

9/18/06

Exam 1: Friday

Chapter 5, portions of chapters 1 - 4

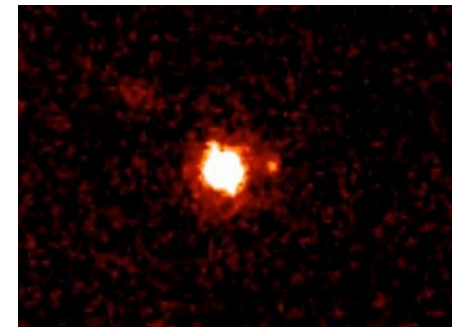
40 multiple-choice questions

Review sheet will be posted today

Review session Thursday 5 PM RLM 4.102 [NOTE different room than help sessions].

Astronomy in the news? Shuttle Atlantis undocked from Space Station Sunday, will probably land on Wednesday.

Pic of the Day - Dwarf planet Eris - long live Xena



SUPERNOVAE

Catastrophic explosions that end the lives of stars,

Provide the heavy elements on which planets and life as we know it depends,

Energize the interstellar gas to form new stars,

Produce exotic compact objects, neutron stars and black holes,

Provide yardsticks to measure the history and fate of the Universe.

Reading:

Chapter 6 Supernovae

Also § 2.1, 2.2, 2.4 & 2.5 for background

Issues to look for in background:

Why is it necessary for a thermonuclear fuel to get hot to burn - charge repulsion § 2.1 & 2.2

Core Collapse § 2.4 & 2.5

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

a *neutron star*,

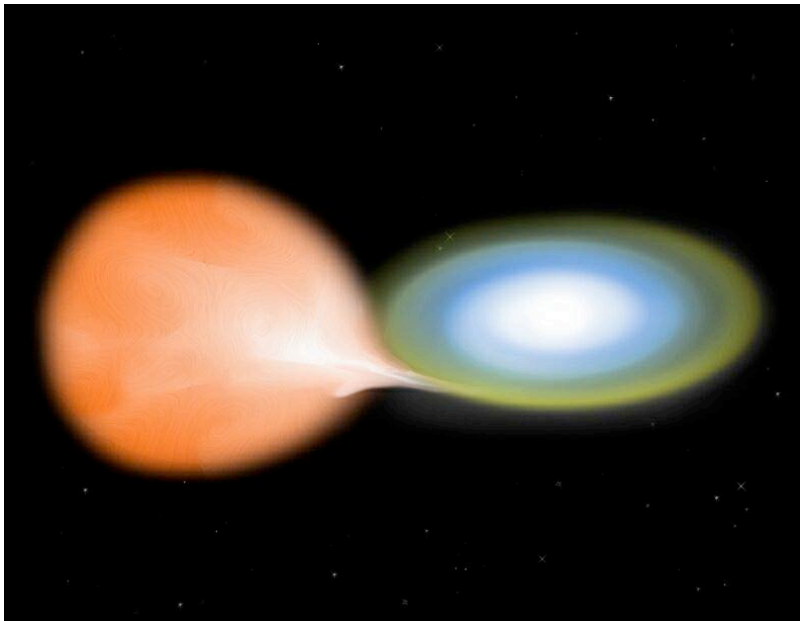
or perhaps

a *black hole*

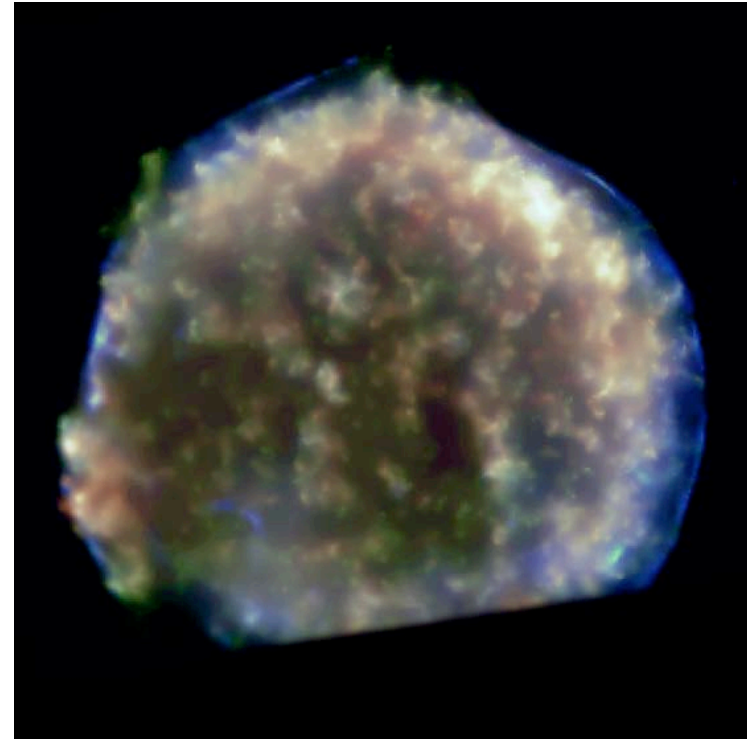


The mechanism of the explosion is still a mystery.

The other type of supernovae (Type Ia) 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.

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.

Millennium Celebration!

