September 3, 2010

First Exam next Friday (Monday Labor Day Holiday)

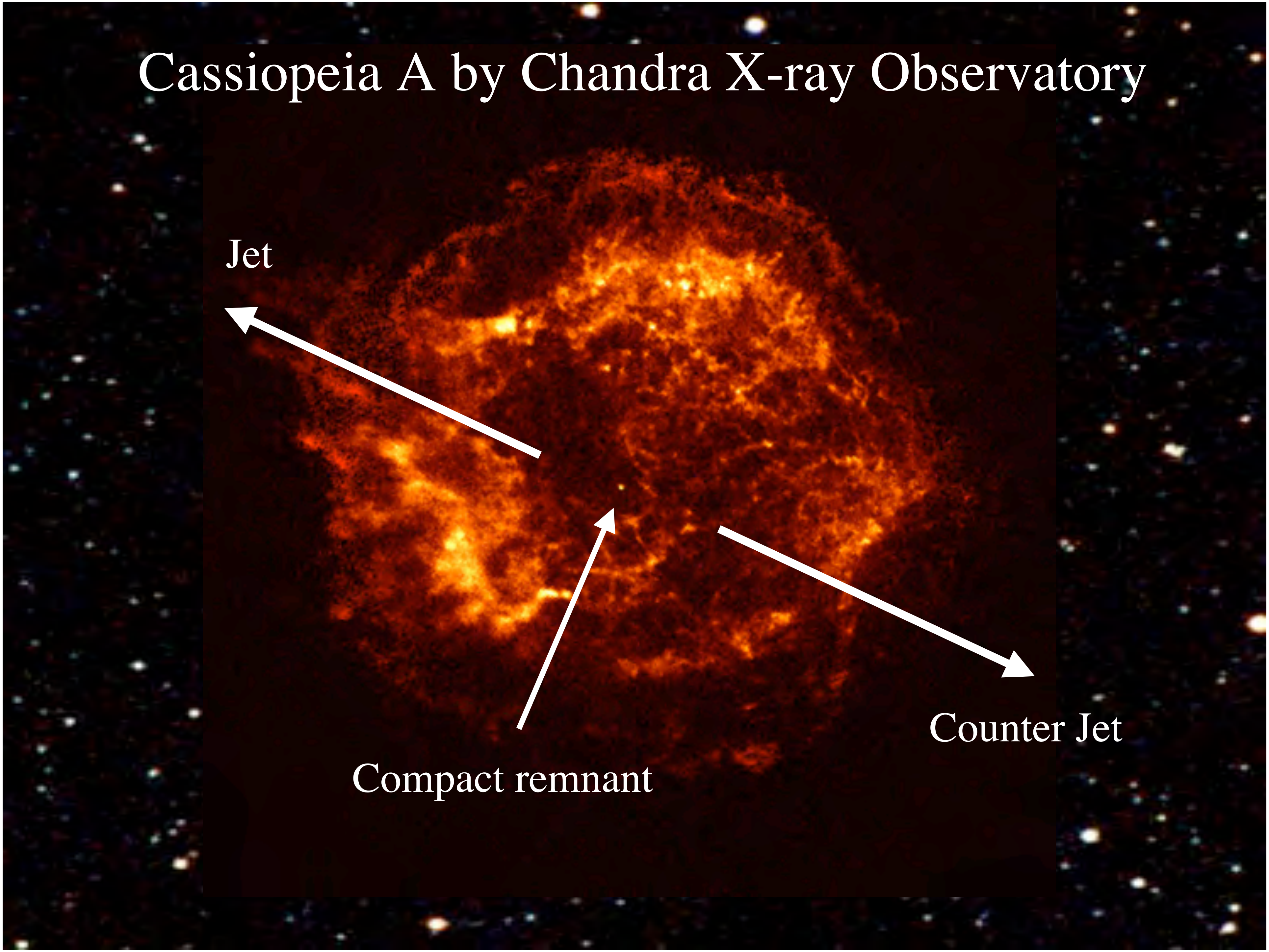
Reading assignment, Chapter 6 Sections 6.1 - 6.3, plus Section 1.2.4, Sections 2.1 - 2.5, Section 5.1, Betelgeuse pg 115ff

