Wednesday, March 4, 2015

Exam 2, Skywatch 2, returned, grades posted, histogram.

Reading for Exam 3:

Chapter 6, end of Section 6 (binary evolution), Section 6.7 (radioactive decay), Chapter 7 (SN 1987A)

Background in Chapters 3, 4, 5.

Background: Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.8, 3.10, 4.1, 4.2, 4.3, 4.4, 5.2, 5.4 (binary stars and accretion disks).

Astronomy in the news?

After a journey of more than two years, NASA's Dawn space probe will reach the dwarf planet Ceres on Thursday night.

Goal

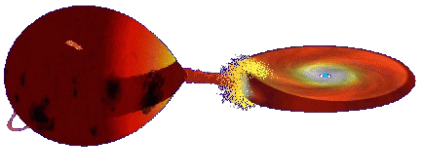
To understand how stars, and Type Ia supernovae, evolve in binary systems.

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.

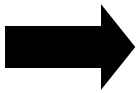
Matter gradually spirals inward, a process called ***accretion.***

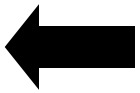
$\Rightarrow$ the result is an ***Accretion Disk*** (Chapter 4). 

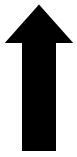
An accretion disk requires a transferring star for supply and a central star to give gravity, but it is essentially a separate entity with a structure and life of its own.

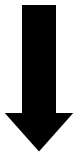
One Minute Exam:

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

 The most massive star

 The least massive star

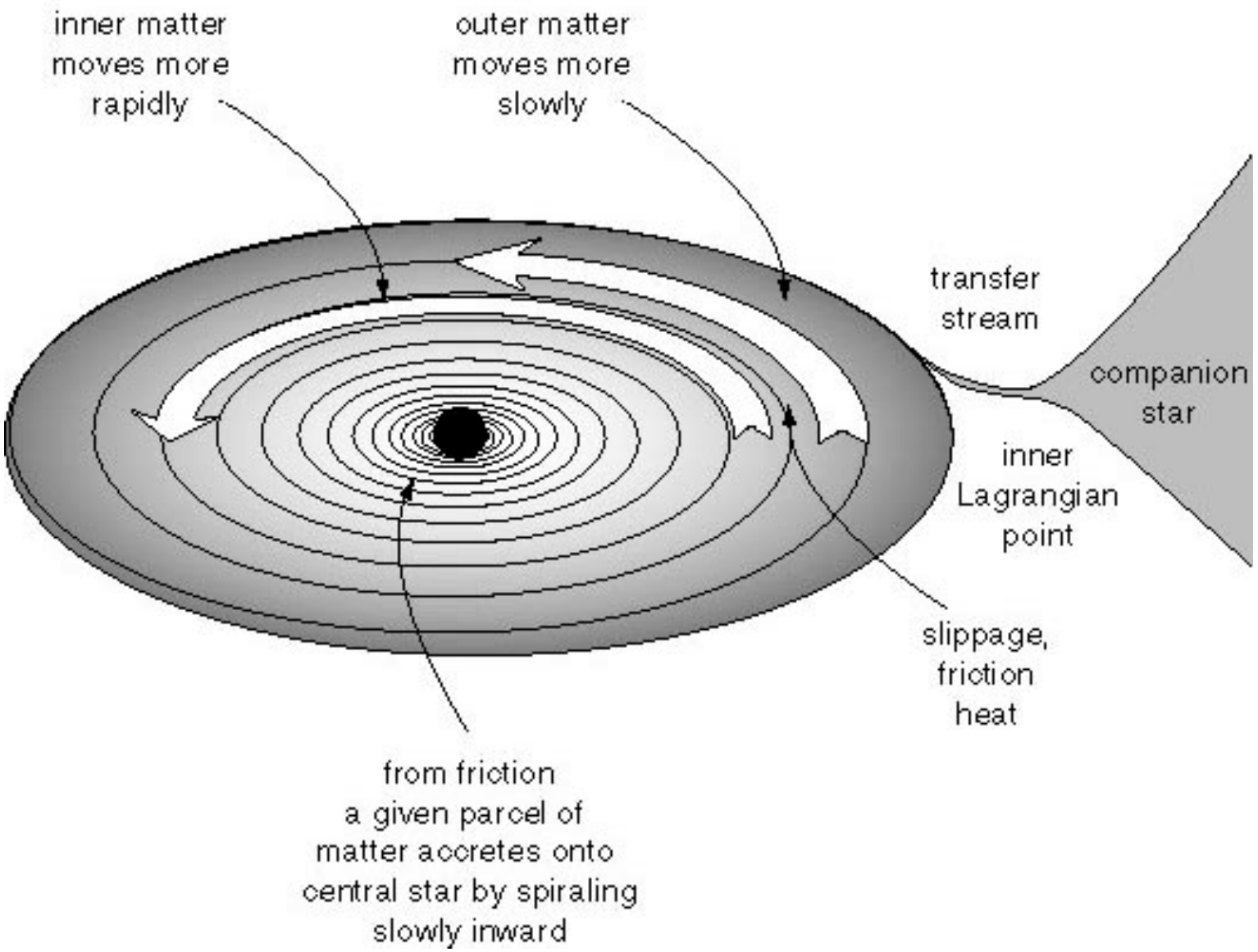
 The one with the smaller Roche lobe

 The one with the smaller radius

Goal

To understand how accretion disks shine and cause matter to accrete onto the central star.

