Wednesday, January 25, 2017

Powerpoint of lectures posted as pdf after every class, on Canvas and at http://www.as.utexas.edu/astronomy/education/spring17/wheeler/309n.html?a=lec

Wednesday Star Parties RLM, Friday/Saturday Public nights on Painter Hall. Option for doing Sky Watch.

Astronomy in the news?

NSEW?

What is that bright light in the West after sunset?

Who has identified Betelgeuse? Name in native tongue?

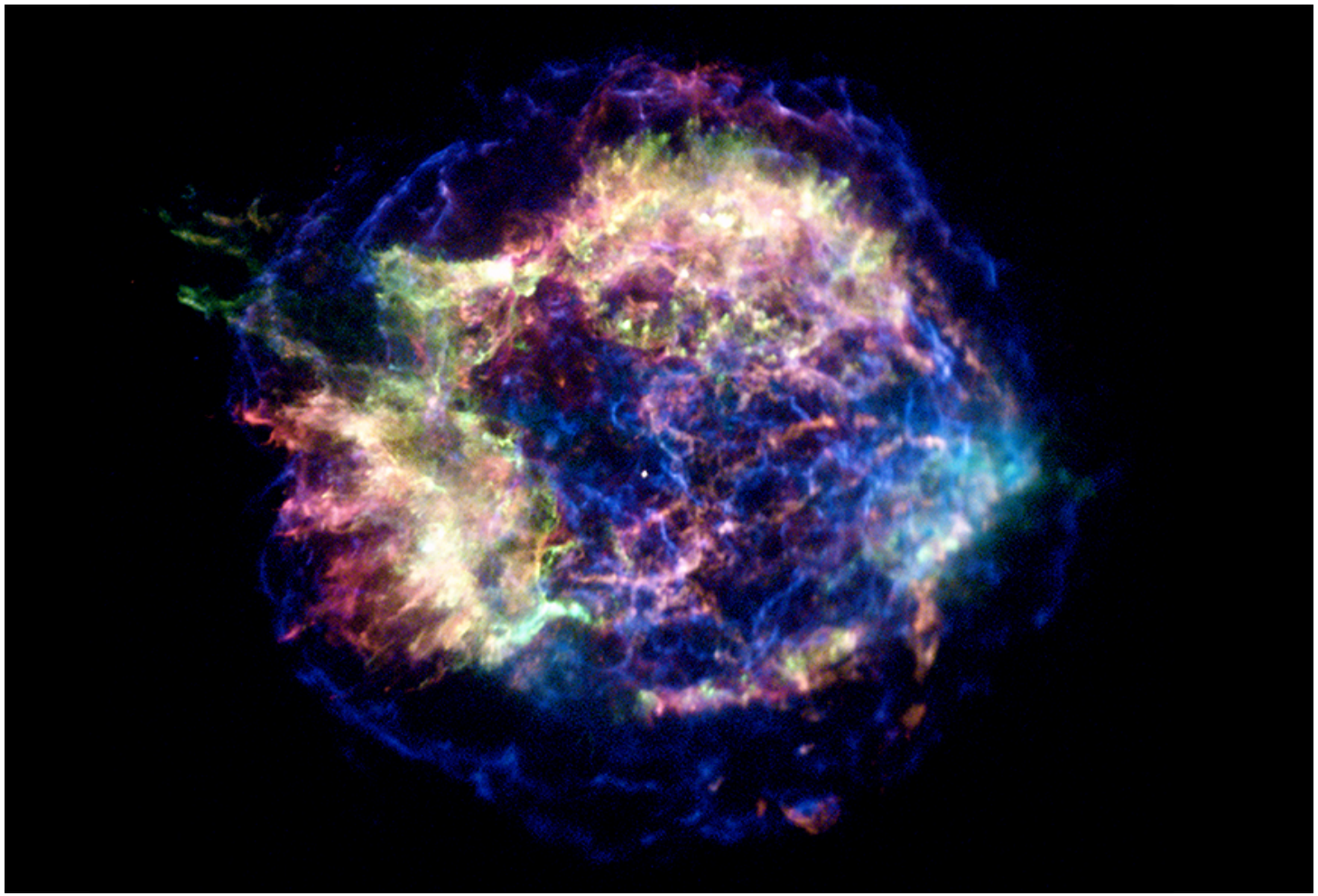
Whole sky chart.

Background Check

What is a neutron star?

What is a black hole?

Supernovae!



Reading:

Chapter 6 Supernovae, §6.1, 6.2, 6.3

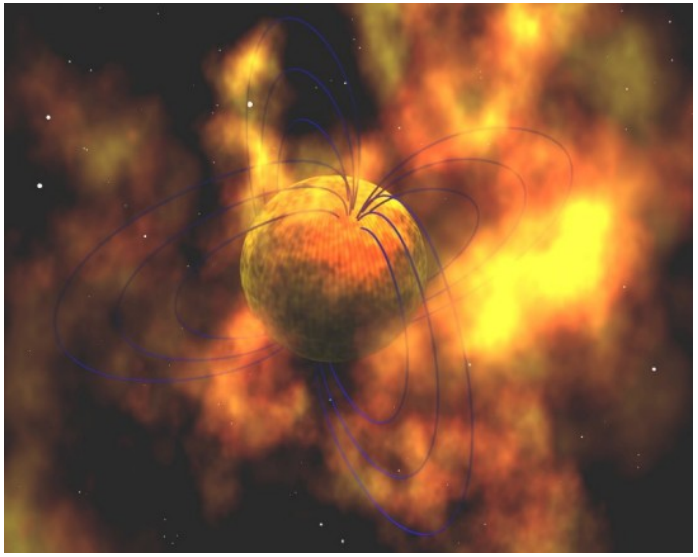
Background:

Chapter 1 Introduction, §1.1, 1.2.1, 1.3.1, 1.3.2

Chapter 5 White dwarfs, §5.1

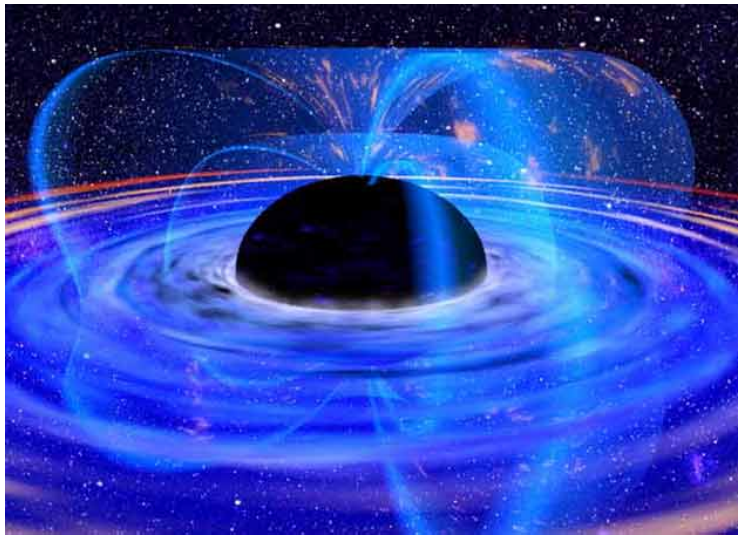
One type of supernova is powered by the ***collapse*** of the core of a massive star to produce

a ***neutron star***,



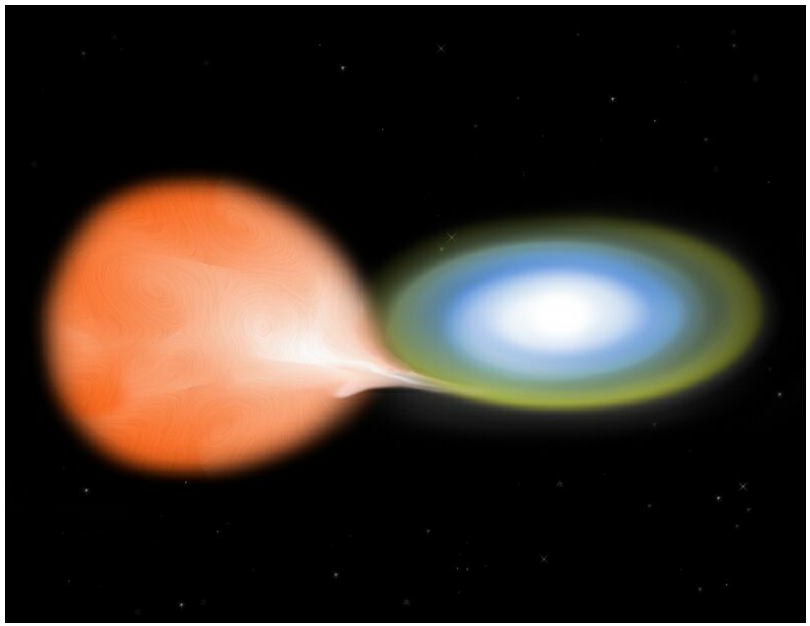
or perhaps

a ***black hole***

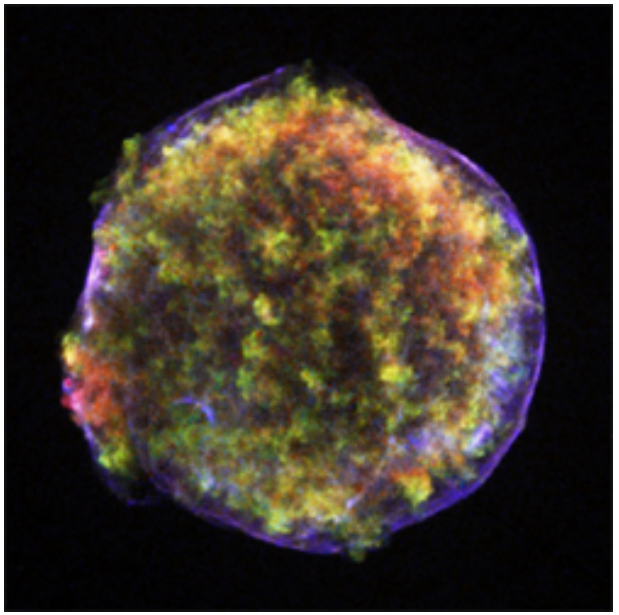


The mechanism of the explosion is still not fully understood.

The other common type of supernovae is thought to come from a white dwarf that grows to an explosive condition in a binary system.

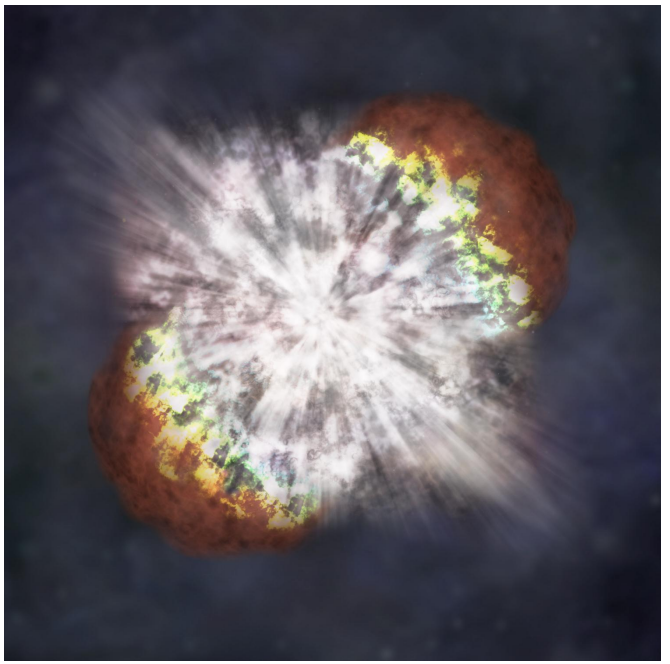


Chandra X-ray Observatory image
Of Tycho's supernova of 1572



These explode completely, like a stick of dynamite, and leave no compact object (neutron star or black hole) behind.