Review Sheet posted today for download,

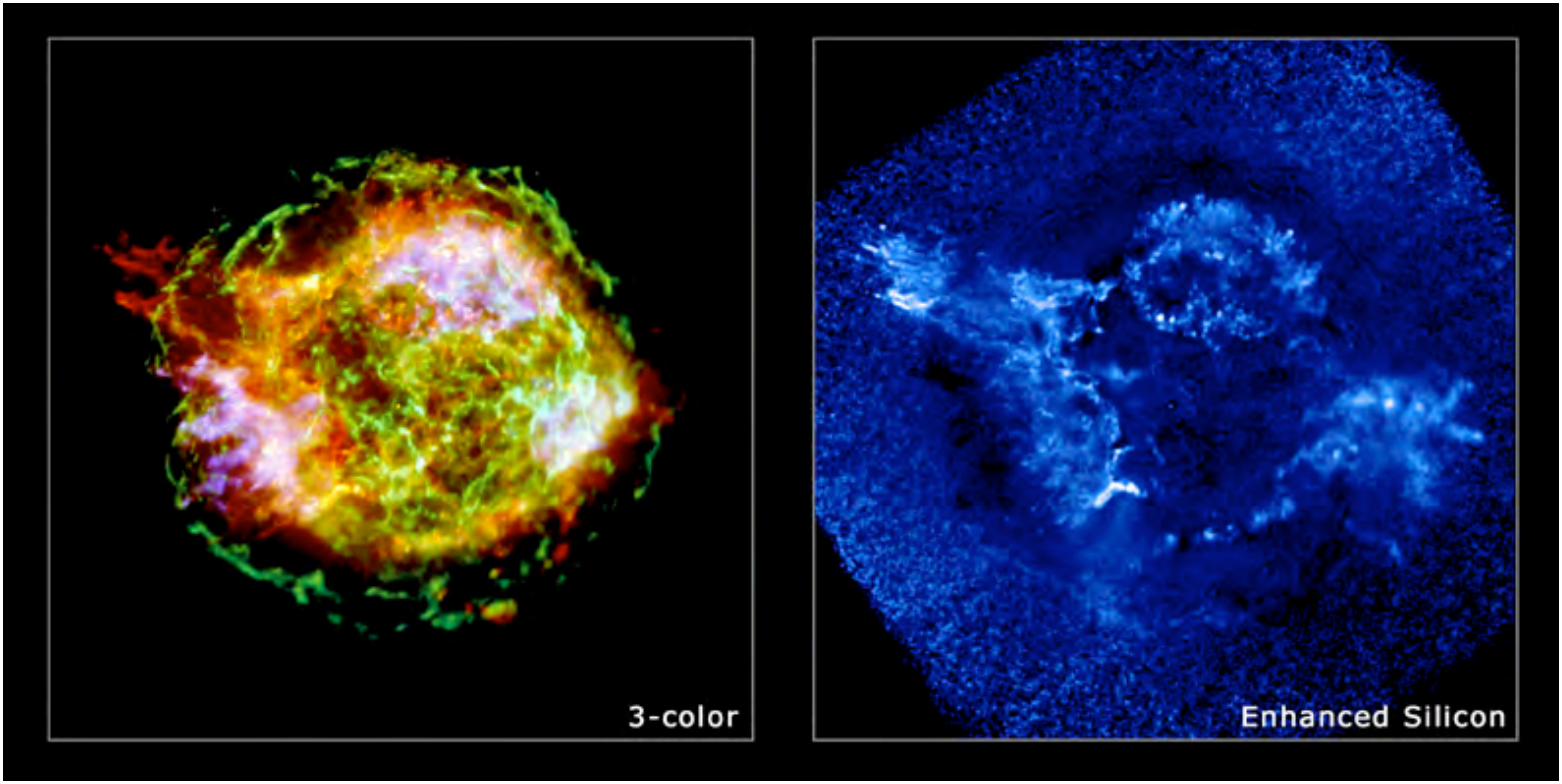
Review Session Thursday 5 PM, Room TBD.

Astronomy in the News?

Pic of the Day – Small Magellanic Cloud, a nearby irregular galaxy, less heavy elements than the Sun, patches of ongoing star formation (plus two globular clusters of stars on left and bottom).


