February 25, 2011

Second exam, Friday, March 4. Review sheet Monday. Review 5 PM Thursday, room TBD.

Second Sky Watch due.

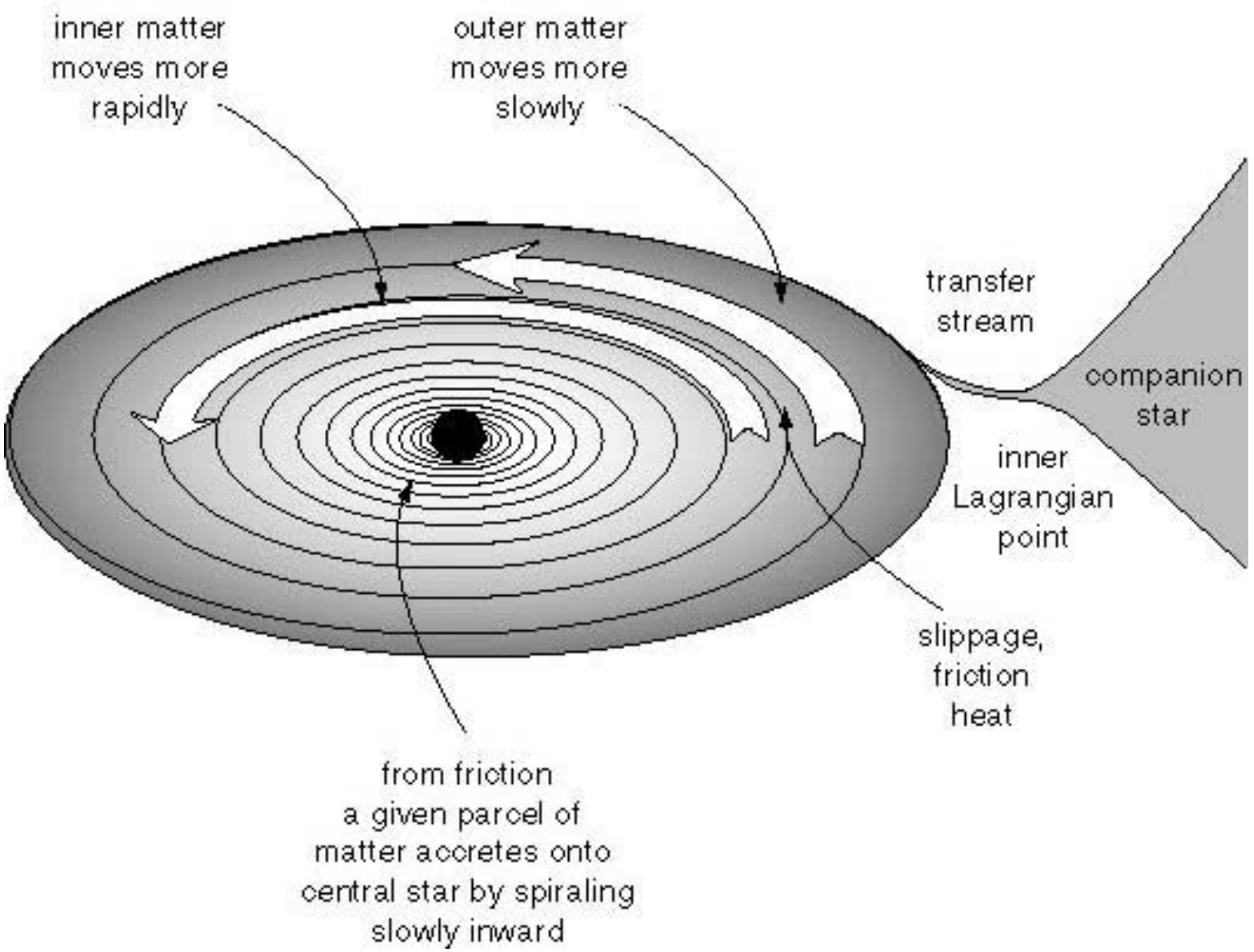
Reading: Sections 6.4 - 6.7, Betelgeuse, Section 1.2, Chapter 2, Sections 3.1 – 3.5, 3.10, 4.1 – 4.5.

Astronomy in the news? Space Shuttle Discovery launched for the last time. Will rendezvous with the International Space Station tomorrow.

Pic of the day: small irregular galaxy, NGC 4449, similar to Large Magellanic Cloud, host of SN 1987A

Goal – to understand how accretion disks work, what sort of radiation they emit.

