

Monday, September 9, 2103

First exam Friday, September 13, first Skywatch due

Review sheet posted today.

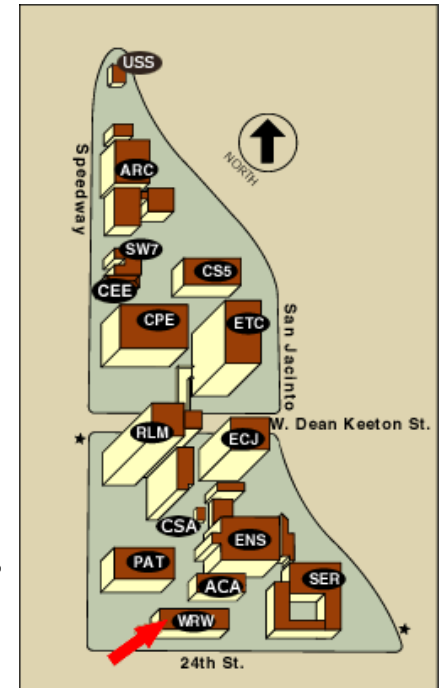
Review session Thursday, 5 – 6 PM, WRW 102

Reading posted under “announcements” on web page,
Chapter 6 - Sections 6.1, 6.2, 6.3 (also sections 1.2.4,
2.1-2.5, and 5.1)

Exam will draw on material presented in lecture. Use
reading for back up, reinforcement.

Astronomy in the news? LADEE US Moon probe launched
Friday evening. Studying water, lunar dust. YouTube

Quantum device.



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.

SN 185	earliest record	No NS
SN 386		NS, jet?
SN 1006	brightest	No NS
SN 1054	Crab Nebula	NS, jets
SN 1181	(Radio Source 3C58)	NS, jets
SN 1572	Tycho	No NS
SN 1604	Kepler	No NS
~1680	Cas A	NS? Jets

