Thursday, September 10, 2009

IYA “Other Worlds Exhibit” Harry Ransom Center, started September 8. View for extra credit.

Rongfeng on travel next week, cancel his office hours. Chi-ting will cover Wednesday Help Session.

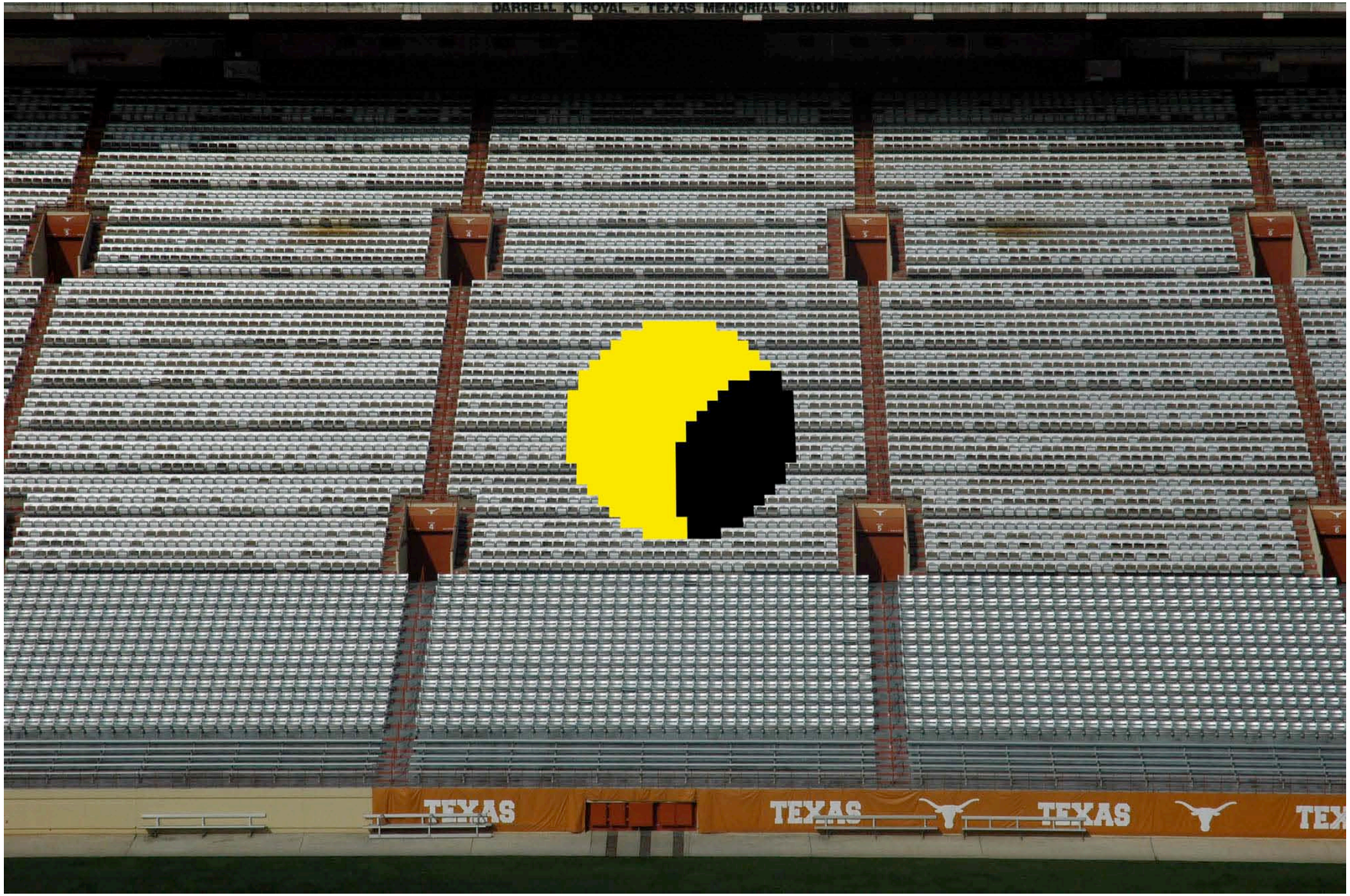
Astronomy in the News? Photos from newly-repaired Hubble Space Telescope released

Project October 6, 10 AM to 2 PM: 350 volunteers to reproduce Texas solar eclipses for next 340 years in stadium.

Wheeler answer in Astronomy magazine SN in binary

Pic of the Day - Butterfly nebular, planetary nebula from repaired Hubble.