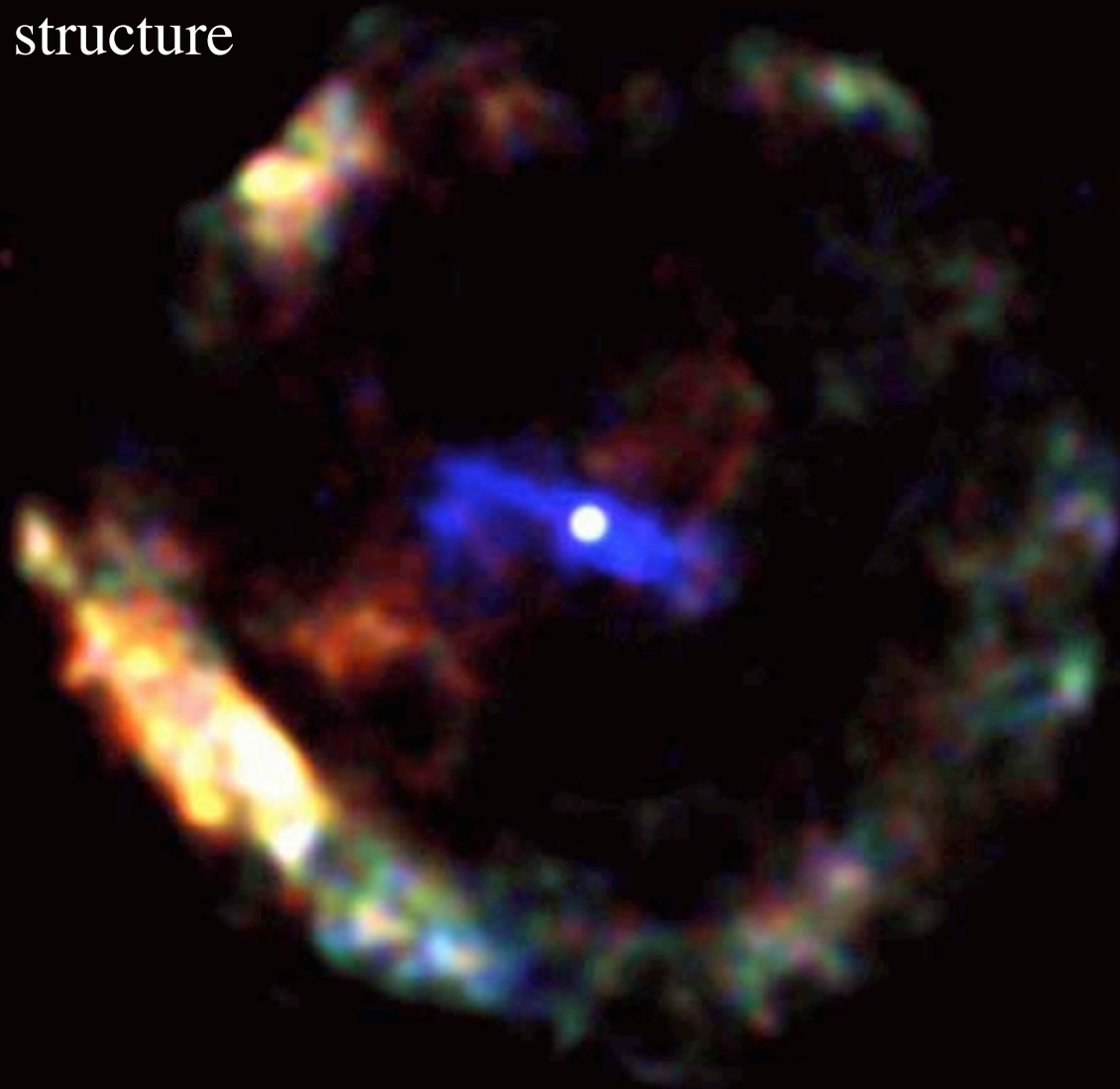
SN 386	earliest record	NS, jet?
SN 1006	← brightest	No NS
SN 1054	Crab Nebula	NS, jets
SN 1181	(Radio Source 3C58)	NS, jets
SN 1572	Tycho	No NS
SN 1604	Kepler	No NS
~1680	Cas A	NS? jets
SN 1987A	nearby galaxy	NS? jets
Vela	10,000 years ago	NS, jets

G11.2-0.3 = SN 386

65 ms pulsar

axis structure

X-ray image



A Chandra Observatory X-ray image of the supernova remnant SN 1006. The image shows a large, irregularly shaped, glowing structure with a complex, filamentary appearance. The colors are primarily red and orange, with some blue and purple hues, set against a black background. The structure has a mottled, grainy texture with some brighter spots and darker regions.

Chandra Observatory X-ray image SN 1006

Happy Birthday!