A third type was discovered by my group about a decade ago. These are rare, but 10 to 100 times brighter than “ordinary” supernovae and hence called superluminous supernovae.



Circumstantial evidence points to their origin in very massive stars, perhaps 100 times the mass of the Sun.

Some theories propose that these stars blow up completely leaving no compact remnant. Other theories propose that they form and are powered by highly magnetic neutron stars.

Goal:

To understand what we have learned from the study of old supernova explosions in our Milky Way Galaxy.

Chapter 6 Supernovae

Historical Supernovae - ***in our Milky Way Galaxy*** observed with naked eye over 2000 years especially by Chinese (preserved records), but also Japanese, Koreans, Arabs, Native Americans(?), finally Europeans. (WD = White Dwarf; NS = Neutron Star)

SN 185	earliest record	No NS	WD
SN 386		NS, jet?	massive
SN 1006	brightest	No NS	WD
SN 1054	Crab Nebula	NS, jets	massive
SN 1181	(Radio Source 3C58)	NS, jets	massive
SN 1572	Tycho	No NS	WD
SN 1604	Kepler	No NS	WD
~1680	Cas A	NS? jets	massive
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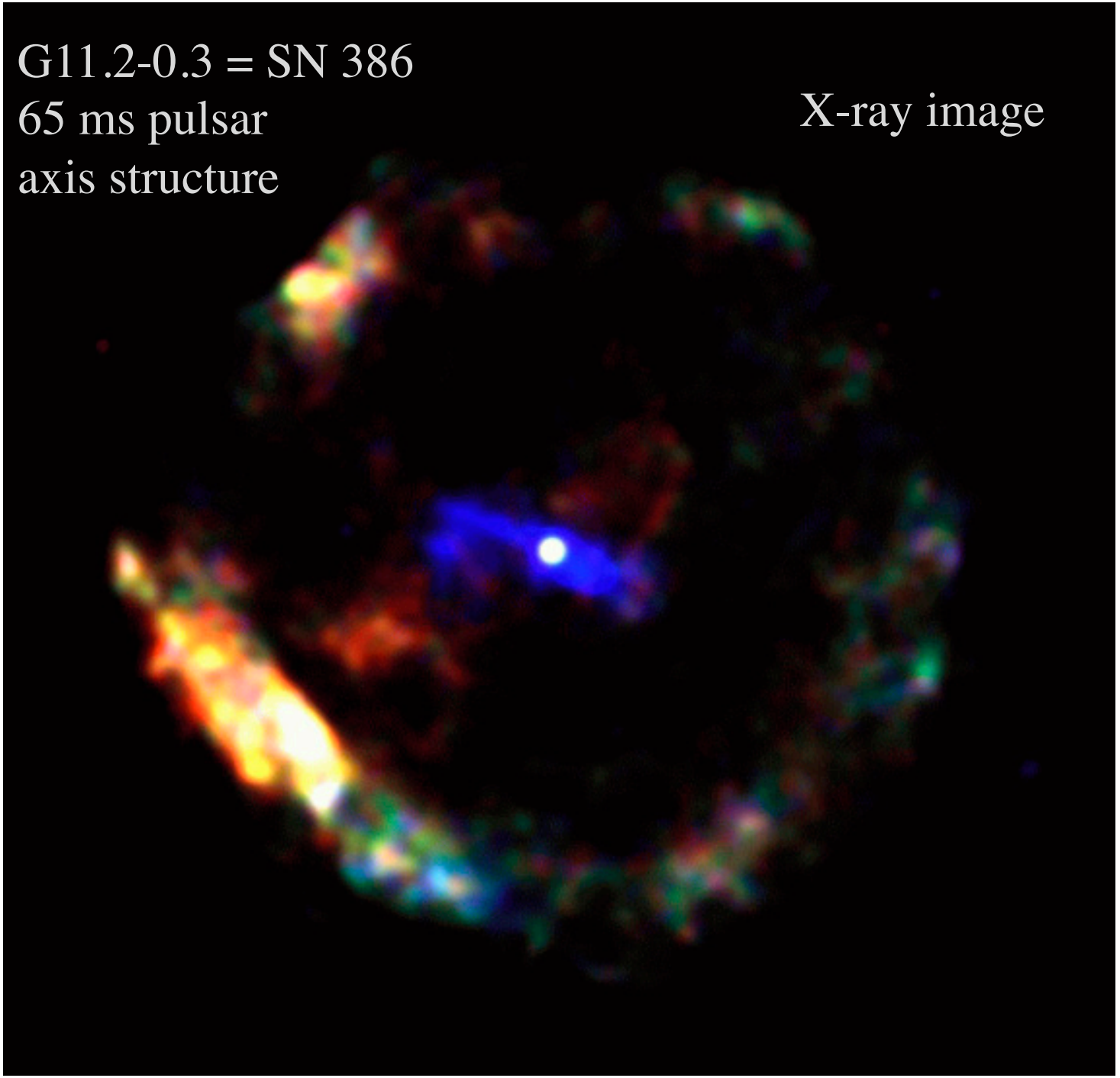
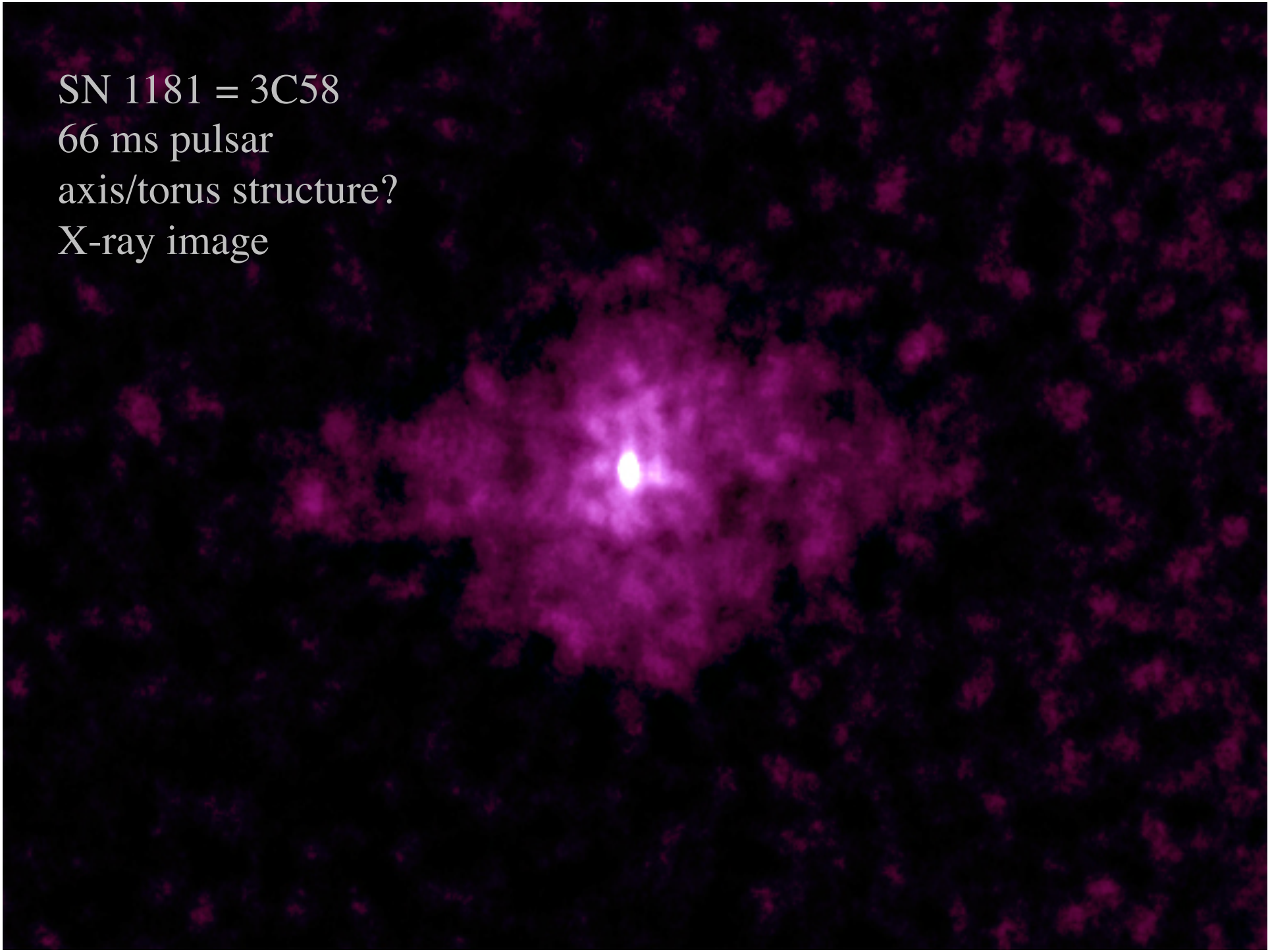
G1.9+0.3	latest? 140 years old	No NS	WD
SN 1987A	nearby galaxy	NS? Jets	massive