Stadium eclipse project seeking volunteers for October 10: eclipsesforaustin@gmail.com



More new Hubble images

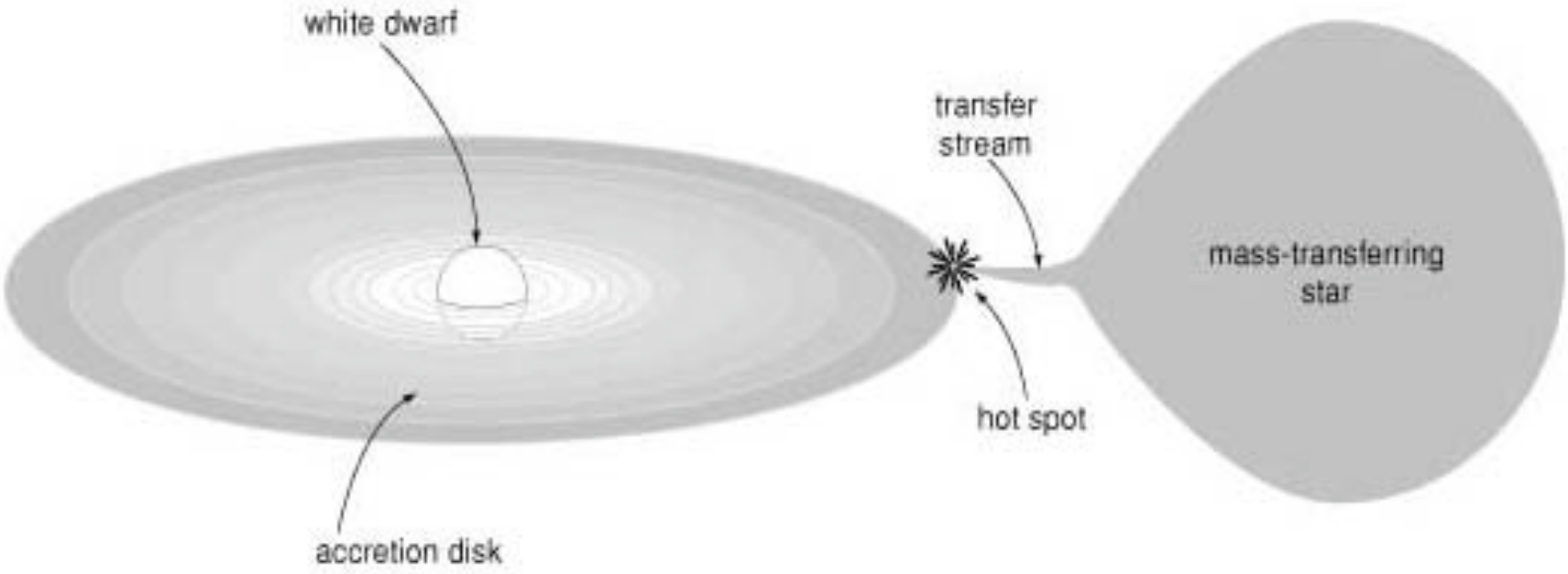
Cataclysmic Variables

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***.



Cataclysmic Variables

Dwarf Nova - flare × 10 brighter
intervals of weeks to months
last days to weeks

Recurrent Nova - flare × 1000 brighter
every 10-100 years
last weeks to months

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} × brighter (10 billion times)
last months to years

Dwarf Nova

Activity in the ***accretion disk***, not transferring star or central star.

Mechanism - store and flush, works when the transfer rate is low.

Disk is first cool, semi-transparent,
heat radiates away
little accretion, input more than accretion,
matter accumulates in STORAGE STATE

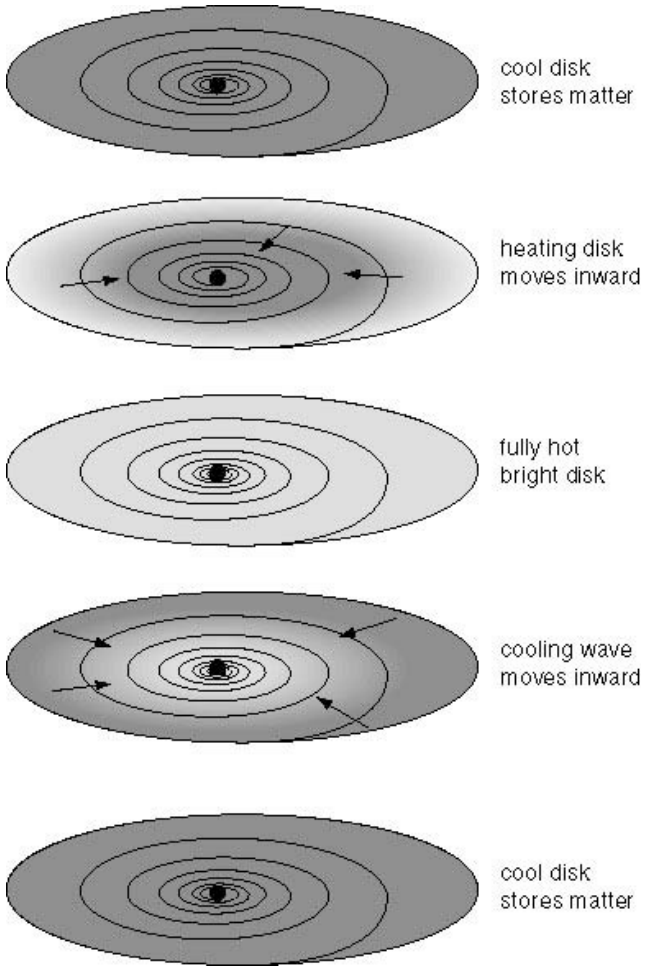
Disk gets denser, opaque, traps heat.
hotter disk generates ***more friction and heat***

