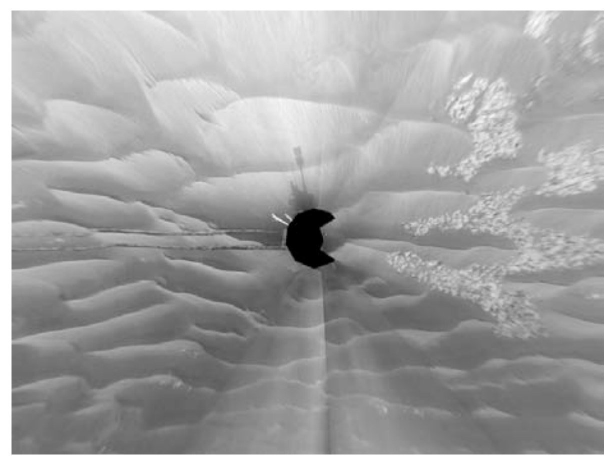
Tuesday, March 24, 2009

Reading for Test 3, Chapter 8: Sections 8.1, 8.2, 8.5, 8.6, 8.7, 8.10

***Sky Watch due***

Astronomy in the News? Successful launch of space shuttle to International Space Station on March 15. March 20 spring equinox, first day of Spring

Pic of the Day - photo by Mars Rover Opportunity



# Extra Credit for International Year of Astronomy

1 point added to term average

Check out: http://mcdonaldobservatory.org/iya/

In particular:

This IYA cornerstone project will consist of four days of astronomy activities across the globe April 2-5. During that time, professional observatories around the world — including McDonald Observatory — will stage a 24-hour webcast April 3 (Universal Time) to show what happens in a night at a research observatory. This webcast will be available on the official 100 Hours of Astronomy website. McDonald Observatory Director Dr. David L. Lambert will be a featured speaker. The McDonald Observatory portion of the webcast will begin at 12:20 a.m. Central Daylight Time on April 4 (5:20 Universal Time April 3).

Listen to part of this and write up a brief report.

# Extra Credit for International Year of Astronomy

http://astronomy2009.us/


ORDER YOUR VERY OWN
GALILEOSCOPE AT
WWW.GALILEOSCOPE.ORG

Replica of Galileo’s original telescope.

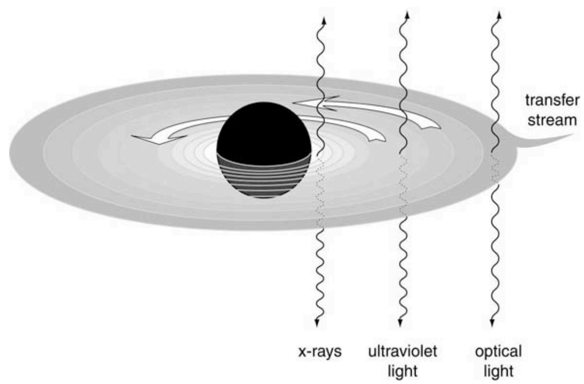
$15

Absolutely NOT REQUIRED for extra credit.

some NS are in binaries ***with mass transfer***

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

=> X-rays




In addition, 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. Many satellites launched since then, including *Chandra Observatory*.

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, Repeat in hours to months.

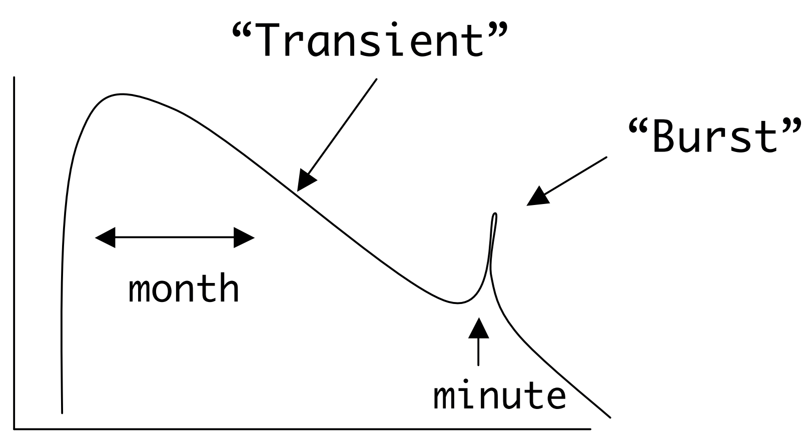
Analog of ***classical novae***, thermonuclear burning on surface of neutron star not white dwarf

