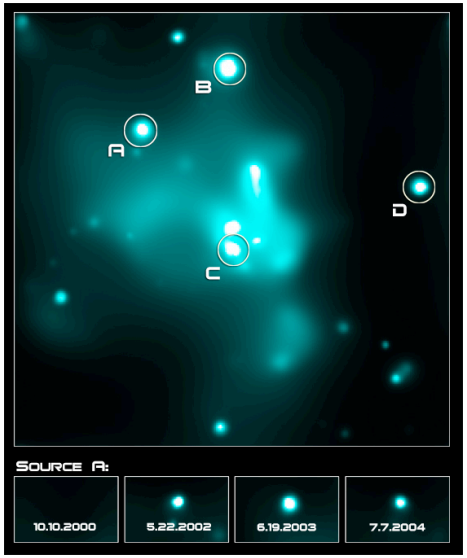
Books - used books definitely coming, maybe new.  Book poll.

Will post pdf files of draft of chapters 1 - 5.

Forgot to mention Thursday help session 5 PM RLM 15.216B

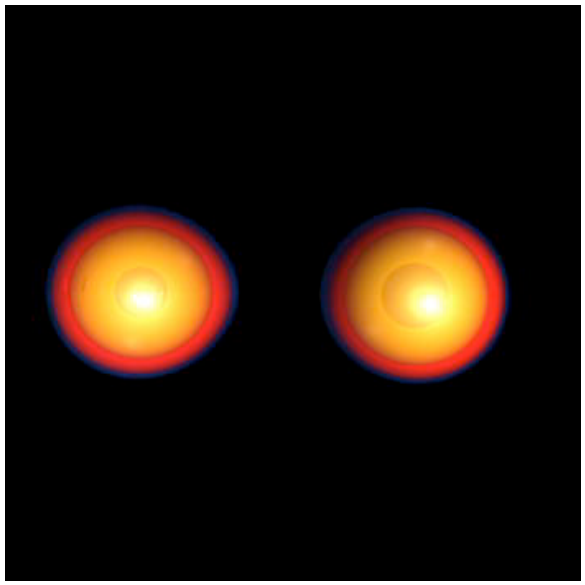
Astronomy in the news? Year of Einstein - 1905 three revolutionary papers, Brownian motion proof of atoms, photoelectic effect proof of quantum properties, special relativity. Celebrations throughout the year.

Pic of day,  Swarm of Black Holes in center of Galary

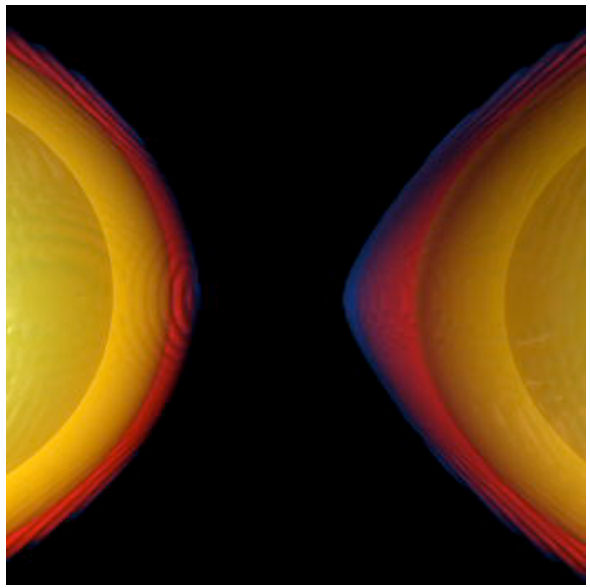


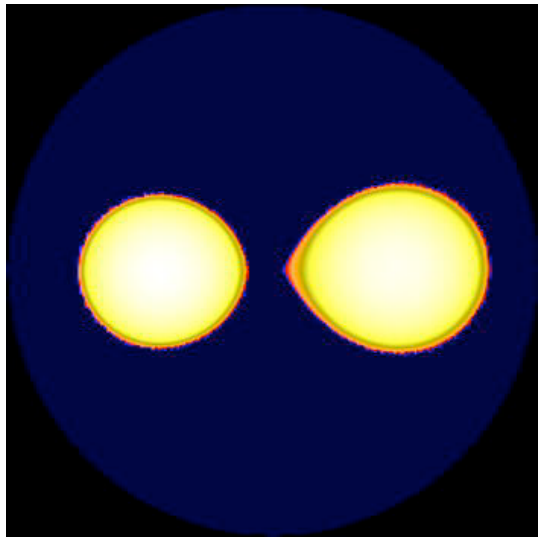
Solution to the ***Algol Paradox***, how the evolved star can be the least massive - ***Mass Transfer*** through the ***Roche Lobe*** of the initially more massive, evolving star.