⇒***Run away to bright, hot disk***

HOT, BRIGHT, FLUSHING STATE

More rapid flow through disk, faster than input
⇒ disk thins out, turns semi-transparent,
cools, returns to STORAGE STATE

REPEAT



Demonstration of Dwarf Nova

Accretion Disk Instability

Need a volunteer

Sky Watch

Dwarf Novae:

SS Cygni - brightest dwarf novae in the sky, but a bit too dim for naked eye. In constellation Cygnus.

U Geminorum - in the constellation Gemini

Self-graded pop quiz

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

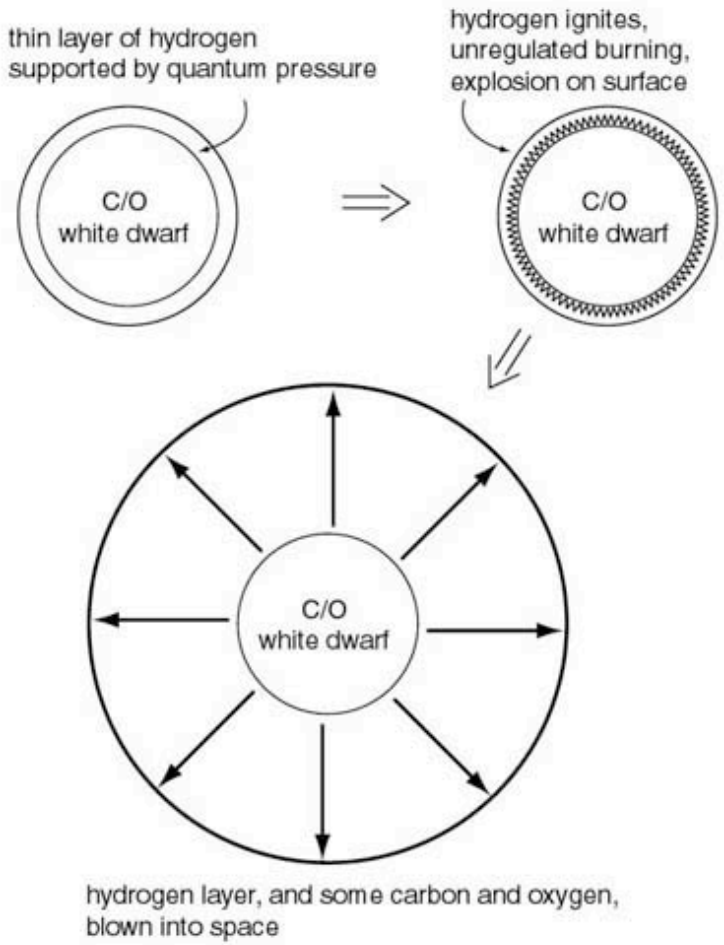
Draw a picture of a Cataclysmic Variable and label all the key parts.

Classical Nova

Hydrogen from transfer accumulates on surface of white dwarf composed (usually) of Carbon/Oxygen
(burning He → C/O in core of red giant before envelope is ejected as a planetary nebula)

H is supported by ***Quantum Pressure***
H gets denser, hotter begins to burn (to make He)
Burning is ***unregulated*** - explode surface layer of H

C/O core essentially undisturbed, although a little mass is ripped from the surface of the core



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.

Recurrent Nova

Mechanism uncertain

Probably variation of Classical Nova with mass of white dwarf especially near ***Chandrasekhar mass***

At ***Chandrasekhar mass***, may get a Supernova (will discuss specific mechanism later, Chapter 6)

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

In dwarf nova systems, the activity causing the outburst occurs

A In the mass transferring star

B In the accretion disk

C On the surface of the white dwarf

D At the inner Lagrangian point

§5.3 Origin of Cataclysmic Variables

Cataclysmic variables often have a ***main sequence companion transferring mass*** -- how can this be?

The two stars must once have been far apart to allow the originally more massive star to make a red giant with a white dwarf core.

Need room!!

The stars are observed now to be close together with the main sequence star filling its Roche lobe.

The main sequence star has not expanded to become a red giant, how come it is filling its Roche lobe?