Cassiopeia A by Chandra X-ray Observatory
Jet
Compact remnant
Counter Jet

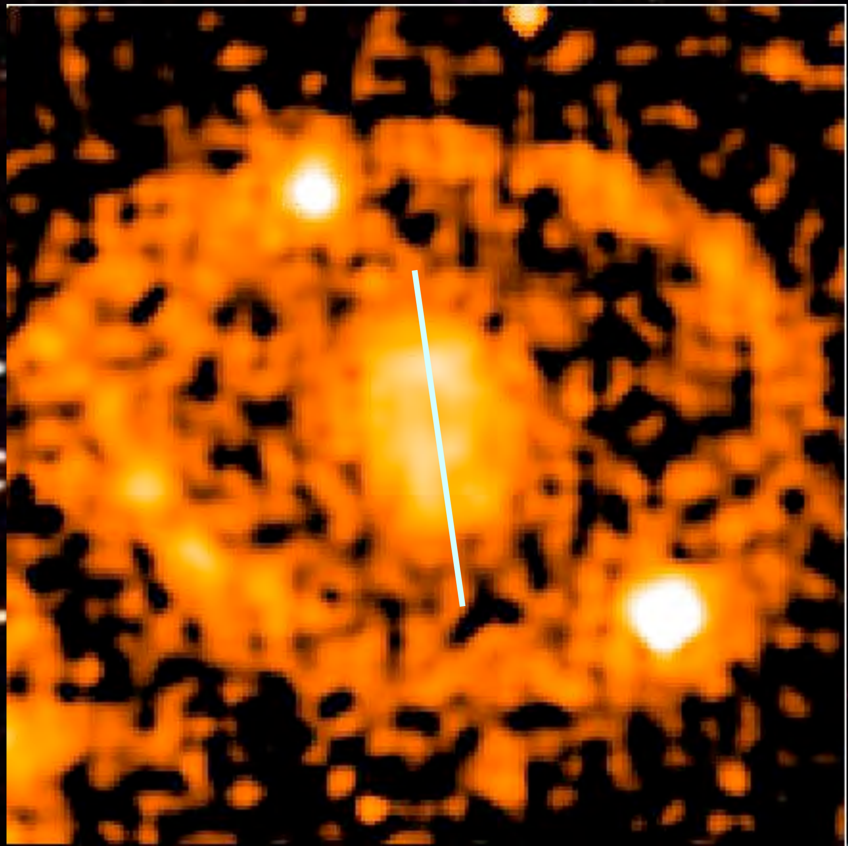
Recent Chandra Observatory X-ray Image of Cas A