SN 1987A	nearby galaxy	NS? jets

Chandra Observatory X-ray image, Spitzer, WISE infrared image
SN 185 = RCW 86

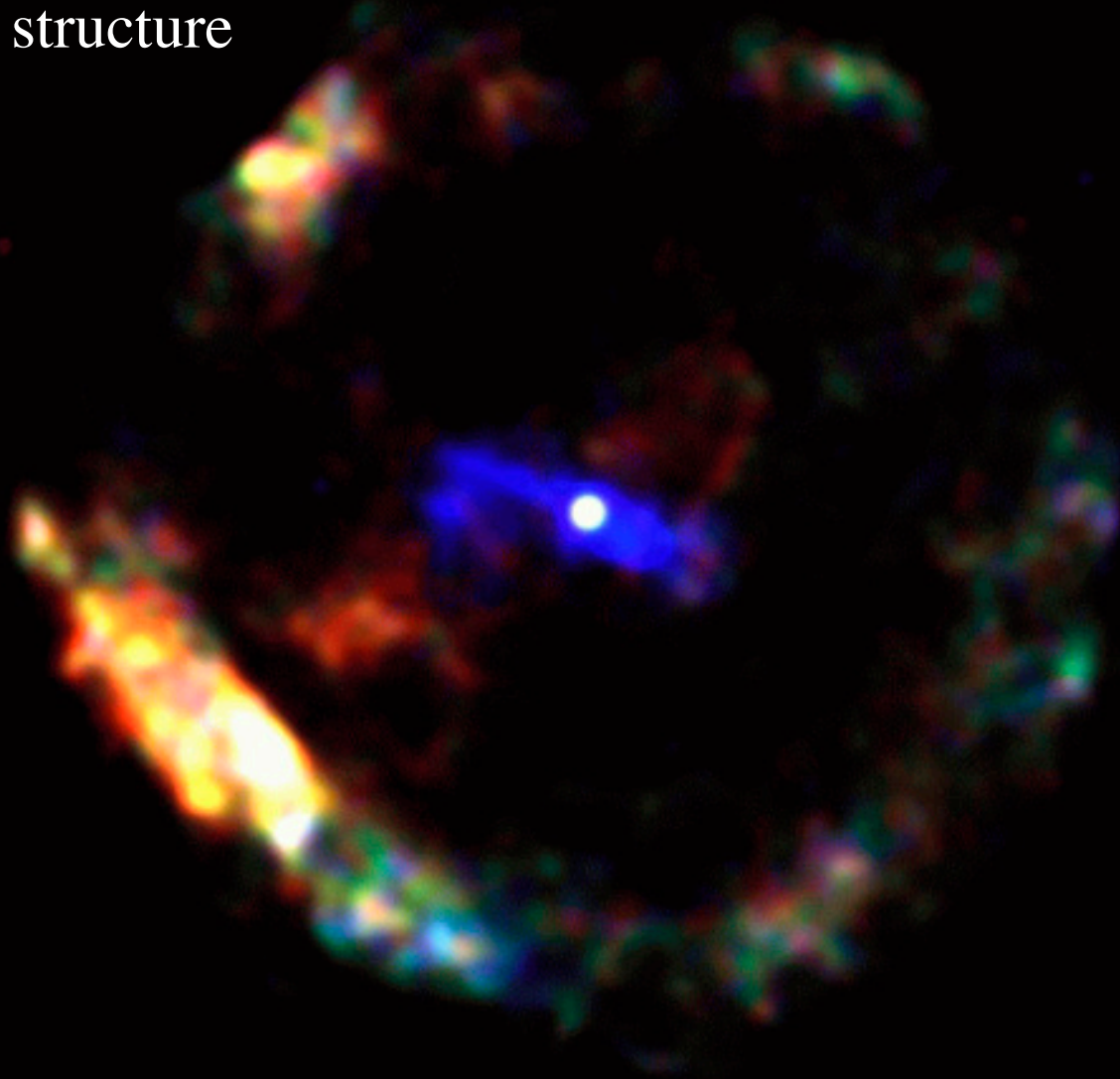
No evidence for neutron star



G11.2-0.3 = SN 386