Basic Disk Dynamics - Figure 4.1



Demonstration of Accretion Disk Dynamics

Need a volunteer

Basic Disk Dynamics

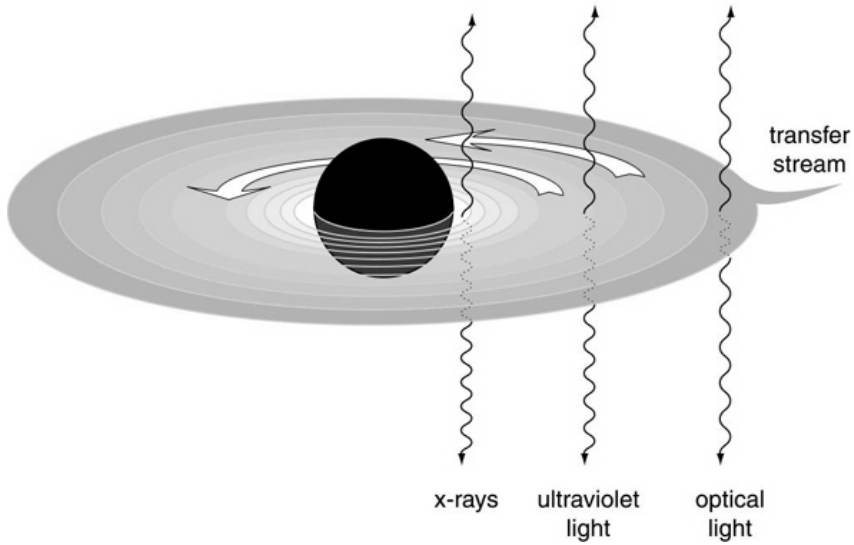
Orbits closer to the center are faster.
This creates rubbing and friction and heat, everywhere in the disk.

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
size of: planet city

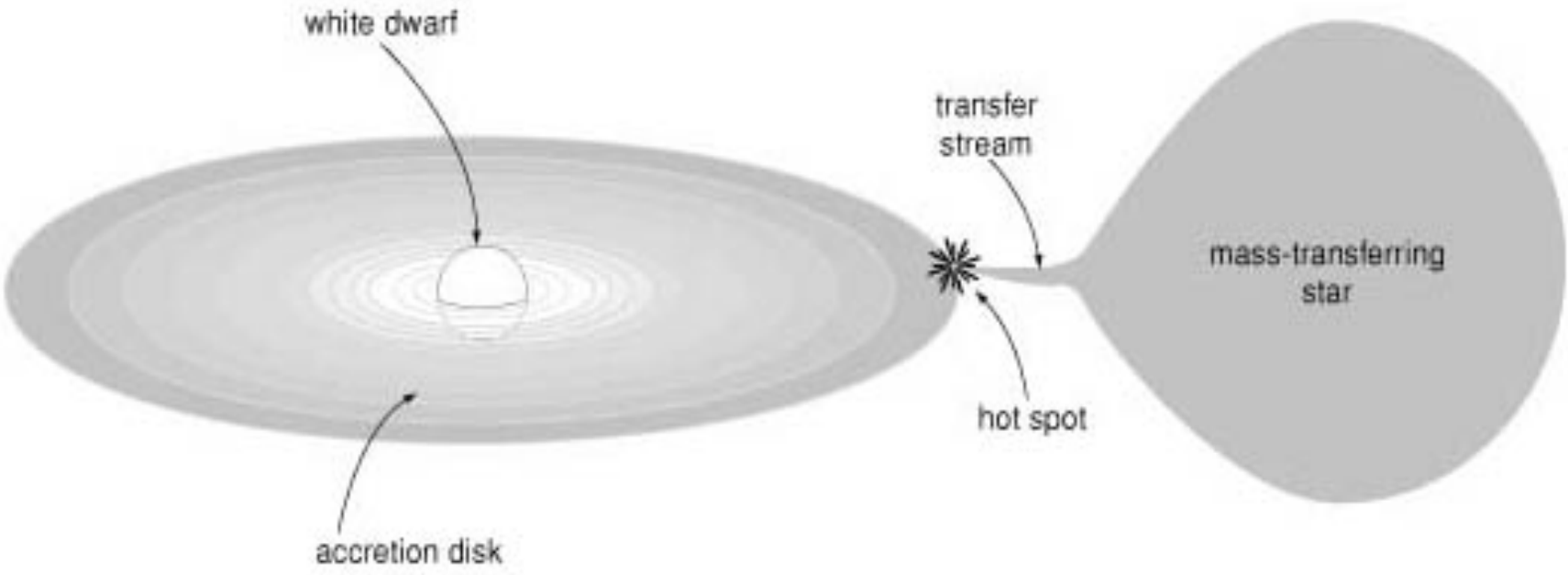


Goal – to understand how white dwarfs in binary star systems can, and cannot, grow to the Chandrasekar mass and explode.

Cataclysmic Variables

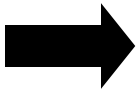
Second stage of mass transfer (Section 5.2)
General Category "Novae"
"New" stars flare up, see where none had been seen before.

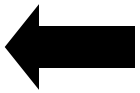
All CVs share same general features: ***transferring star***, ***transfer stream***, ***hot spot***, ***accretion disk***, and ***white dwarf***.

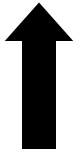


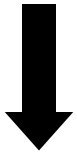
One Minute Exam:

In an accretion disk, friction causes moving matter to

 Slow down

 Speed up

 Move outward

 Pass from one Roche lobe to another