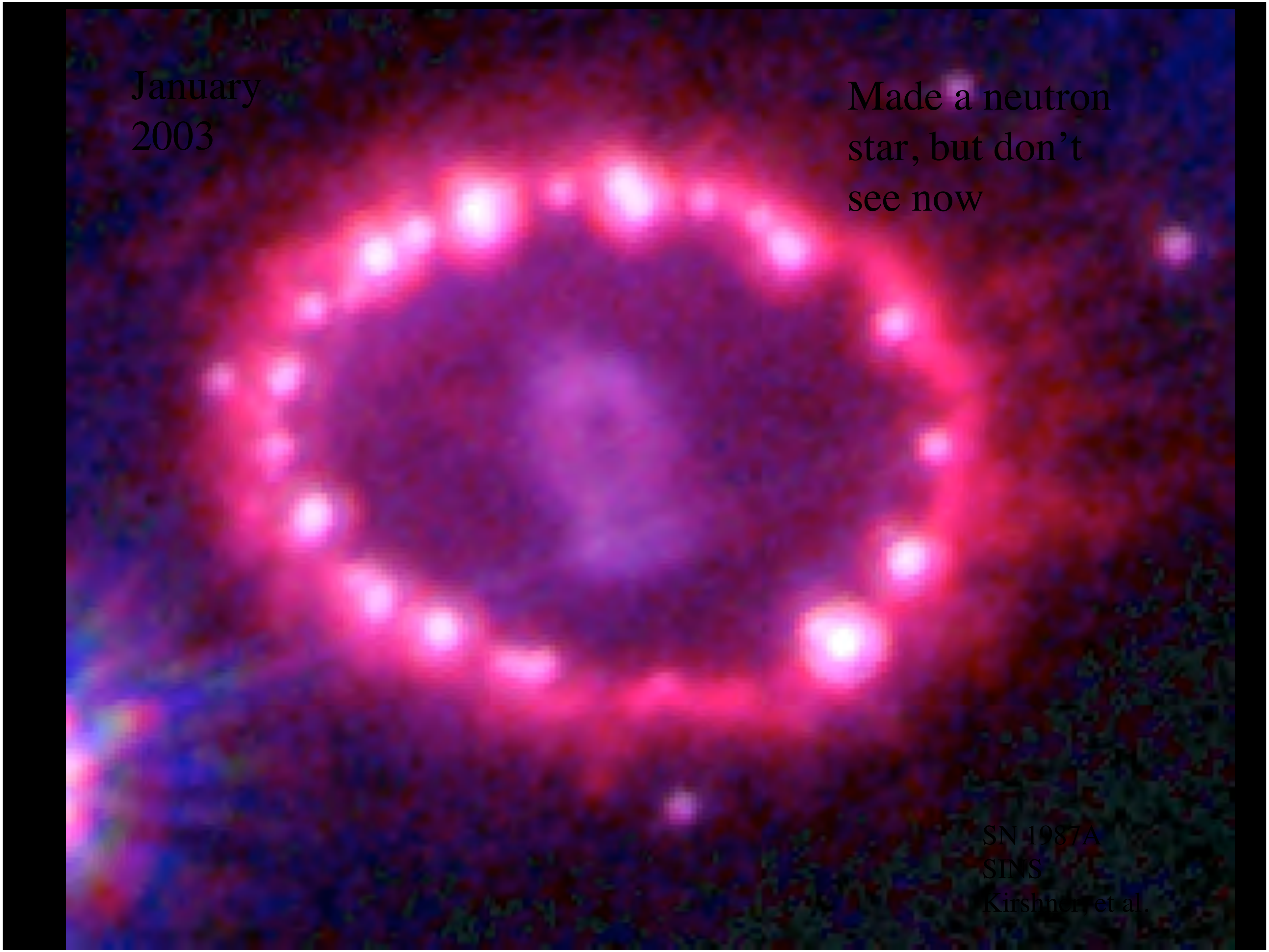


SN 1987A
Exploded in nearby galaxy

Bi-polar symmetry

Elongated debris




January
2003
Made a neutron
star, but don’t
see now
SN 1987A
SINS
Kirshner, et al.

Sky Watch Extra Credit - location of supernovae

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

SN 1054 Crab Nebula - Taurus

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?

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.

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.

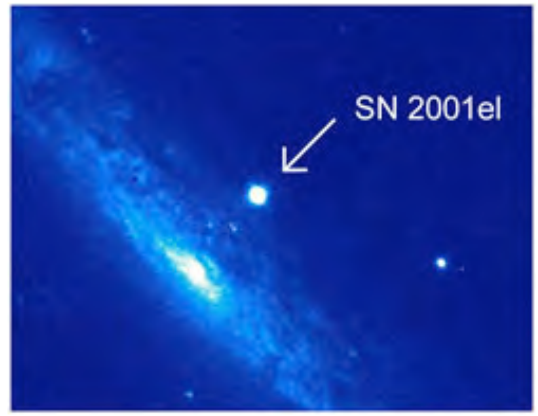
Led to the recognition and naming of “super” novae.

Web site of recent bright supernovae:

