

10/23/06

Extra Credit Due Today

Exam grades posted

Key will be posted late tomorrow.

Exams will be returned on Wednesday.

News? Hematite magnets

Pic of the day - pic of Orinid meteor shower taken in Turkey



Radio pulsars are alone in space or in non-transferring binary

Other NS are in binaries with mass transfer

High gravity of NS, rapid motion in inner disk, great friction, heat

=> X-rays

matter lands on, collides with NS Surface => X-rays

Uhuru satellite launched from Kenya 1972 found sky ablaze in X-rays

Neutron stars and black holes in binary systems.

For strong magnetic field matter connects to, flows *along* lines of force

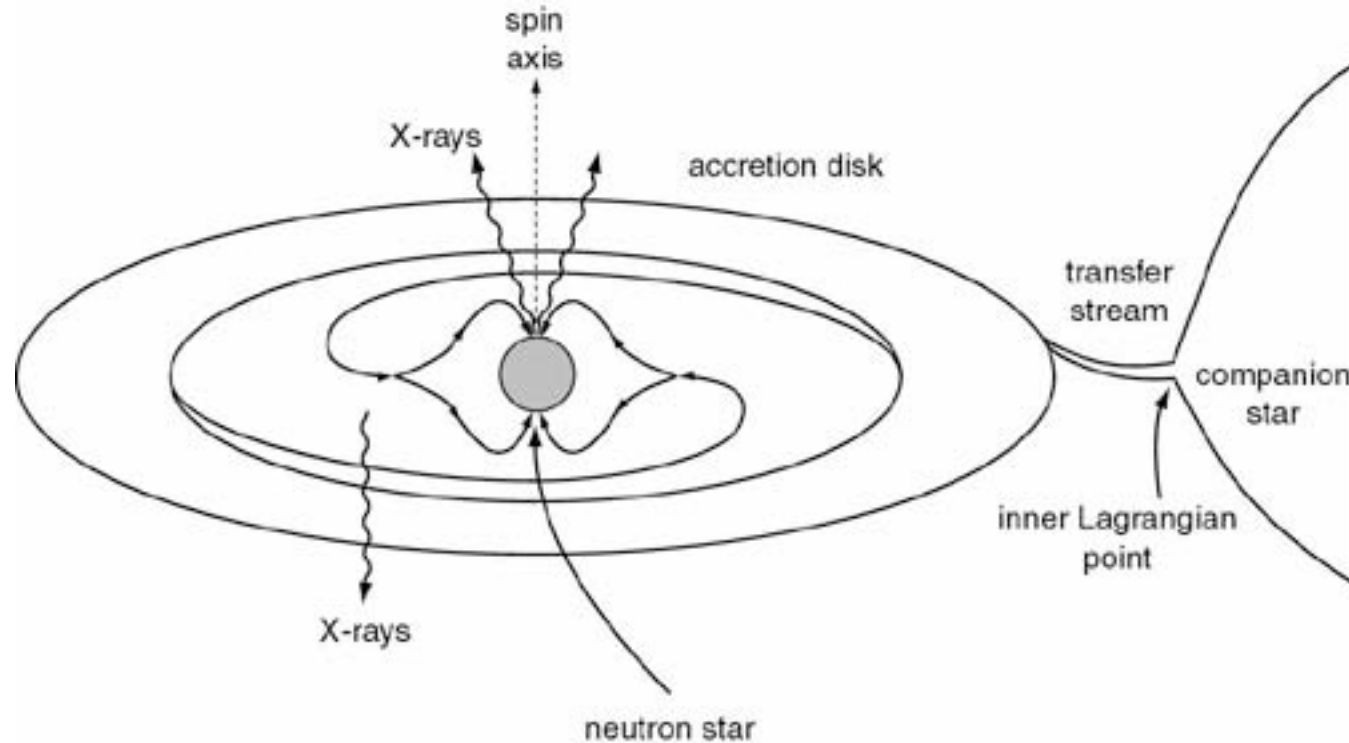
(can't flow across field lines of force)

Automatically channels matter to poles - hot X-rays (kills radio)

Rotation gives X-ray "pulses" by light house mechanism.

Nobel prize in 2002 to Riccardo Giacconi for this and related discoveries.

Figure 8.2



Some neutron stars are in binary systems, they accrete mass through an accretion disk and produce *X-rays*.

