03/03/2008

Exam 2 back Wednesday, sky watch Friday No class Friday

Astronomy in the News - flows along gullies on Mars are likely sand slides not water falls.

Pic of the day - thawing sand dunes on Mars, sublimation of carbon dioxide and water ice.





Reading

Chapter 8 Sections 8.1, 8.2, 8.5, 8.6, 8.7, 8.10

Third exam will probably be Chapters, 8 and 9, maybe 10



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 Xrays by "lighthouse" mechanism <u>X-ray Transients</u> - 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, $100 \times \text{Crab}$ 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	Aquil a	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	Aquil a	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

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.

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.

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.

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.

Which statement is most relevant to making a soft gammaray 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?