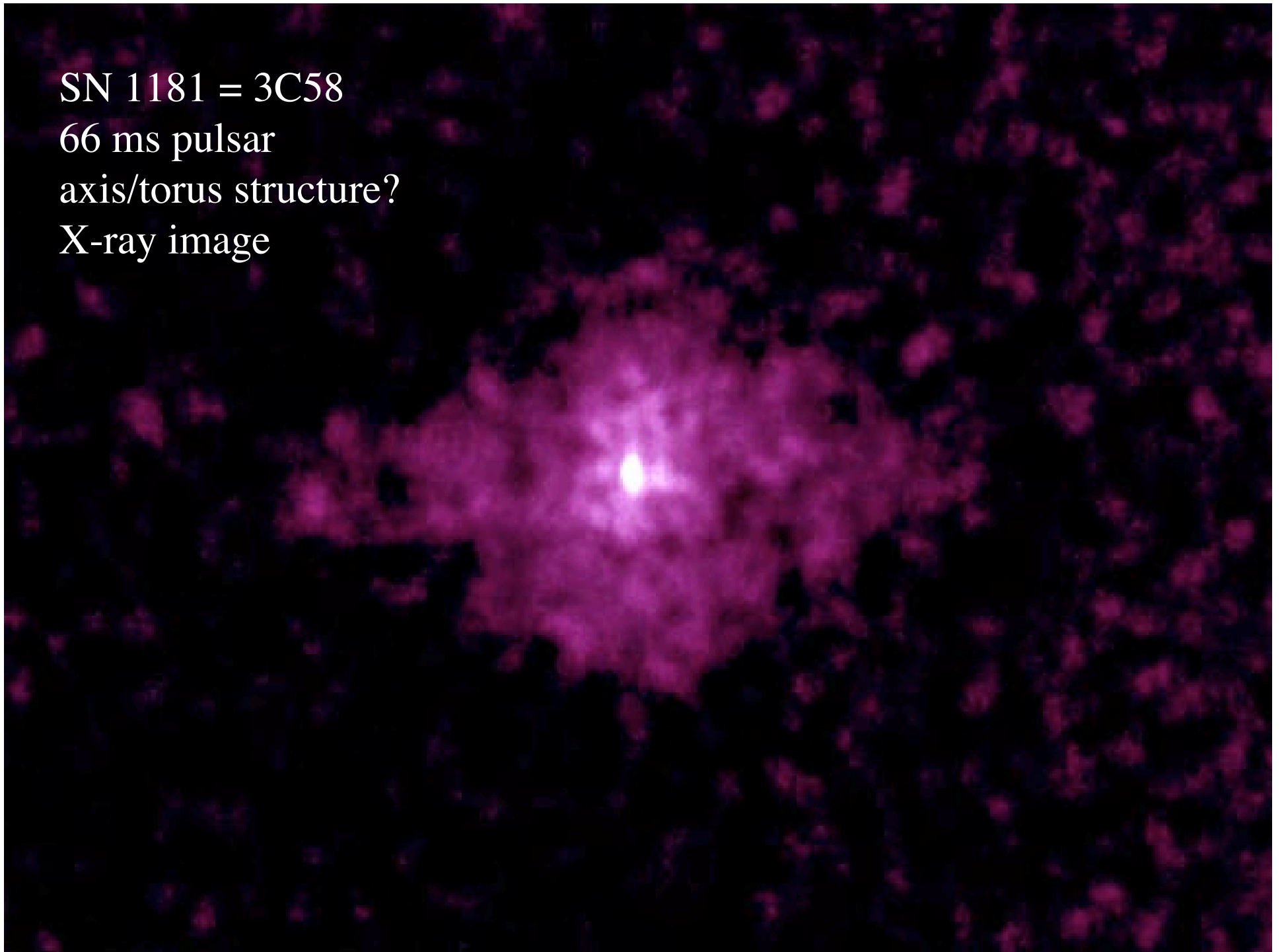
The supernova was probably seen first on April 30, 1006, according to records from the Far East (China and Japan).

SN 1181 = 3C58

66 ms pulsar

axis/torus structure?