Chandra Observatory X-ray image, Spitzer, WISE infrared image
SN 185 = RCW 86
No evidence for neutron star


G11.2-0.3 = SN 386
65 ms pulsar
axis structure
X-ray image


Chandra Observatory X-ray image SN 1006
No evidence for neutron star

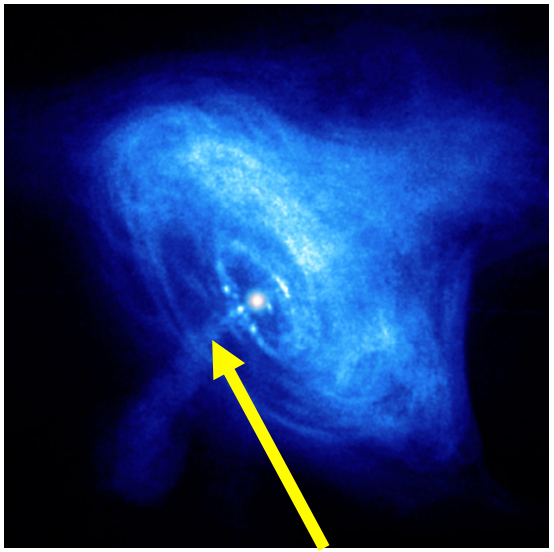

SN 1181 = 3C58
66 ms pulsar