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

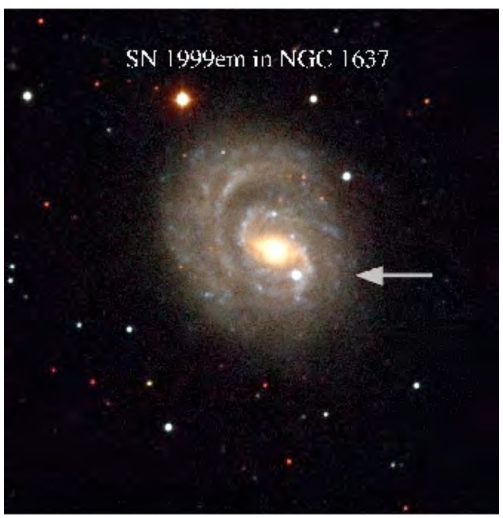
Sample of extragalactic supernovae

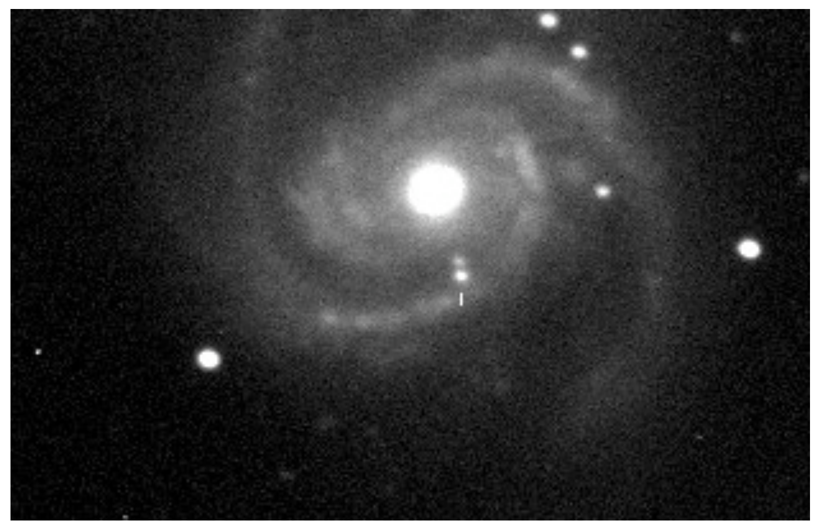
SN1994D



SN2001el

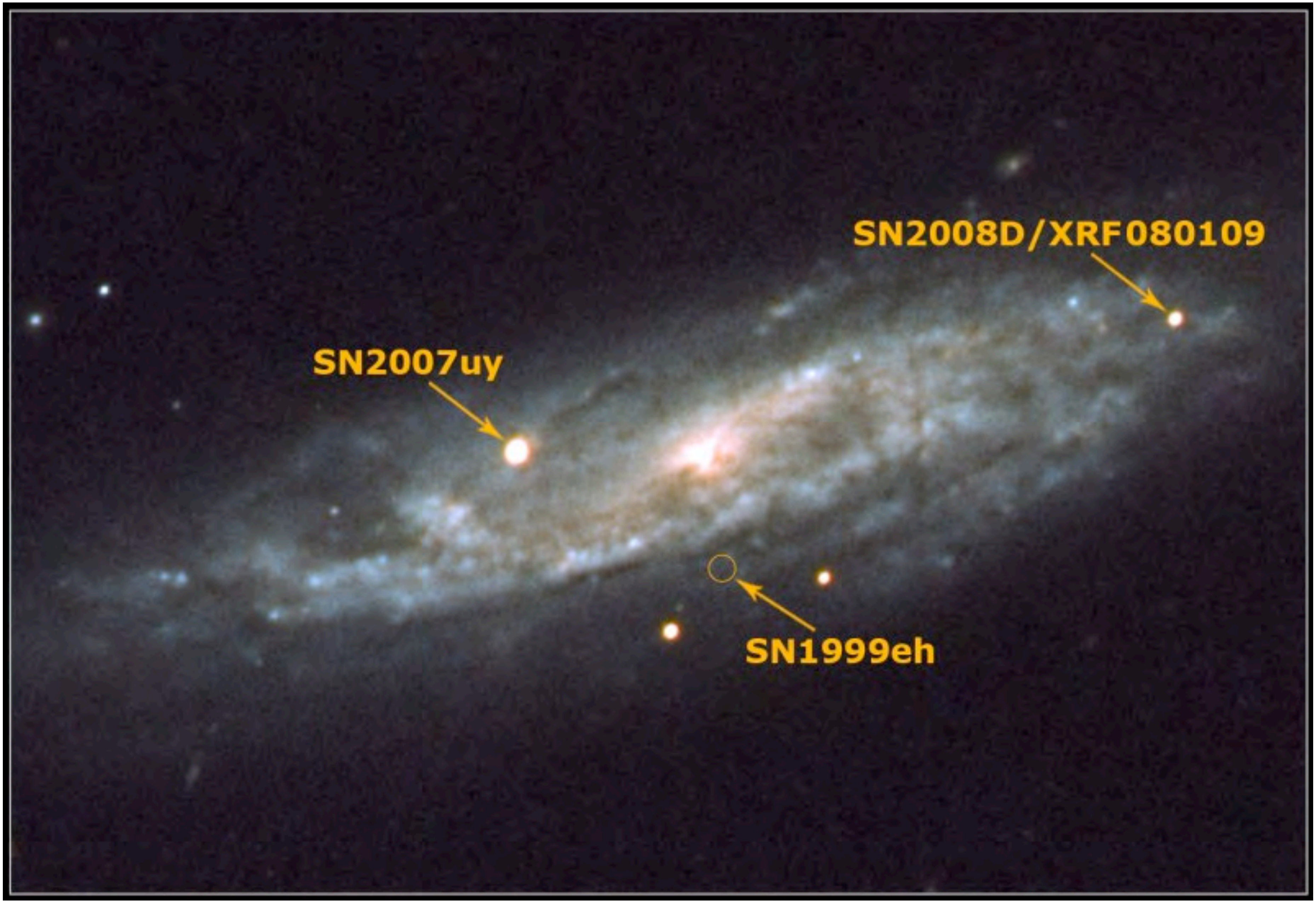
SN1999em





SN 2006X

Some galaxies are rapid producers of supernovae.



Extra Galactic Supernovae: the basis for modern astronomy of supernovae

Cannot predict which galaxies will produce a supernova, so watch lots of galaxies

We found two dozen per year prior to SN 1987A, but with new attention and use in cosmology, now find several hundred per year, most at great distances, more difficult to study.

Nomenclature: A-Z, aa-az, ba-bz, etc.

SN1987A - 1st of 1987 (also most important, but that is not what the "A" means).

This year's latest, SN 2010hi, discovered September 2 - #217 so far in 2010.

Discussion Point:

How would you tell that an explosion was from a massive star or from a white dwarf star?

Categories of Supernovae

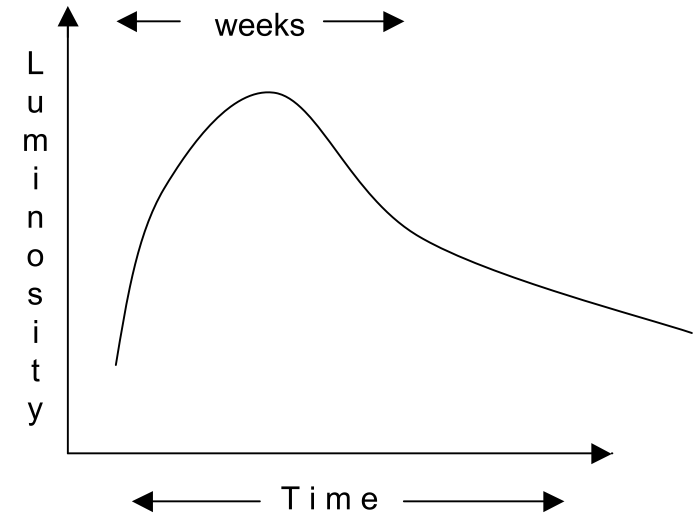
1st category discovered

Type Ia - no detectable Hydrogen in the spectrum, rather “intermediate mass elements” such as oxygen, magnesium, silicon, sulfur, calcium. Iron appears later as the light fades.

These occur in all galaxy types:
In **spiral galaxies** they tend to avoid the spiral arms, they have had time to drift away from the birth site → ***the star that explodes is old***
In **irregular galaxies**
In **elliptical galaxies** where star formation is thought to have ceased long ago → ***the star that explodes is old***

⇨***the progenitor that explodes must be long-lived, not very massive, suggesting a white dwarf.*** Sun is long-lived, but won’t explode

Type Ia - no hydrogen, intermediate mass elements early, iron later



Light Curve - brightness vs. time consistent with an exploding C/O white dwarf
expect total disruption, ***no neutron star***

Type Ia occur in elliptical galaxies, tend to avoid spiral arms in spiral galaxies - old when explode, all evidence points to an exploding white dwarf.