X-ray image



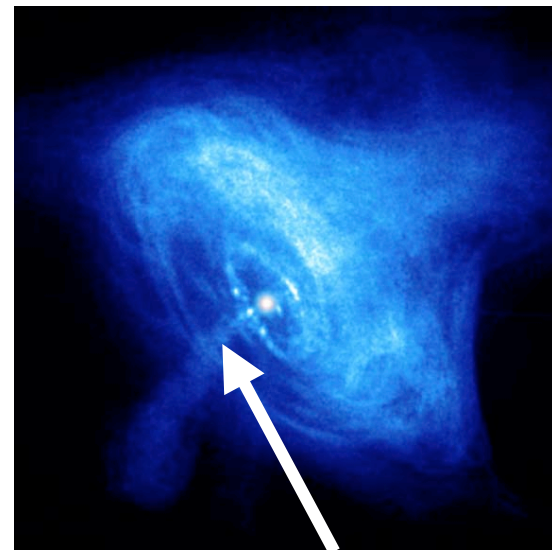
Crab Nebula

Remnant of “Chinese” Guest Star of 1054

Optical Image



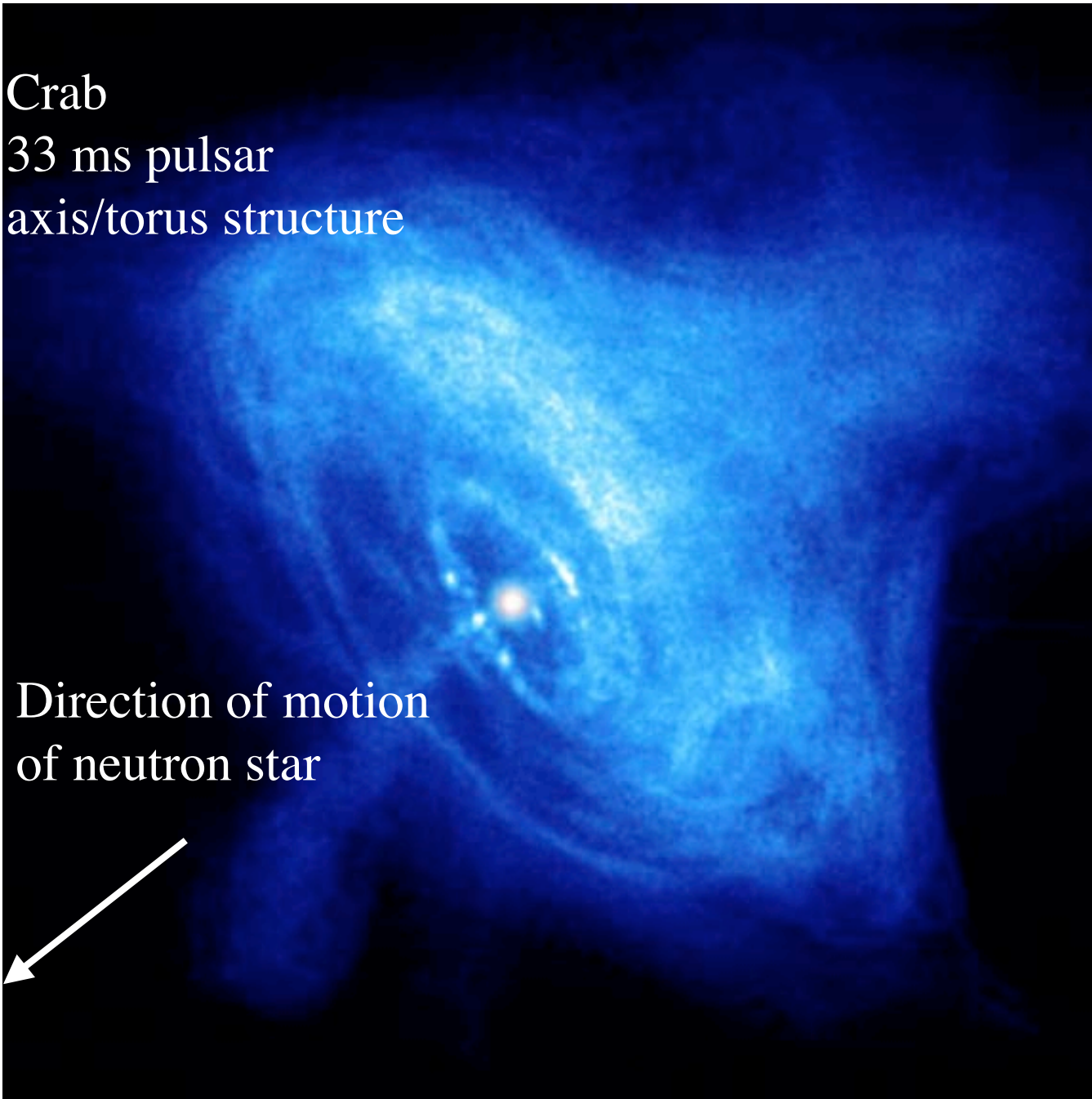
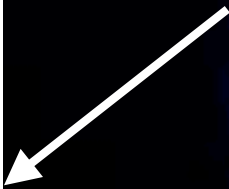
Chandra Observatory
X-Ray Image