# Basic Disk Dynamics - Figure 4.1



# Demonstration of Accretion Disk Dynamics

Need a volunteer

# Basic Disk Dynamics

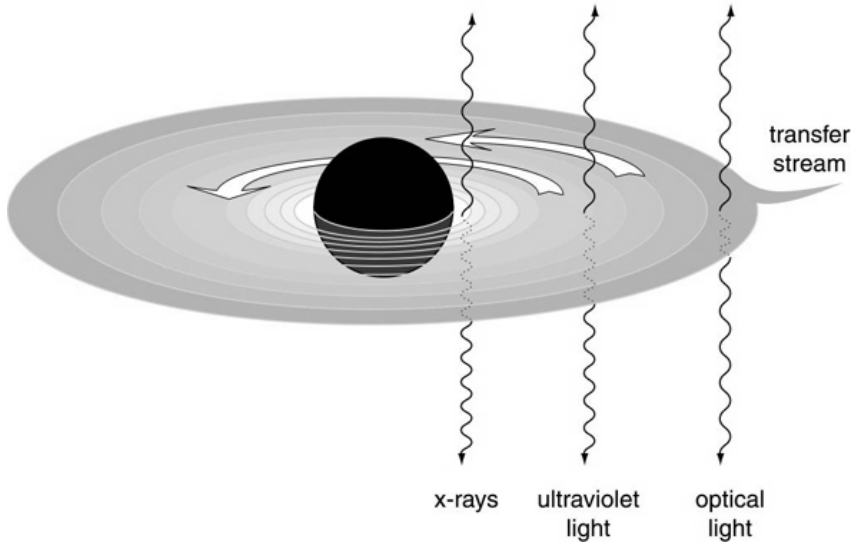
Orbits closer to the center are faster.
This creates rubbing and friction and heat, everywhere in the disk.

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



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

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

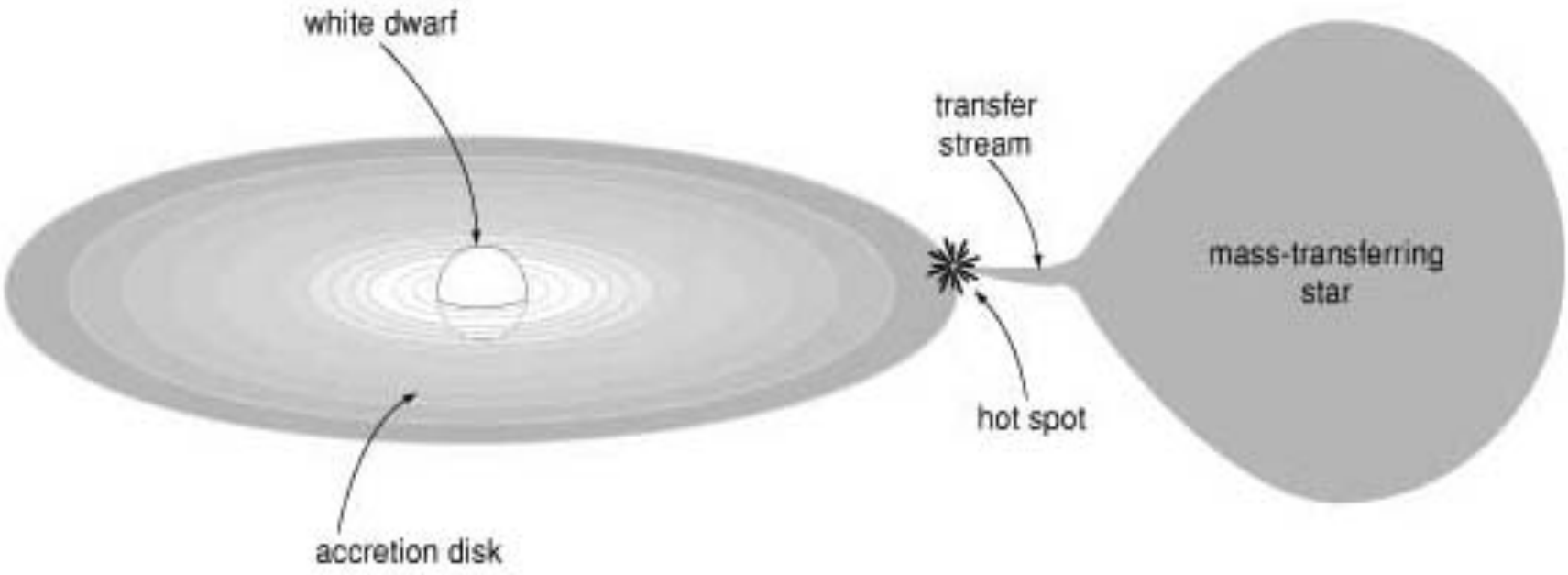
# Cataclysmic Variables

Second stage of mass transfer

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***.



# § 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 → violent explosion
Type Ia Supernova?!

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, mass transfer => ***Two WDs!***

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.

Sky Watch

Recurrent Novae:

U Sco in the constellation Scorpius is a Recurrent Nova,
It may be a candidate to explode as a supernova!

Might see Scorpius. Also has neutron stars and black holes.

T Pyx in constellation Pyxis.

One Minute Exam

We expect classical nova systems to end up making two white dwarfs orbiting one another because:

The first white dwarf loses mass and hence cannot grow and explode

The first white dwarf will accrete mass until it reaches the Chandrasekhar limit

The main sequence star transferring mass must eventually make a white dwarf

The second white dwarf has the Chandrasekhar mass