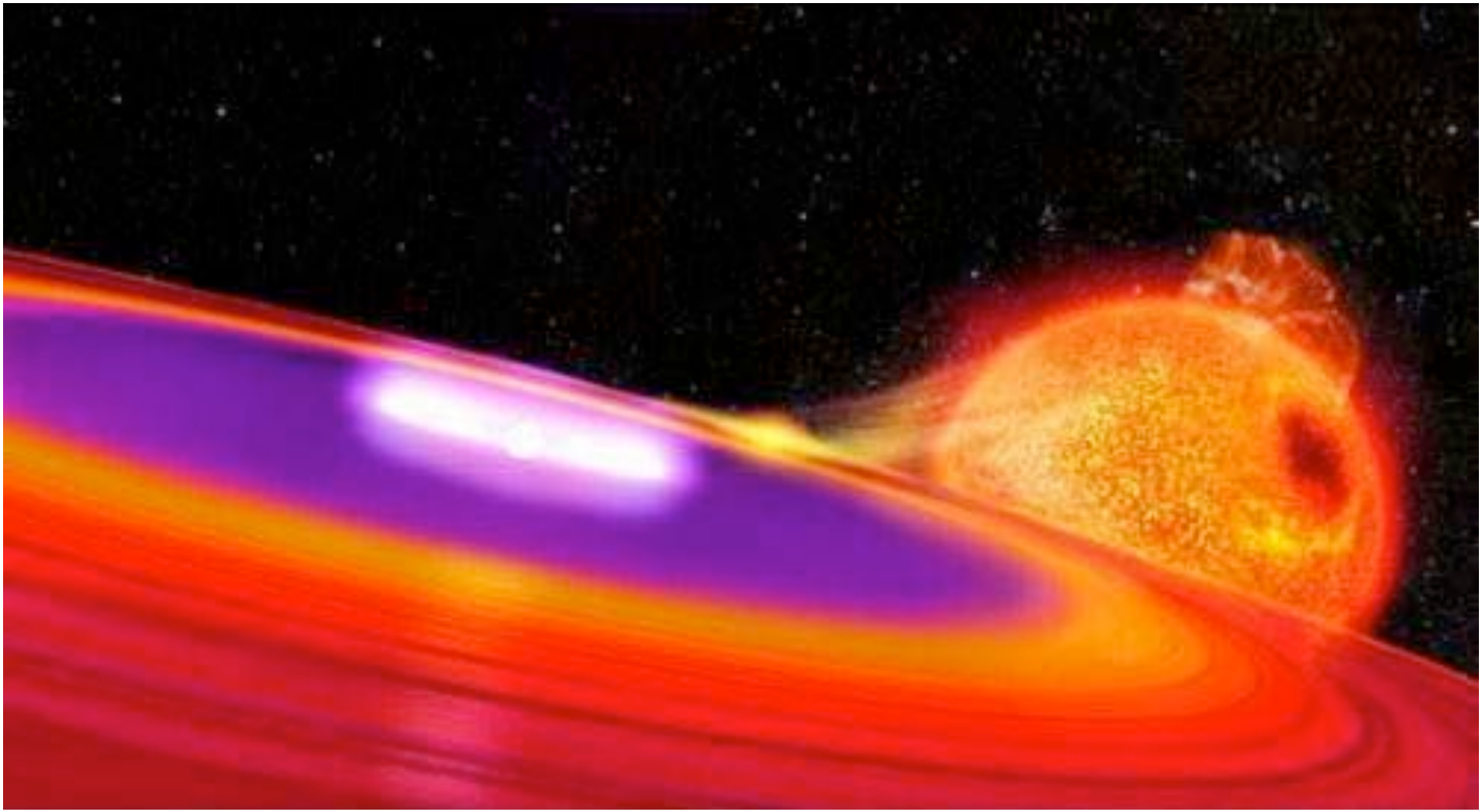
Two stars are born orbiting one another in a binary system. Which star will transfer matter first?