Left-over jet

Crab
33 ms pulsar
axis/torus structure

Direction of motion
of neutron star

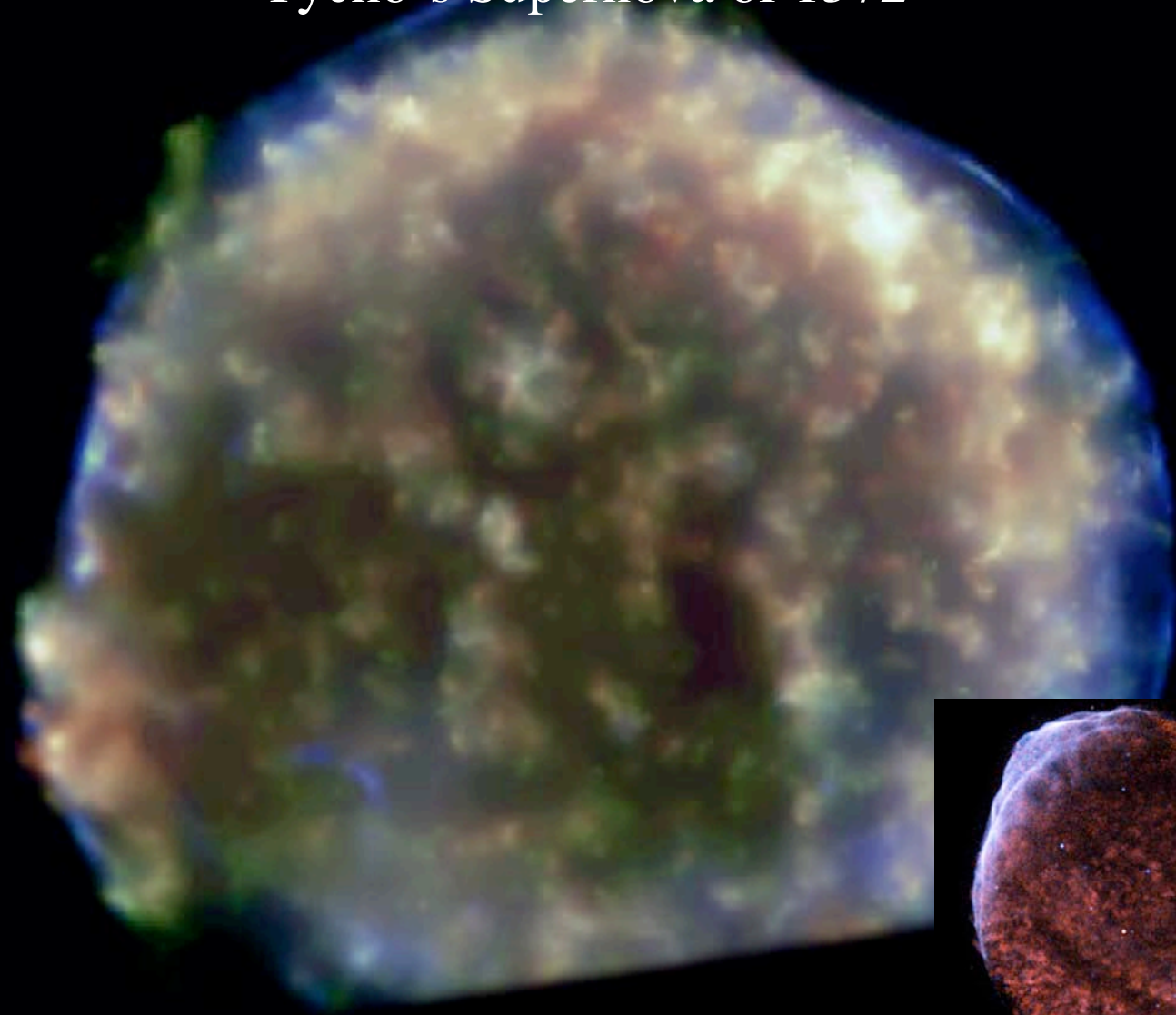


Kepler



Tycho

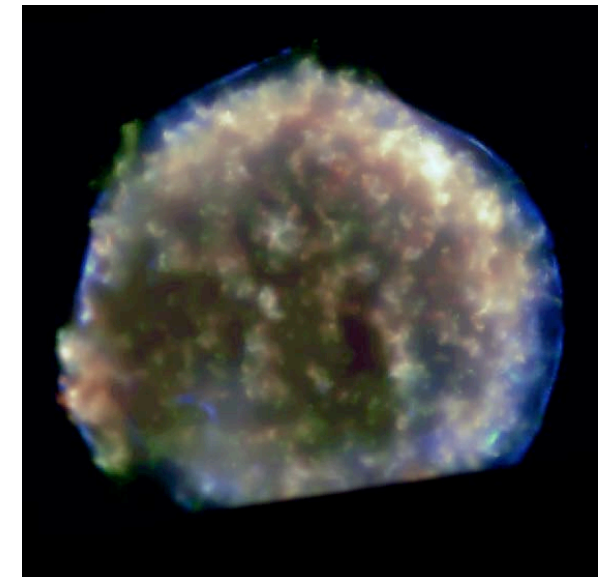
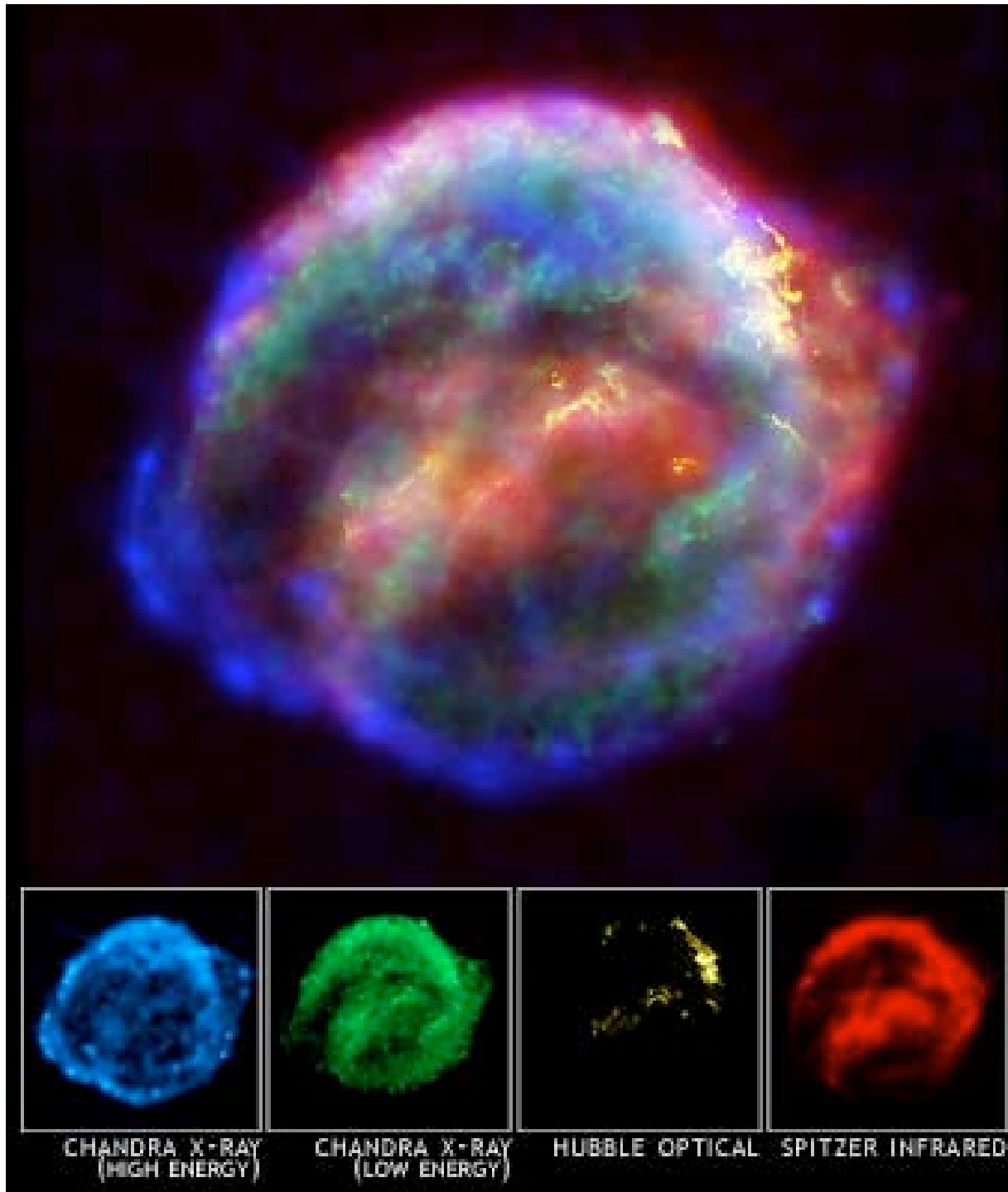
Chandra Observatory X-ray Image of
Tycho's Supernova of 1572