65 ms pulsar

axis structure



Chandra Observatory X-ray image SN 1006

No evidence for neutron star

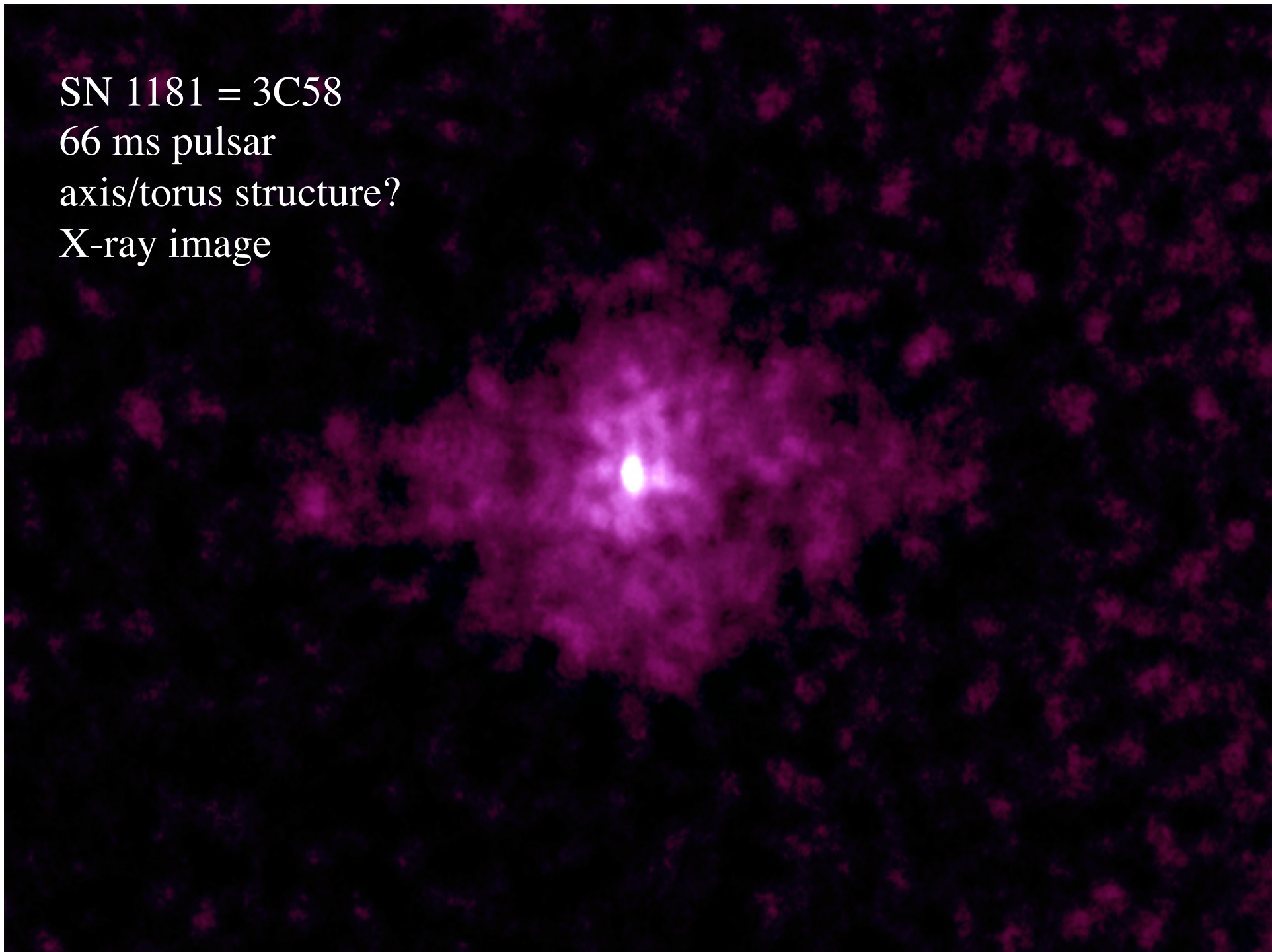


SN 1181 = 3C58

66 ms pulsar

axis/torus structure?