axis/torus structure?
X-ray image

Crab Nebula

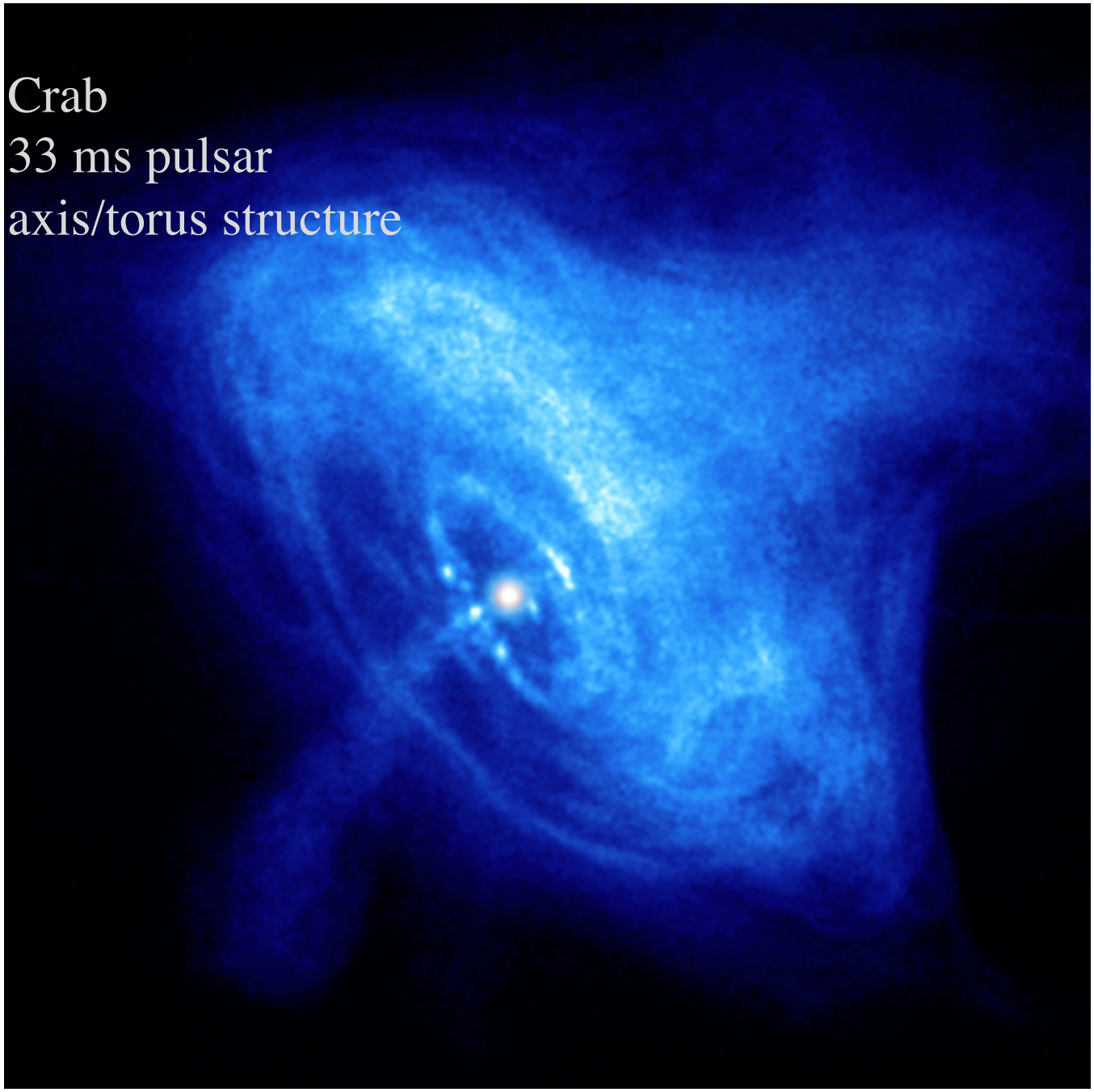
Remnant of "Chinese" Guest Star of 1054

Optical Image

Chandra Observatory
X-Ray Image



Left-over jet

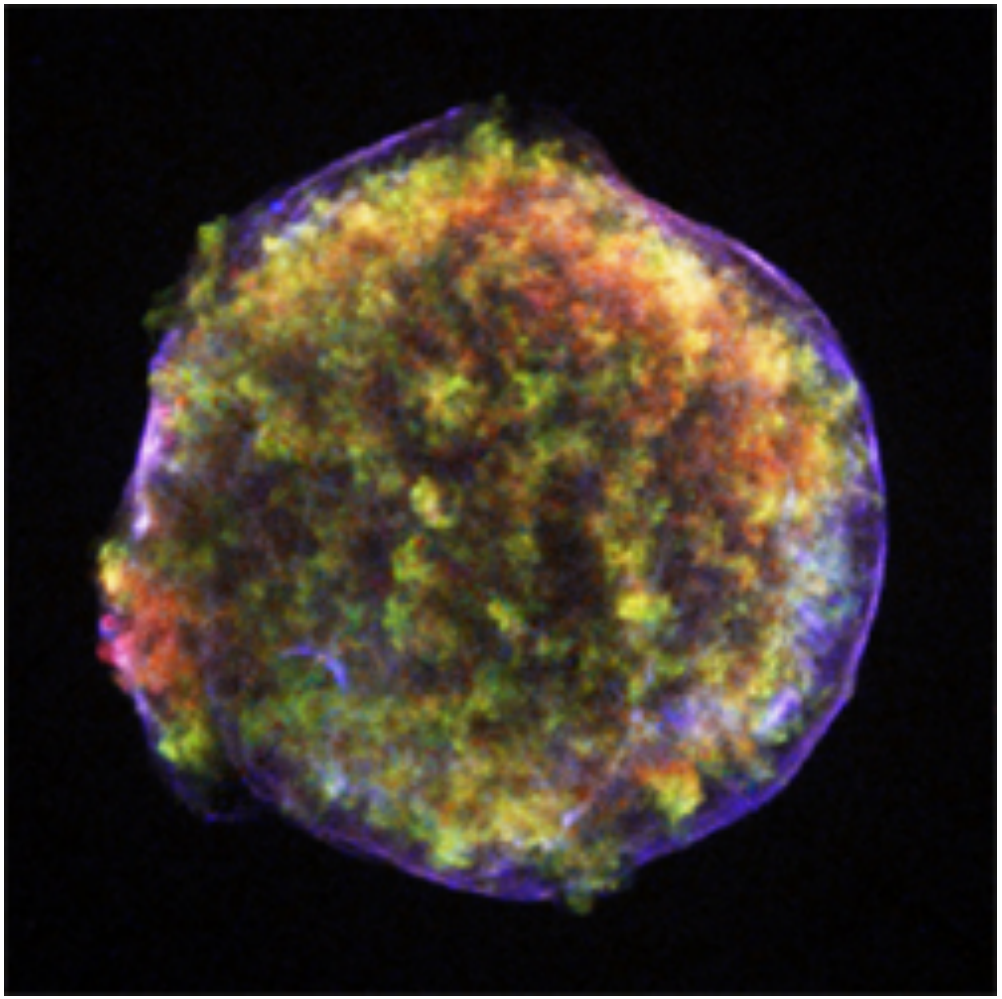

Crab
33 ms pulsar
axis/torus structure

Kepler

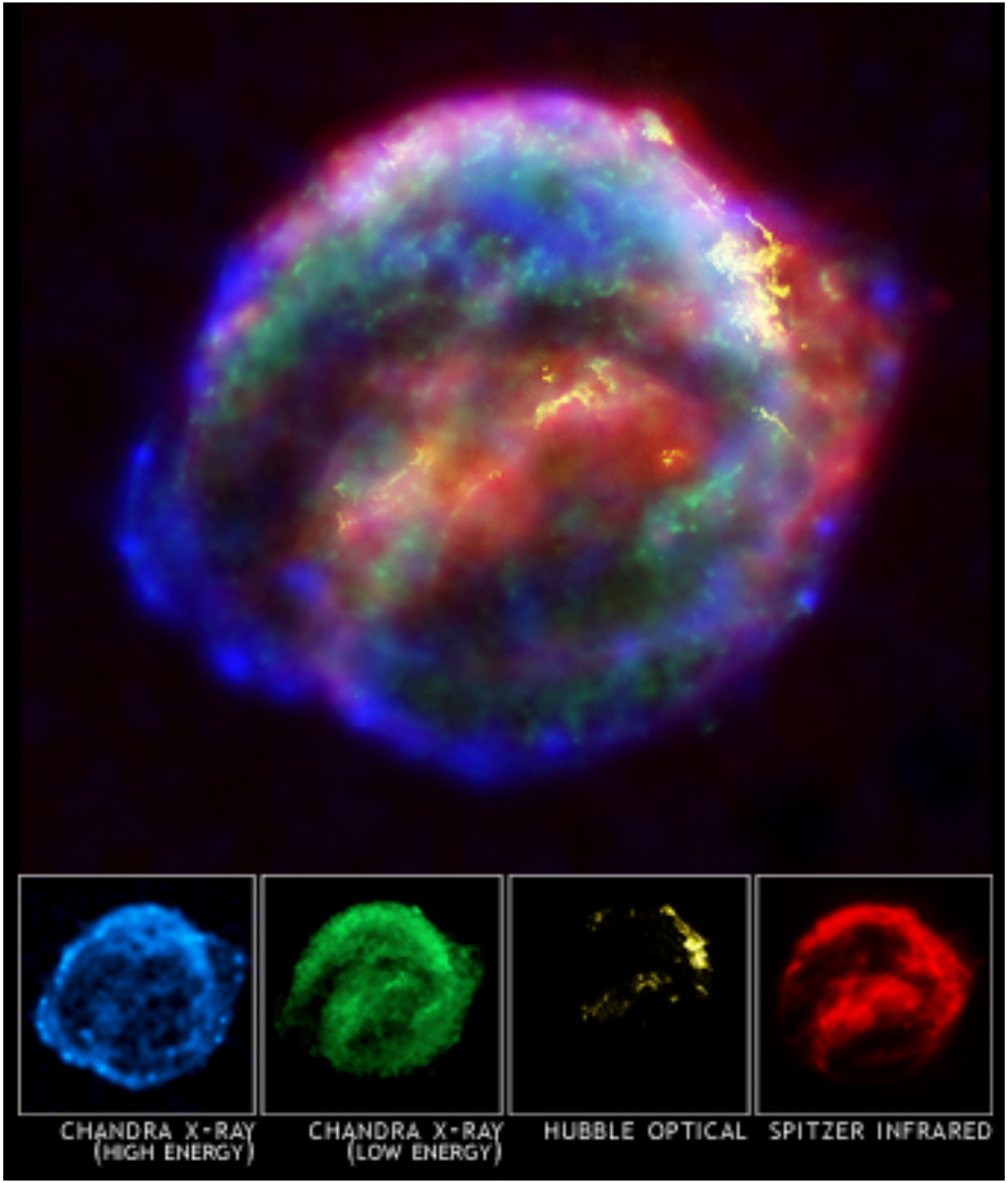