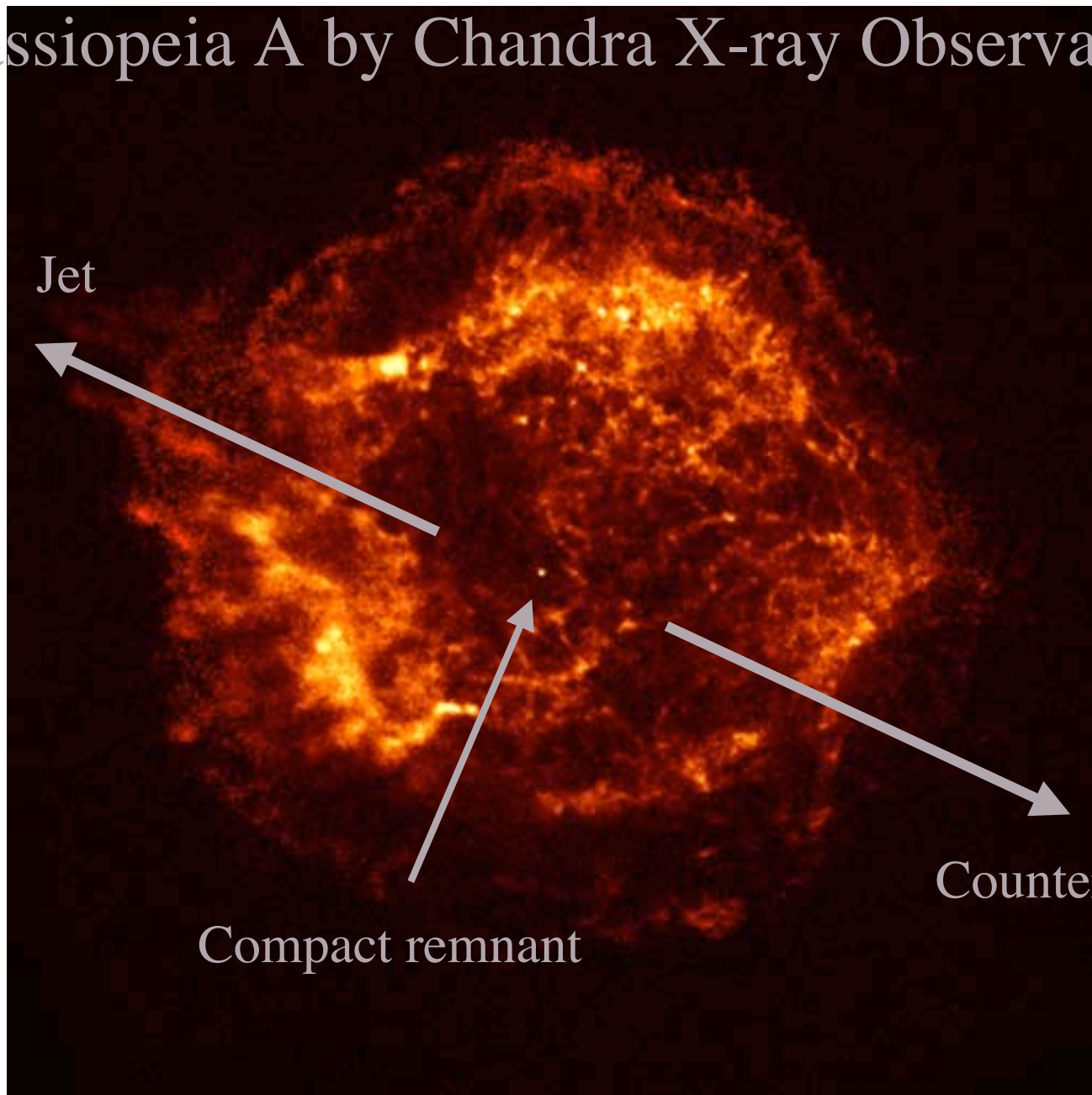
Great
Observatories
composite of
Kepler's
supernova 1604

No sign of neutron
star

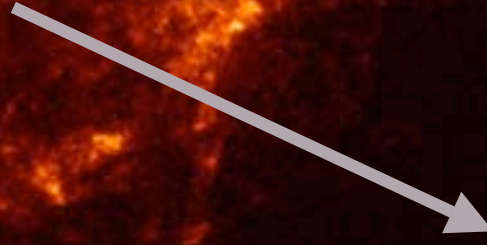
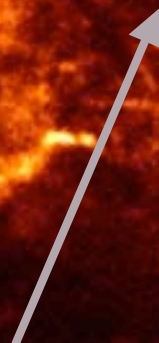
“sideways” alignment?