Stable: no mass transfer



Unstable: mass transfer





Side view

Equatorial slice

http://www.phys.lsu.edu/astro/movie_captions/motl.binary.html

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.

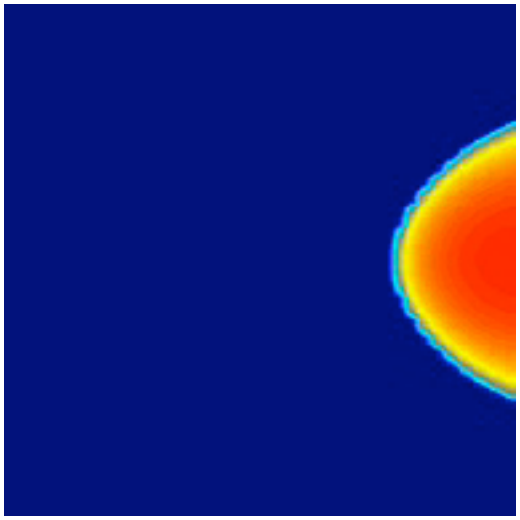
The white dwarf is a tiny moving target, the transfer stream misses the white dwarf, circles around it, collides with itself, forms a ring, and then settles inward to make a flat disk.

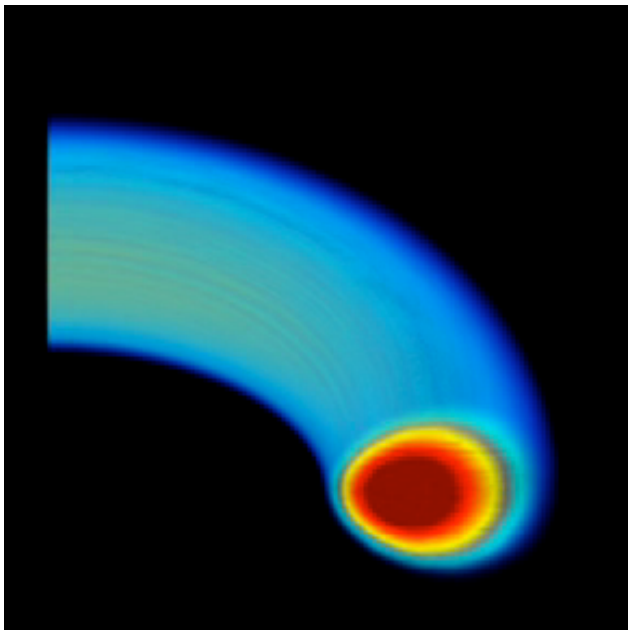
Matter gradually spirals inward, a process called ***accretion.***

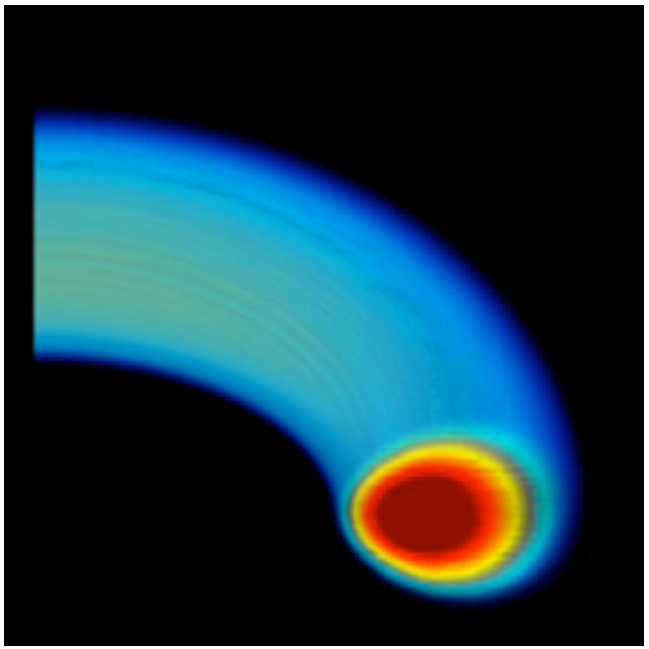
$\Rightarrow$ the result is an ***Accretion Disk*** (Chapter 4).