Tycho

Chandra Observatory X-ray Image of
Tycho's Supernova of 1572

No evidence for neutron star



SN 1006

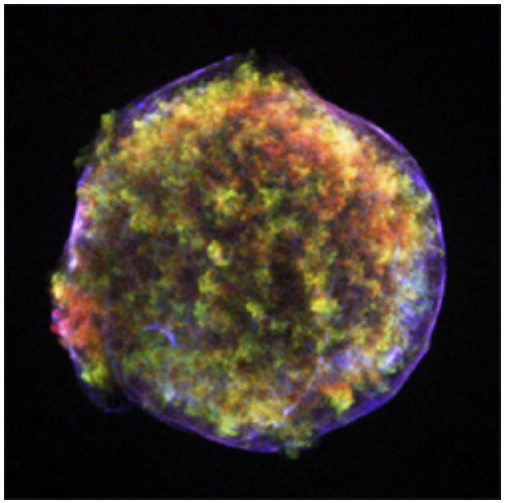


Great Observatories composite of Kepler's supernova 1604

No sign of neutron star

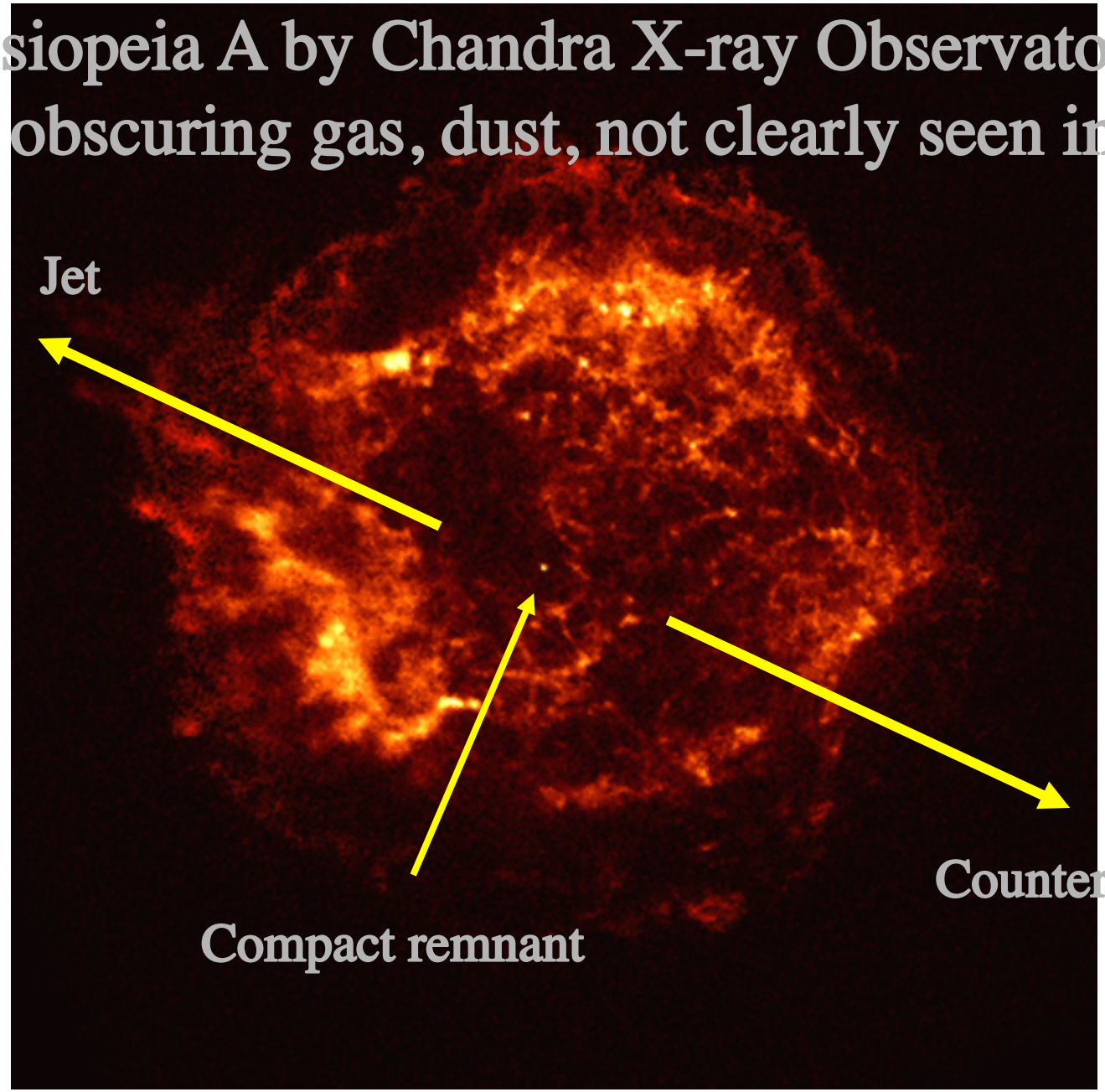
"sideways" alignment?