Cassiopeia A by Chandra X-ray Observatory



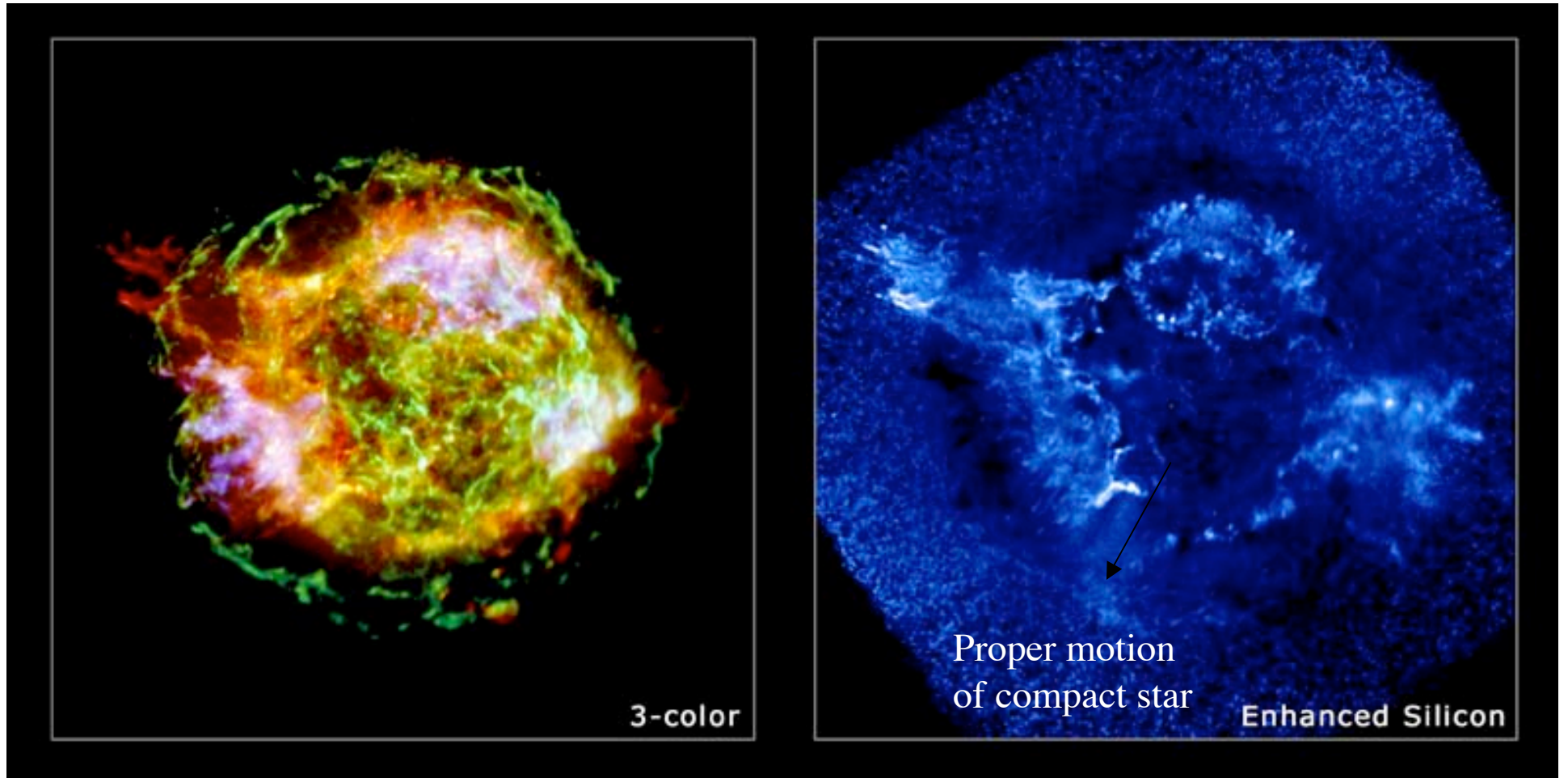
Jet



Counter Jet

Compact remnant

Recent Chandra Observatory X-ray Image of Cas A