A The most massive star

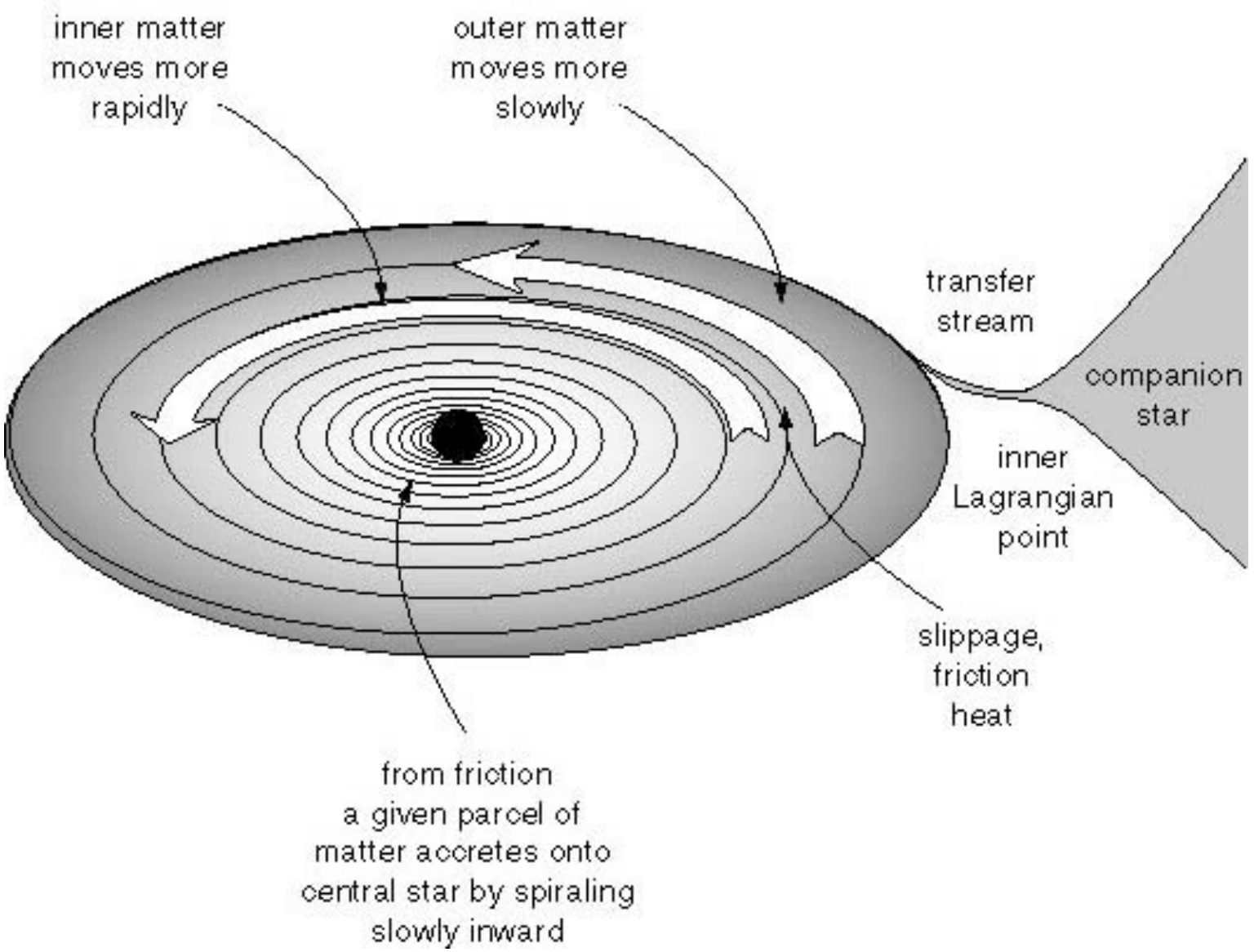
B The least massive star

C The one with the smaller Roche lobe

D The one with the smaller radius



Basic Disk Dynamics - Figure 4.1



Basic Disk Dynamics

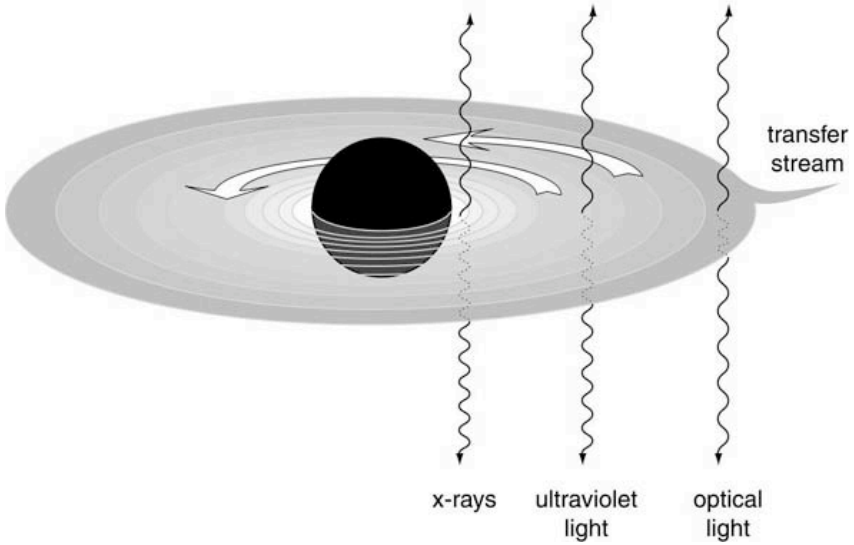
Orbits closer to the center are faster.
This creates rubbing and friction and heat, everywhere in the disk.

Friction tries to slow the orbiting matter, but it falls ***inward*** and ends up moving ***faster***.
(Just as removing heat from a normal star causes it to get hotter)
Slow settling inward by friction -- ***accretion***

Friction also causes ***heat.***

Hotter on inside, cooler on outside

Optical → UV → X-rays
WD NS BH



One Minute Exam:

In an accretion disk, friction causes moving matter to

A Slow down

B Speed up

D Move outward

C Pass from one Roche lobe to another

Cataclysmic Variables

Second stage of mass transfer

General Category “Novae”

“New” stars flare up, see where none had been seen before.

All CVs share same general features: ***transferring star***, ***transfer stream***, ***hot spot***, ***accretion disk***, and ***white dwarf***.