SN 1572 Tycho

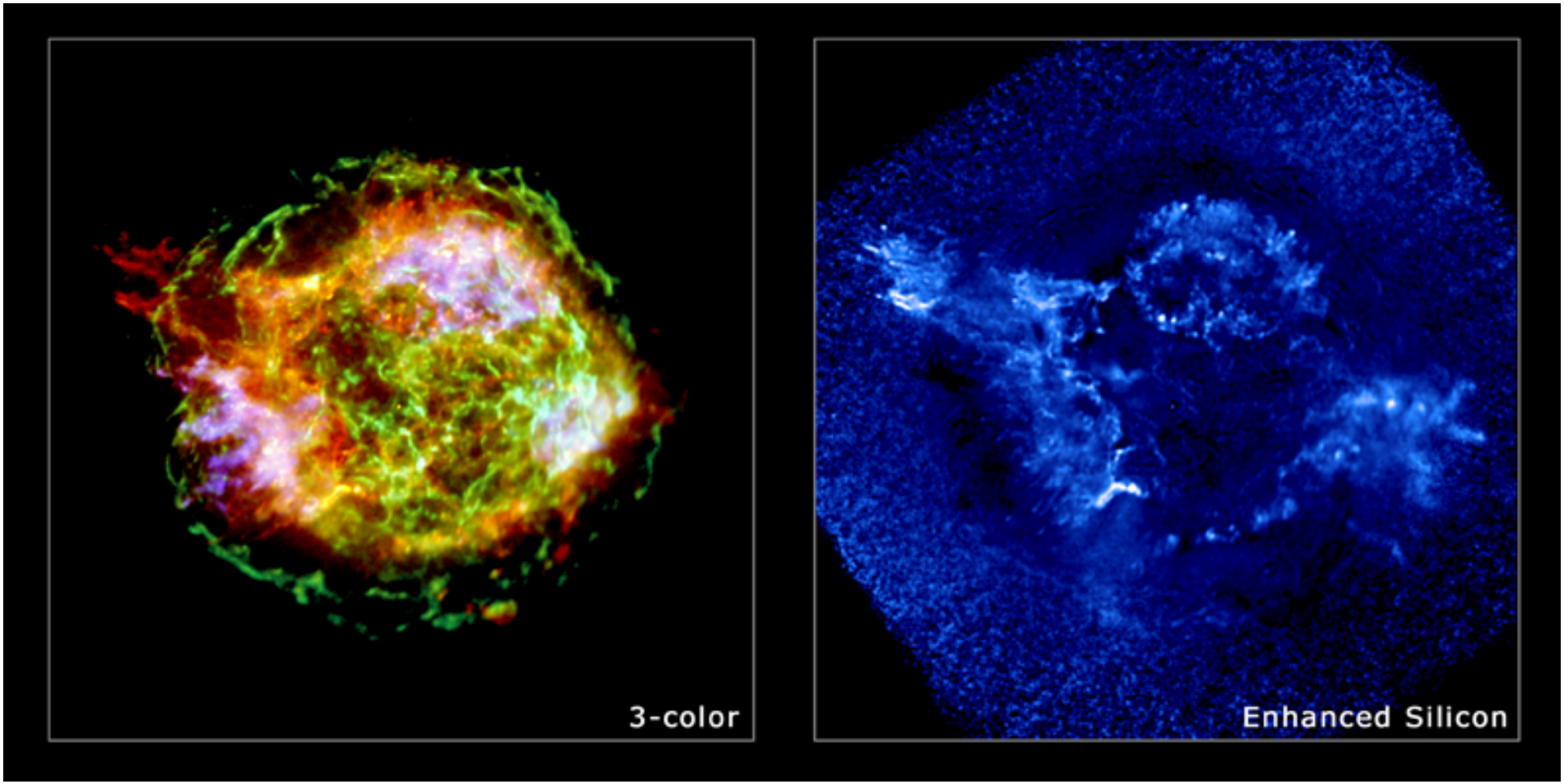


Cassiopeia A by Chandra X-ray Observatory

Behind obscuring gas, dust, not clearly seen in ~ 1680



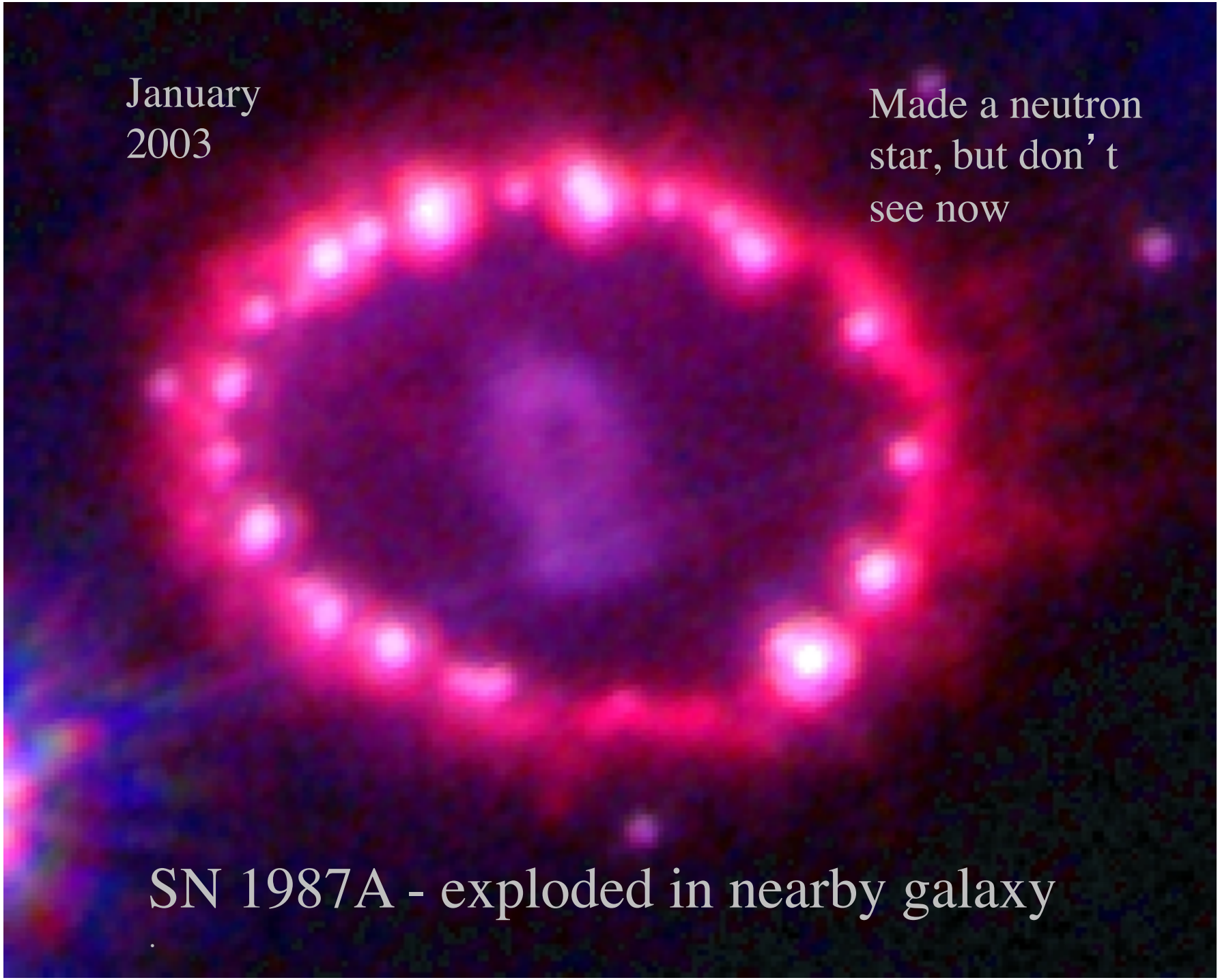
Chandra Observatory X-ray Image of Cas A



Chandra Observatory X-ray Image of G1.9+0.3

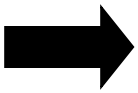
Youngest supernova detected in the Milky Way ~ 140 years old. Exploded near center of Milky Way, obscured by gas, dust, original explosion not observed.

No evidence for neutron star


January
2003
Made a neutron
star, but don't
see now
SN 1987A - exploded in nearby galaxy

One Minute Exam

The Crab Nebula supernova of 1054 shows a neutron star in its center. This suggests that:



It was a red giant when it exploded

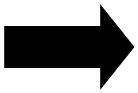
It was formed by the collapse of a massive star

It was formed by an exploding white dwarf

It actually exploded much earlier than 1054

One Minute Exam

Tycho's supernova of 1572 shows no sign of a compact object left over in its center. This suggests that:



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Sky Watch Extra Credit - location of Galactic (Milky Way) supernovae

SN 185 – Circinus/Centaurus (direction of Alpha Centaurus)

SN 386 - Sagittarius

SN 1006 - Lupus/Centaurus (difficult this time of year)

SN 1054 Crab Nebula - Taurus

SN 1181 – Cassiopeia

SN 1572 Tycho - Cassiopeia

SN 1604 Kepler - Ophiuchus

Cassiopeia A – Cassiopeia

G1.9+0.3 – Sagittarius

SN 1987A – only observable from the Southern Hemisphere