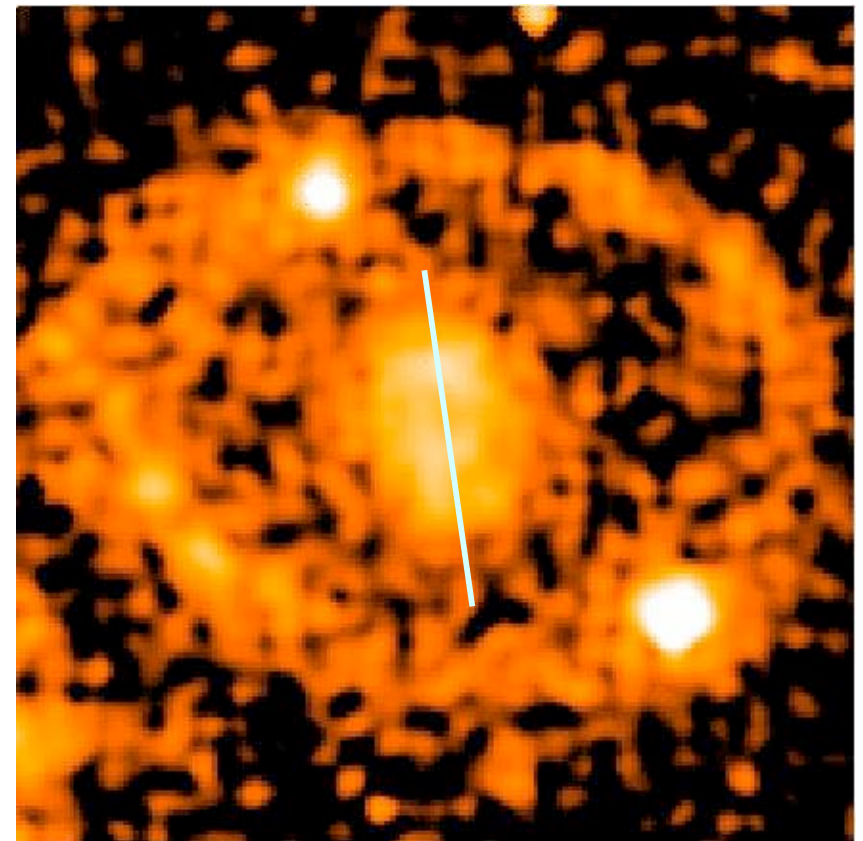


SN 1987A

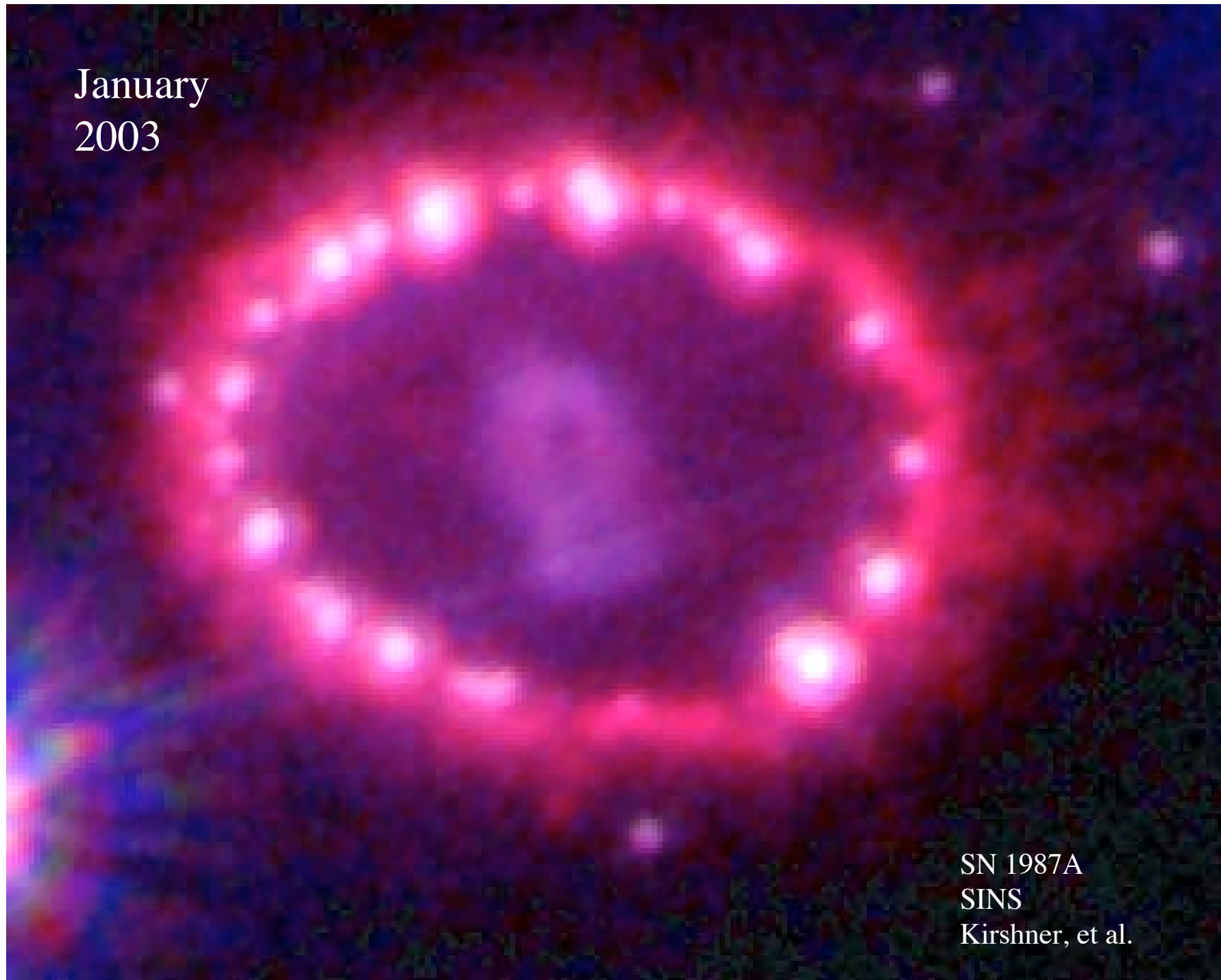
Exploded in nearby galaxy

Bi-polar symmetry

Elongated debris



January
2003



SN 1987A
SINS
Kirshner, et al.