X-ray image



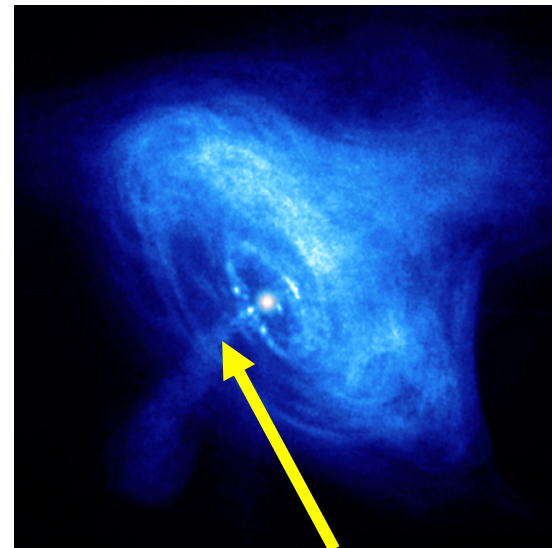
Crab Nebula

Remnant of “Chinese” Guest Star of 1054

Optical Image

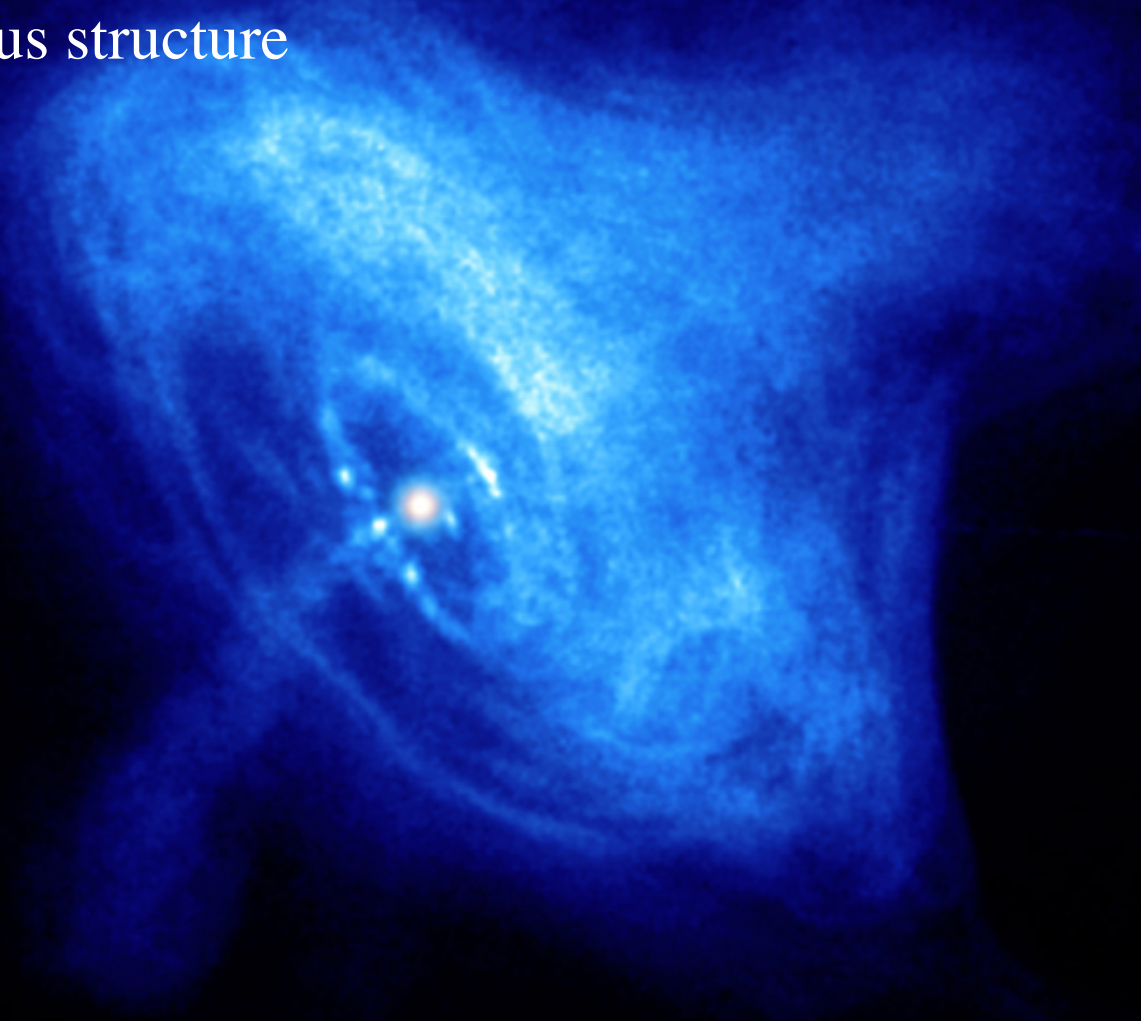


Chandra Observatory
X-Ray Image



Left-over jet

Crab
33 ms pulsar