H is *thermally supported* - regulated burning H → He

He, high density, *quantum pressure* - unregulated → ***flash!***

little matter expelled because of high gravity

One Case
Both
Phenomena



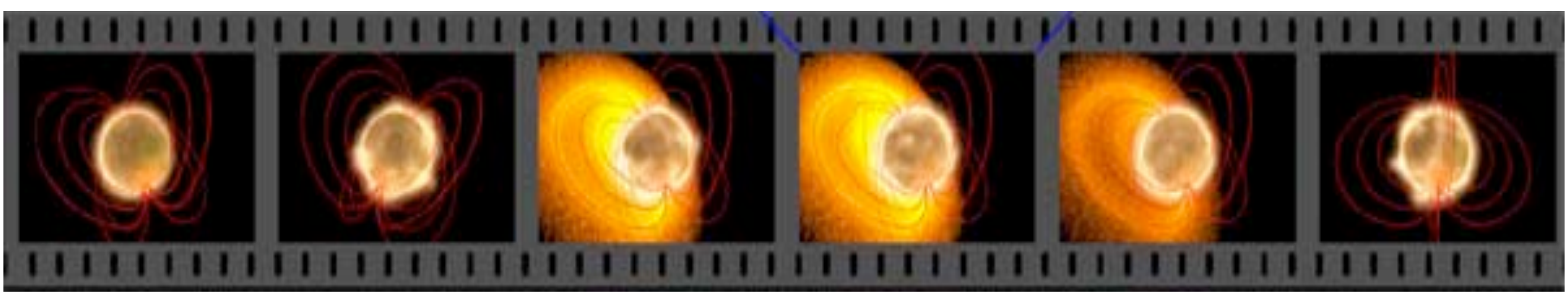
Soft Gamma Ray Repeaters - 4 known

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, from 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 × 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.

# Skywatch Extra Credit Targets
# constellations only, not all visible

## Magnetar Candidates

| Name | Location | Rotation (seconds) | Year Discovered |
|---|---|---|---|
| SGR 0526-66 | Large Magellanic Cloud | 8.0 | 1979 |
| SGR 1900+14 | Aquila | 5.16 | 1979 |
| SGR 1806-20 | Sagittarius | 7.56 | 1979 |
| SGR 1801-23 | Sagittarius | - | 1997 |
| SGR 1627-41 | Ara | 6.4 | 1998 |
| AXP 1E 2259+586 | Cassiopeia | 7.0 | 1981 |
| AXP 1E1048.1-5937 | Carina | 6.4 | 1985 |
| AXP 4U 0142+61 | Cassiopeia | 8.7 | 1993 |
| AXP 1RXS J170849-400910 | Scorpius | 11.0 | 1997 |
| AXP 1E 1841-045 | Scutum | 11.8 | 1997 |
| AXP AX J1844-0258 | Aquila | 7.0 | 1998 |
| AXP CXOU J010043.1-721134 | Small Magellanic Cloud | 8.0 | 2002 |
| AXP XTE J1810-197 | Sagittarius | 5.5 | 2003 |
| AXP CXO J164710.2-455216 | Ara | 10.6 | 2005 |

One Minute Exam

Which statement is most relevant to making a radio pulsar?

A) A solitary neutron star rotates with a tilted magnetic field.

B) A neutron star with an unstable accretion disk accretes matter from a binary companion.

C) A neutron star with a tilted magnetic field accretes matter from a binary companion.

D) A neutron star has a magnetic field 100 times stronger than the pulsar in the Crab nebula.

One Minute Exam

Which statement is most relevant to making an X-ray pulsar?

A) A solitary neutron star rotates with a tilted magnetic field.

B) A neutron star with an unstable accretion disk accretes matter from a binary companion.

C) A neutron star with a tilted magnetic field accretes matter from a binary companion.

D) A neutron star has a magnetic field 100 times stronger than the pulsar in the Crab nebula.

One Minute Exam

Which statement is most relevant to making an X-ray transient?

A) A solitary neutron star rotates with a tilted magnetic field.

B) A neutron star with an unstable accretion disk accretes matter from a binary companion.

C) A neutron star accretes a layer of helium supported by quantum pressure.

D) A neutron star has a magnetic field 100 times stronger than the pulsar in the Crab nebula.

One Minute Exam

Which statement is most relevant to making an X-ray burster?

A) A solitary neutron star rotates with a tilted magnetic field.

B) A neutron star with an unstable accretion disk accretes matter from a binary companion.

C) A neutron star accretes a layer of helium supported by quantum pressure.

D) A neutron star has a magnetic field 100 times stronger than the pulsar in the Crab nebula.

One Minute Exam

Which statement is most relevant to making a soft gamma-ray repeater outburst?

A) A solitary neutron star rotates with a tilted magnetic field.

B) A neutron star with an unstable accretion disk accretes matter from a binary companion.

C) A neutron star accretes a layer of helium supported by quantum pressure.

D) A neutron star has a magnetic field 100 times stronger than the pulsar in the Crab nebula.

# New Topic: Black Holes

Chapter 9

What do you know about them -- When did you learn?

Reading, Chapter 9: all except 9.6.3, 9.6.4

# Black Holes

Mitchell, Laplace, late 18th Century: with Newton's Gravity
could have escape velocity greater than the speed of light =>
light could not get out, completely dark, *corps obscurs*.

Now know Newton was wrong.

Excellent approximation for weak gravity - "true" in that case

Conceptual problems $F = \frac{G\, M_1\, M_2}{r^2}$

infinite force for zero separation (in physics infinity $\Rightarrow$ problem )

instantaneous reaction => infinite speed of gravity

Experiment - wrong deflection of light.

Need Einstein and more!