Accretion onto tilted magnetic poles can give pulses of X-rays by “lighthouse” mechanism

X-ray Transients - flare every few years for a month or so: suspect *disk instability* like *dwarf novae*, but neutron star, not white dwarf.

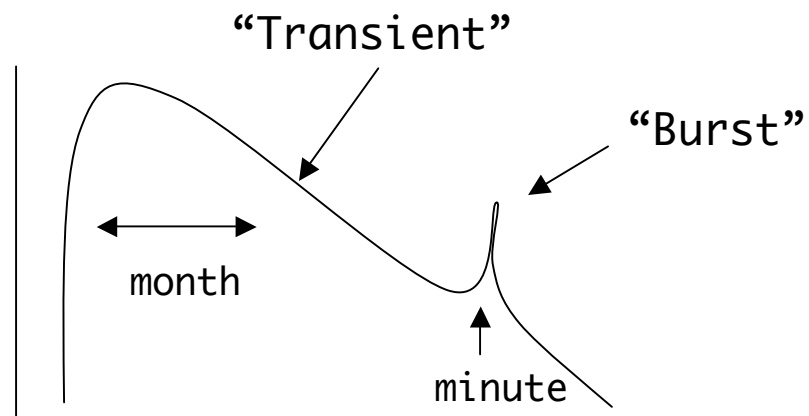
X-ray Bursters - rise in about a second, decay in a minute, no “pulses,” suspect low magnetic fields, Analog of *classical novae*, thermonuclear burning on surface of neutron star not white dwarf

H is *thermally supported* - regulated burning  $H \rightarrow He$

He, high density, *quantum pressure* - unregulated  $\rightarrow$  *flash!*

little matter expelled because of high gravity

One Case  
Both Phenomena



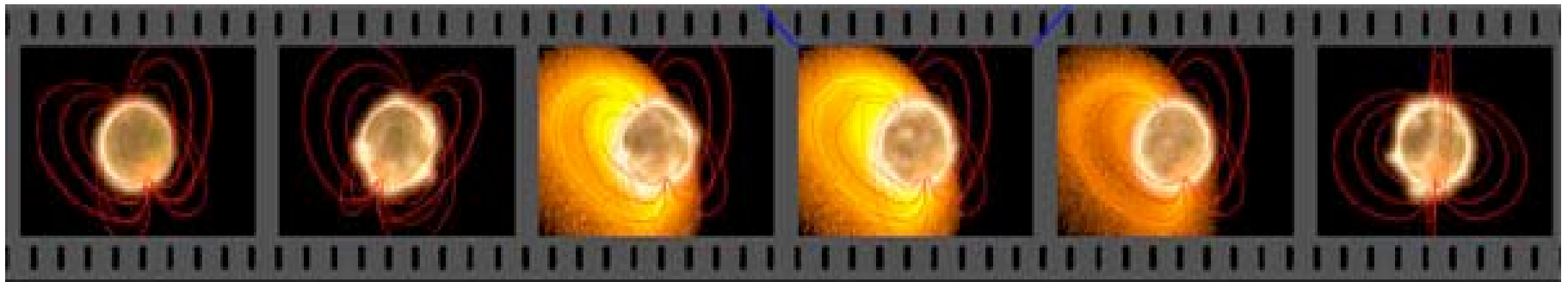
## Soft Gamma Ray Repeaters - 4 known

One flared in the Large Magellanic Cloud galaxy, energy arrived in March 5, 1979.

Another flared in our Galaxy, energy arrived August 27, 1998, caused aurorae from 1000's of light years away.

Yet another flared in our Galaxy with energy arriving December 27, 2004, on the far side of the Galactic center, perhaps 10's of 1000's of light years away, brightest release of energy ever seen in the Galaxy, 100 times more powerful than August 1998 burst.

Magnetic eruption in neutron star [not necessarily in binary system.]



Theory - break patch of iron-like “crust” of neutron star, convert magnetic energy to heat (1998 burst) or completely rearrange magnetic field configuration (2004 burst).

Require “wiggling” of very strong magnetic fields,  $100 \times$  Crab pulsar  
 $\Rightarrow$  *Magnetar* - very highly magnetic pulsar.

Origin of magnetars compared to normal pulsars not yet known.

Formation might be related to hypernovae or Gamma-ray bursts (Chapter 11).

X-ray, Gamma-ray satellites should see many of these brightest bursts (December 27) in distant galaxies.