axis/torus structure



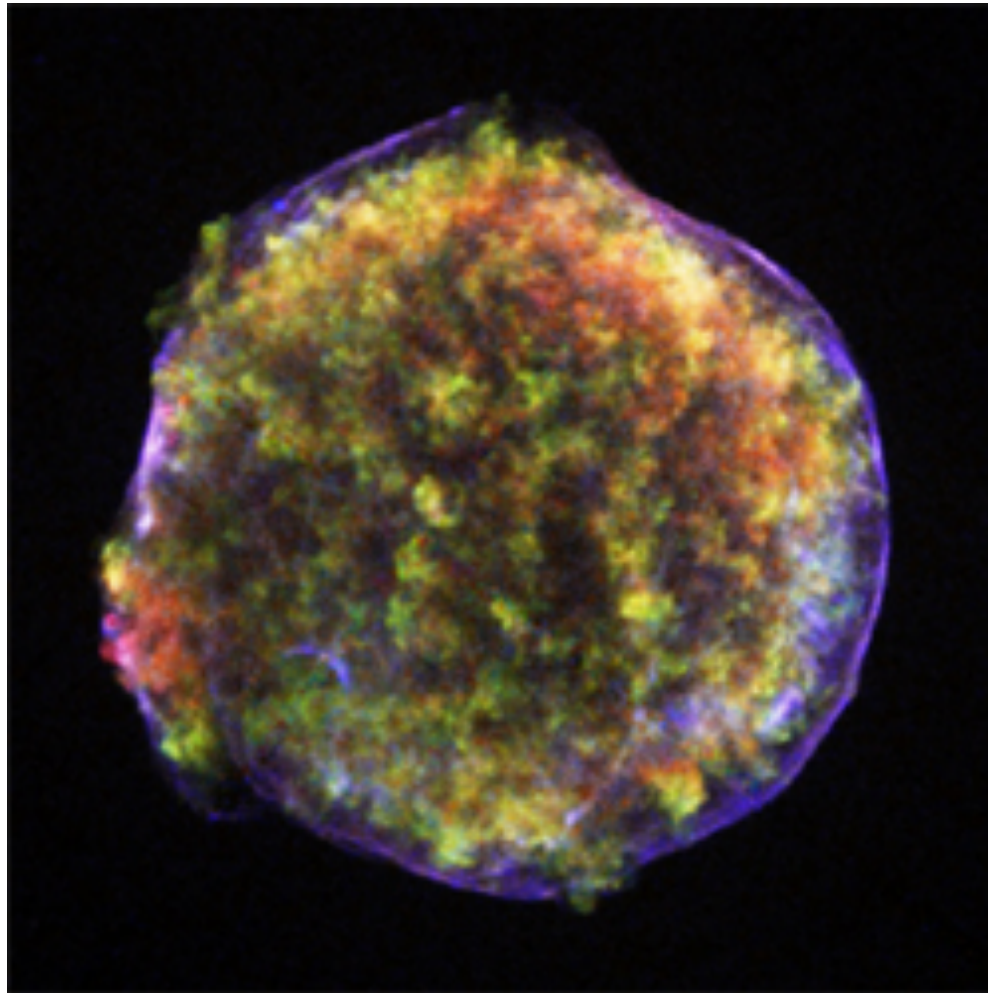
Kepler



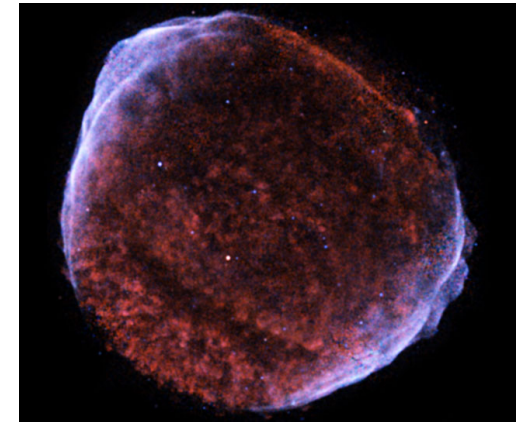
Tycho

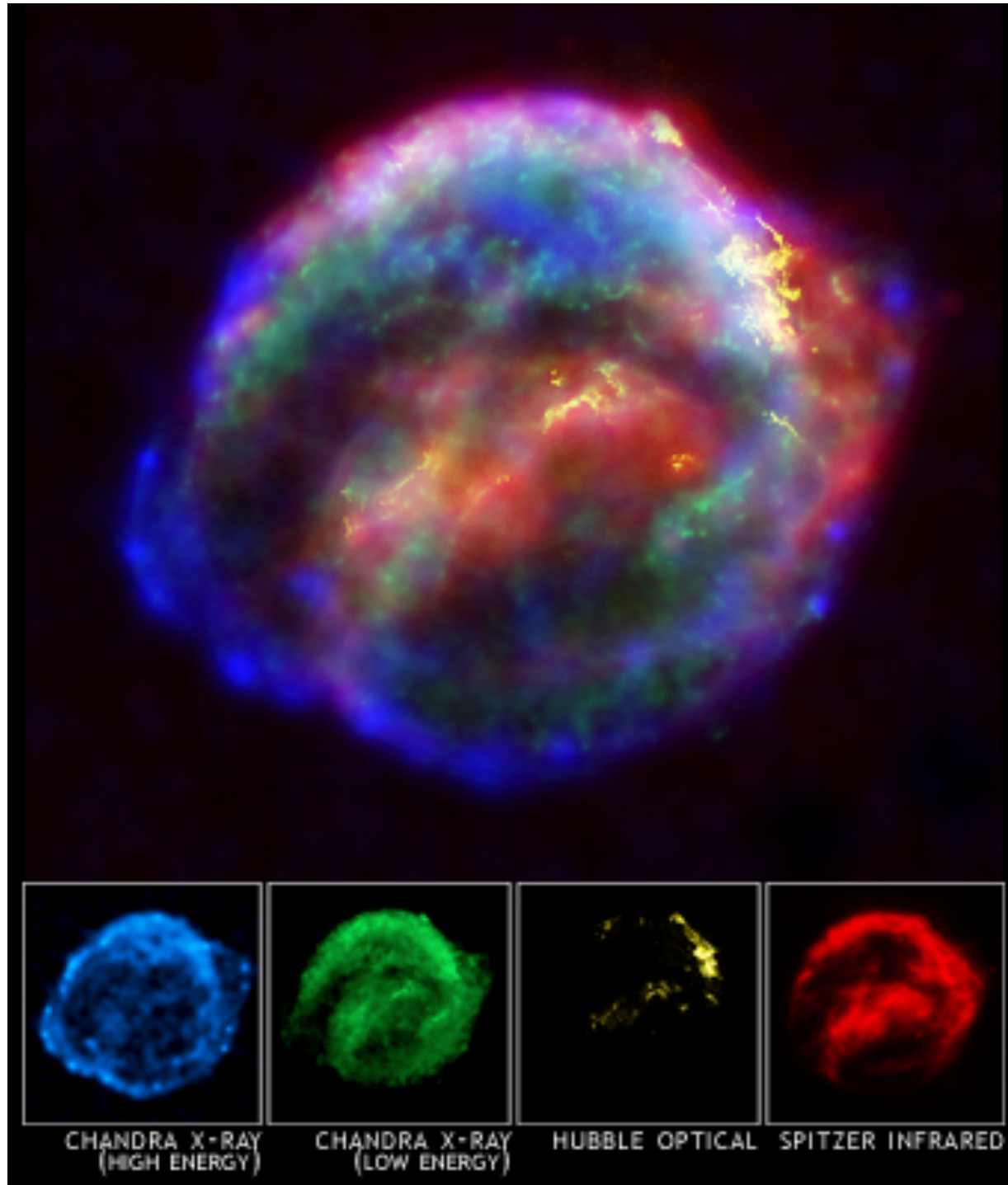
Chandra Observatory X-ray Image of Tycho's Supernova of 1572