*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.*

# Ring of transferred matter evolves into an accretion disk

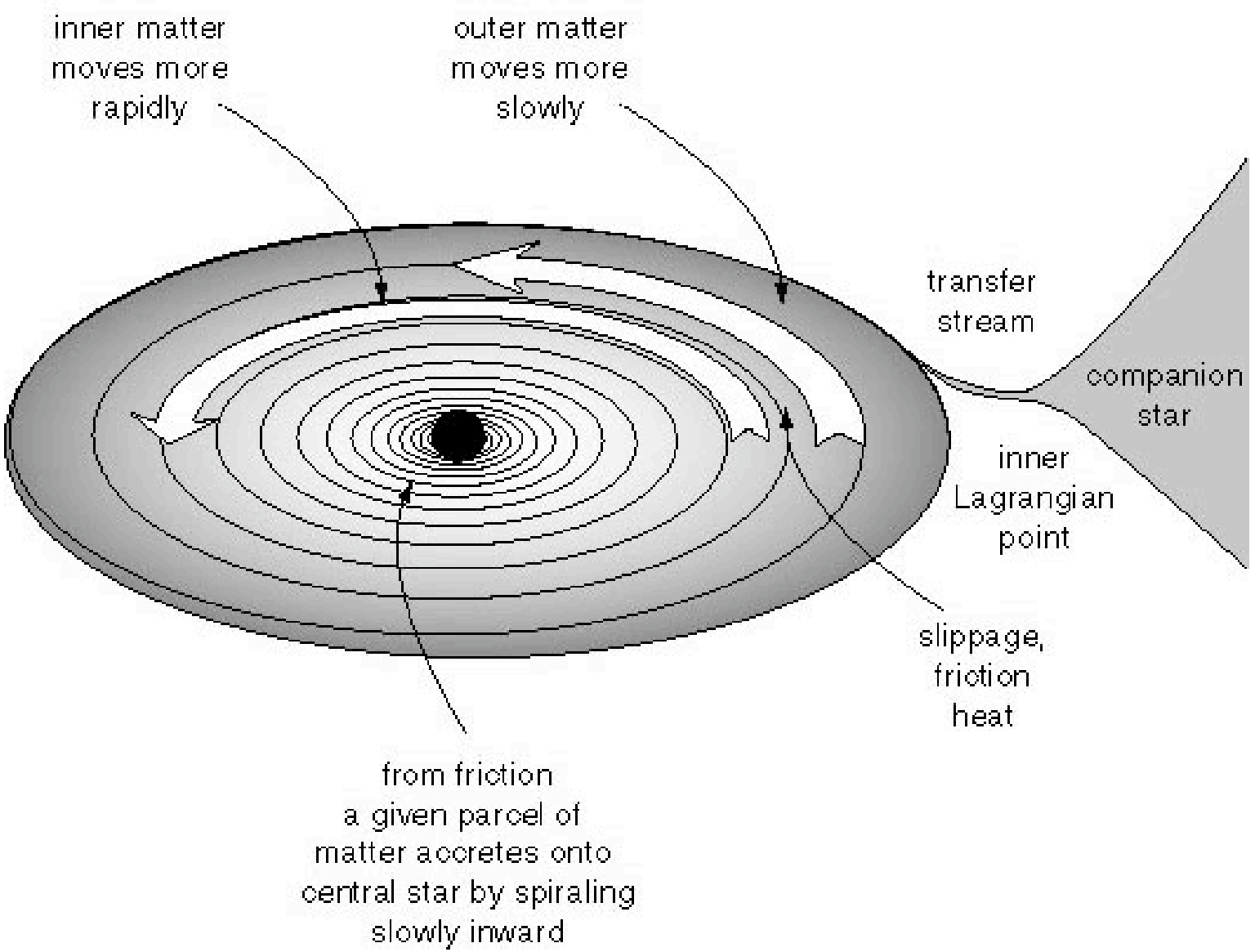






http://www.astro.virginia.edu/~jh8h/nraf/

# Basic Disk Dynamics - Figure 4.1



# Basic Disk Dynamics

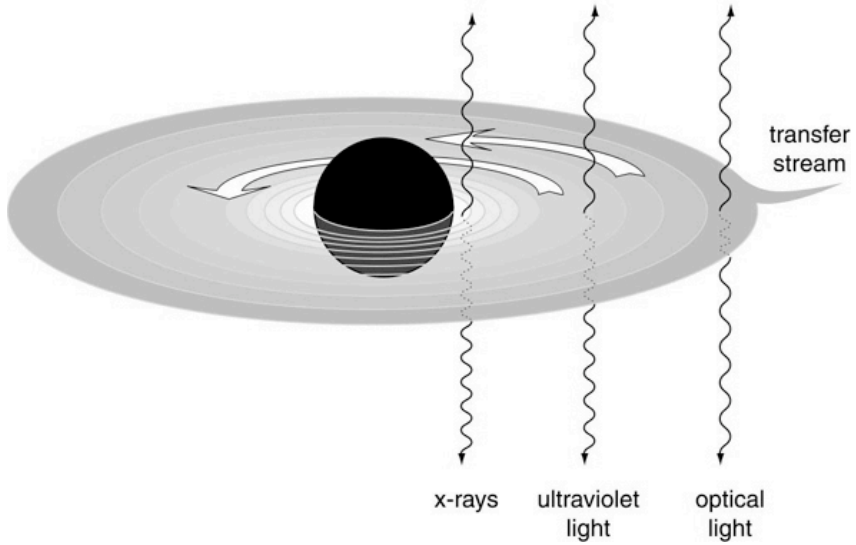
Orbits closer to the center are faster.
This creates rubbing and friction and heat, everywhere in the disk.

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

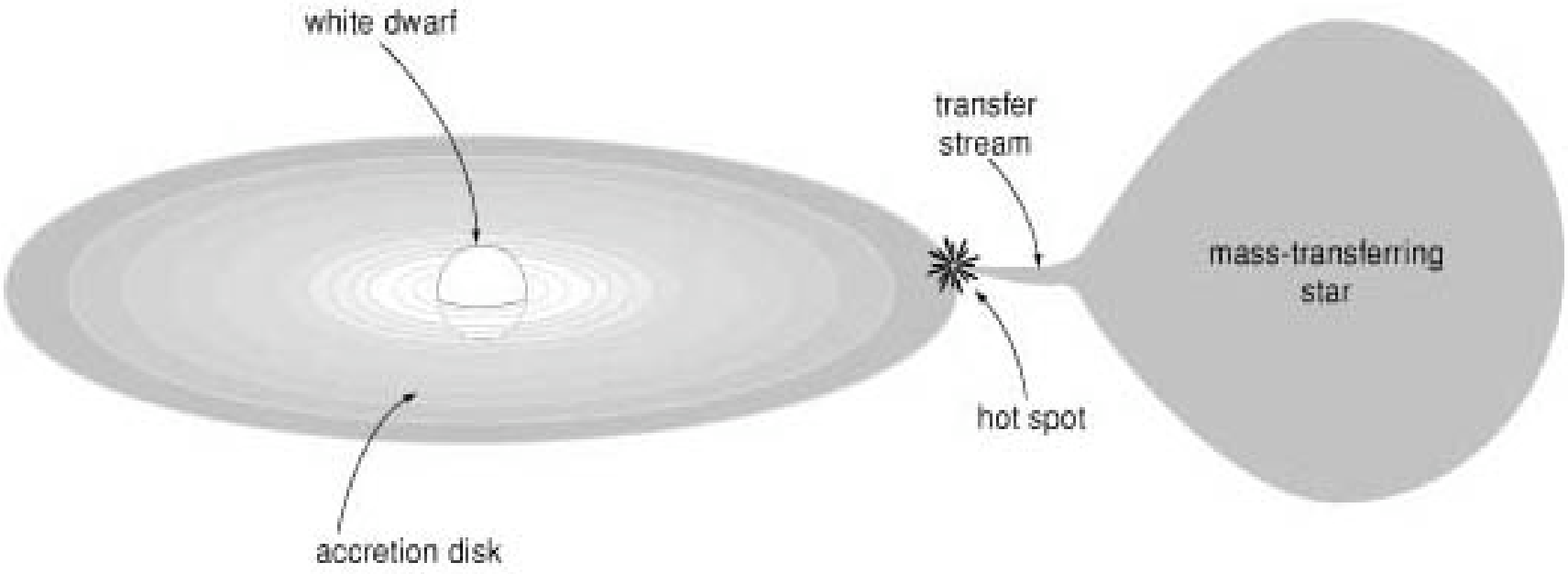
Optical $\rightarrow$ UV $\rightarrow$ X-rays
WD NS BH



# Cataclysmic Variables

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

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



# Cataclysmic Variables

Dwarf Nova - flare $\times$ 10 brighter

intervals of weeks to months

last days to weeks

Recurrent Nova - flare $\times$ 1000 brighter

every 10-100 years

last weeks to months

U Sco is a Recurrent Nova

Classical Nova - $10^4$ to $10^5$ times brighter

never observed to recur -- suspect $10^4$ years

last months to years

Supernova - (one type might originate in a cataclysmic variable)

flare once $10^{10}$ $\times$ brighter (10 billion times)

last months to years