No evidence for neutron star



SN 1006



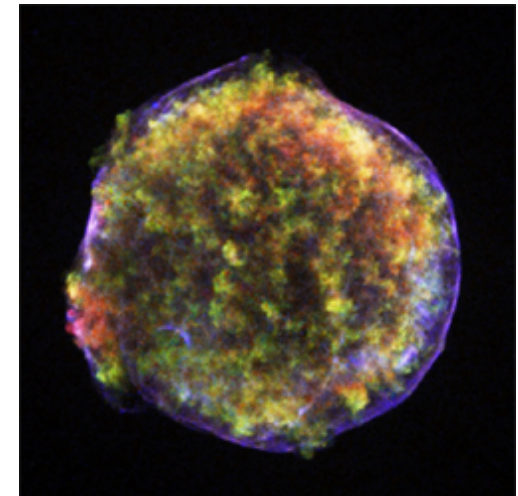


Great
Observatories
composite of
Kepler's
supernova 1604

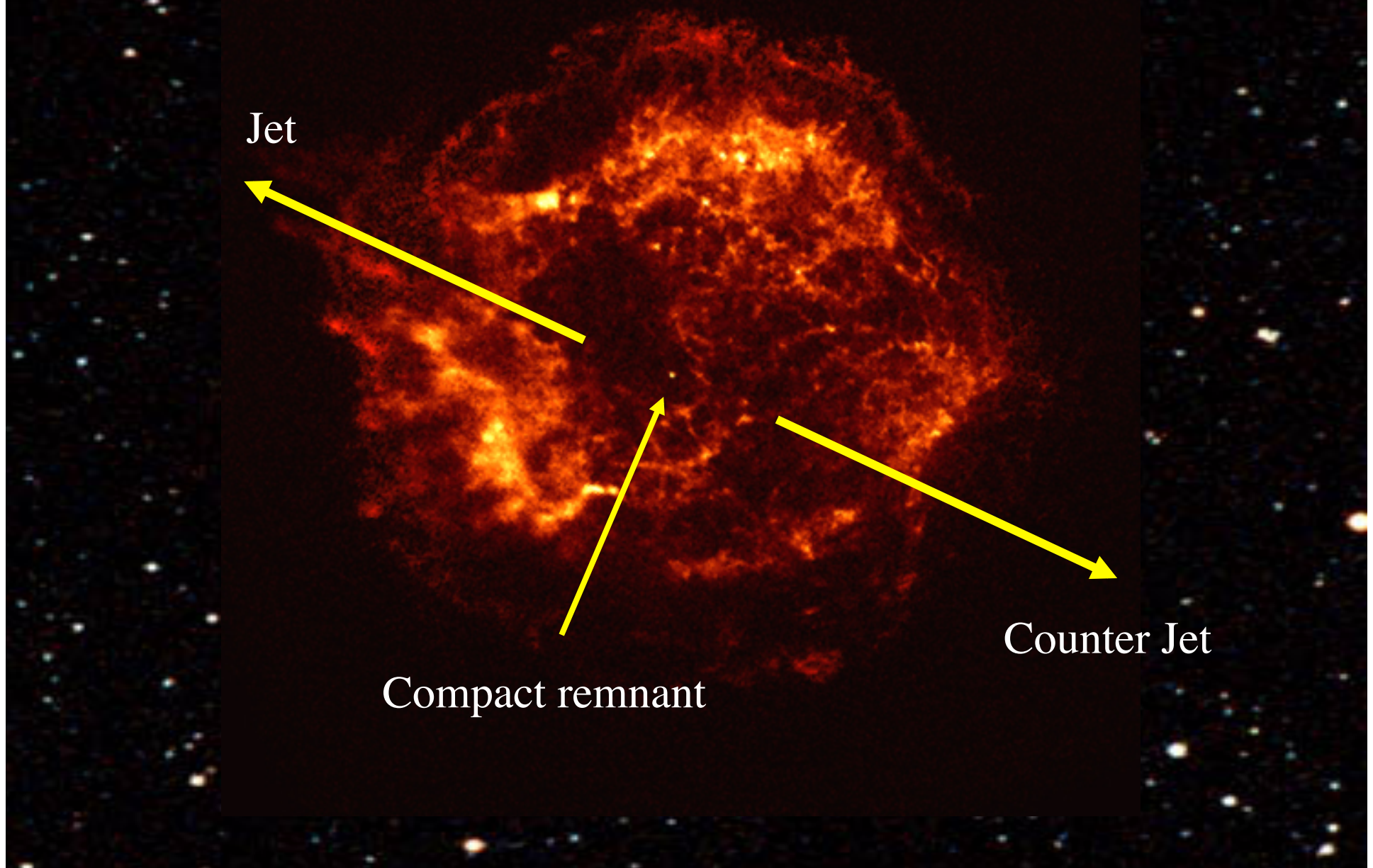
No sign of neutron
star

“sideways” alignment?

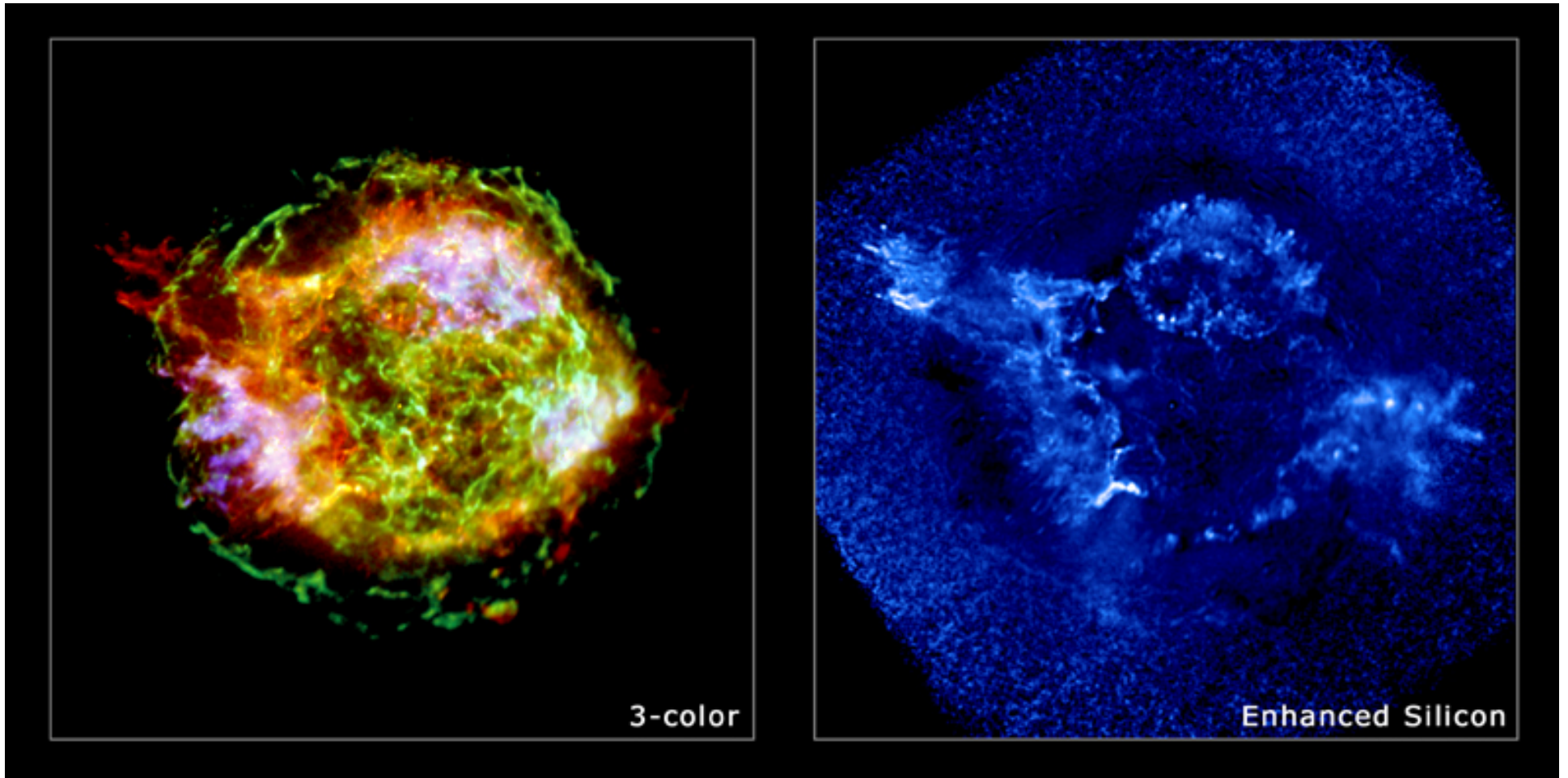
SN 1572 Tycho



Cassiopeia A by Chandra X-ray Observatory



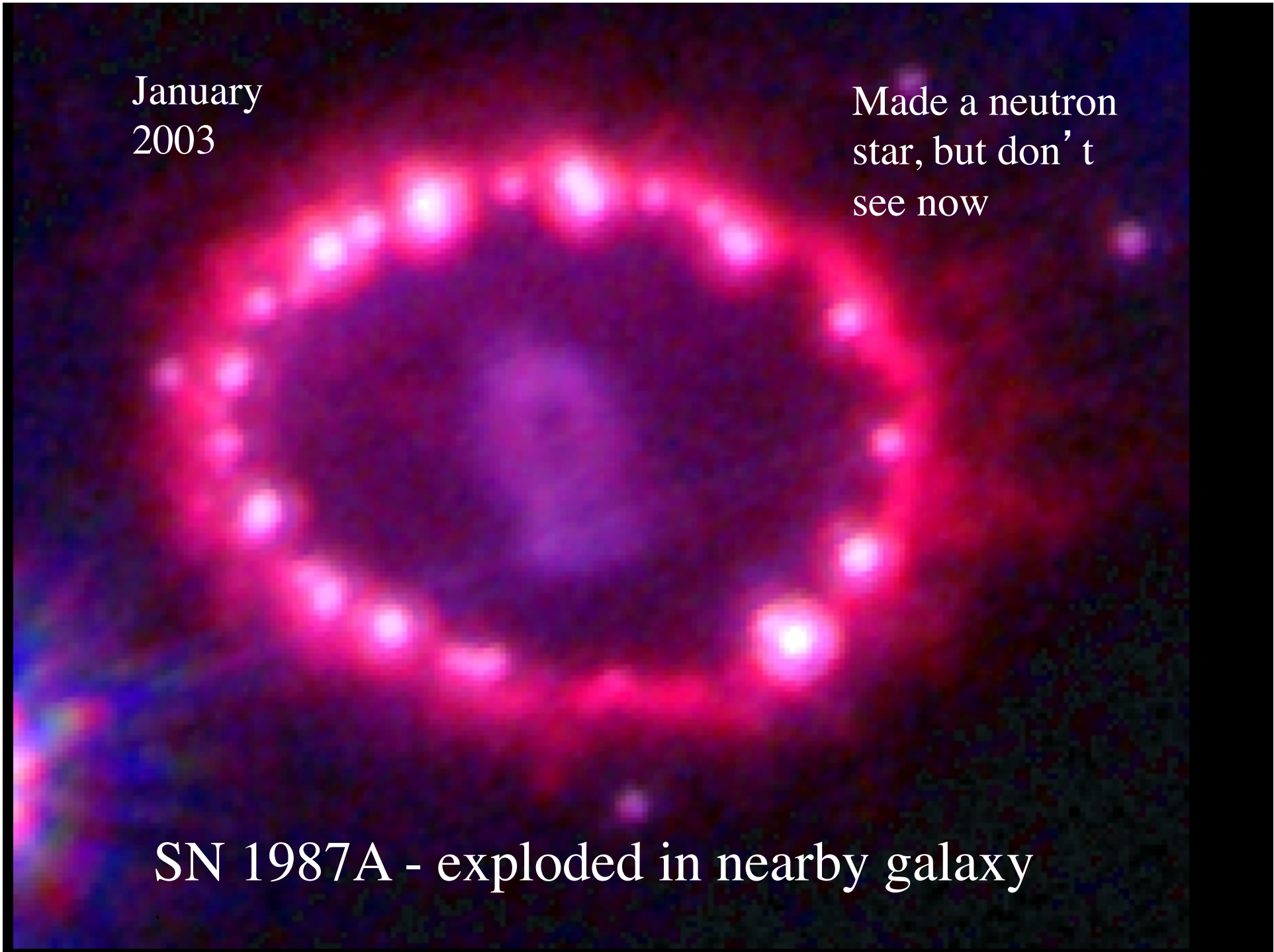
Recent Chandra Observatory X-ray Image of Cas A



January
2003

Made a neutron
star, but don't
see now

SN 1987A - exploded in nearby galaxy



Sky Watch Extra Credit - location of 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

***Betelgeuse - Orion, Red Supergiant due to explode
“soon” 15 solar masses***

*Antares - Bright Red Supergiant in Scorpius, 15 to 18 solar masses
(+companion)*

Rigel - Orion, Blue Supergiant due to explode later, 17 solar masses

U Sco - Scorpius, possible white dwarf supernova progenitor.

One Minute Exam

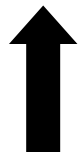
Tycho's supernova of 1572 shows no sign of a compact object left over in its center. This suggests that:



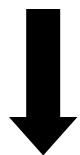
It made a jet



It was formed by the collapse of a massive star



It was formed by an exploding white dwarf



It actually exploded much earlier than 1572

Discussion point: What's going on here?



Goal:

To understand what we have learned from the study of “live” supernova explosions in other galaxies.

All supernovae since 1680, since invention of telescope, modern astronomy, have been discovered in other galaxies.

Galaxies like our Milky Way produce supernovae about once per century.

None since Cas A in about 1680. Our Galaxy is overdue for another!

Recognition (early in the 20th century) that some “novae” were in distant galaxies and hence were 10,000 to 100,000 times brighter than classical novae in the Milky Way.

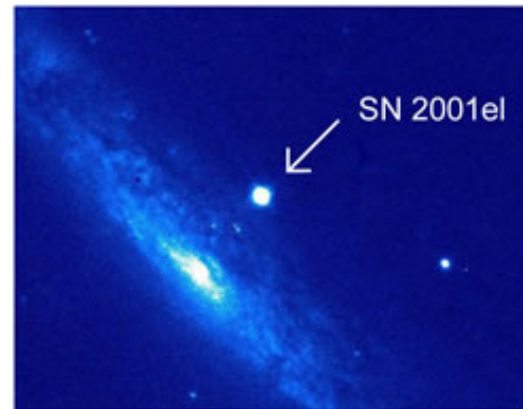
Led to the recognition and naming of “super” novae.

Web site of recent bright supernovae:

<http://www.rochesterastronomy.org/snimages/>

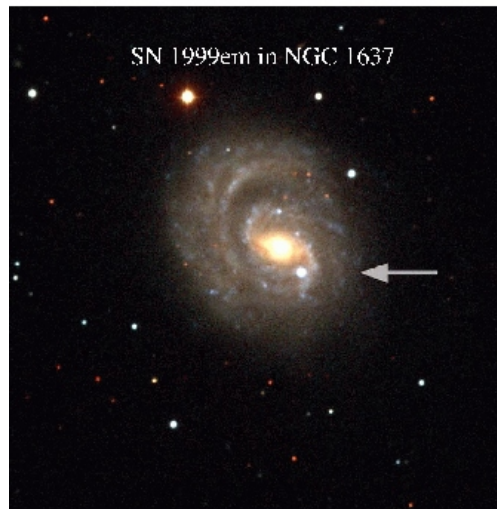
Sample of extragalactic supernovae

SN1994D



SN2001el

SN1999em



SN 2011fe

Some galaxies are rapid producers of supernovae.

