

Friday, January 27, 2017

First exam a week from today.

Review sheet posted Monday.

Review session Thursday, 5:00 – 6:00 PM **WEL 2.308**

Use the Facebook group and the Canvas discussion group to ask questions about things you have not understood.

Skywatch extra credit – how is it going?

Astronomy in the news?

Tabetha's star, discovered by Tabetha Boyajian a little over a year ago. A series of dips in the luminosity suggested that some irregular structure with 100 times the area of the Earth was orbiting the star. Some suggested an alien structure. Bunk (no heat signal), but still not well explained with serious science.

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 the 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 (G1.9+0.3 was already a *supernova remnant* when discovered). Our Galaxy is overdue for another!

Recognition (early in the 20th century, a hundred years ago) that some “novae” (new stars) were in distant galaxies and hence were 10,000 to 100,000 times brighter than classical novae, flaring stars (Chapter 5.2) in the Milky Way.

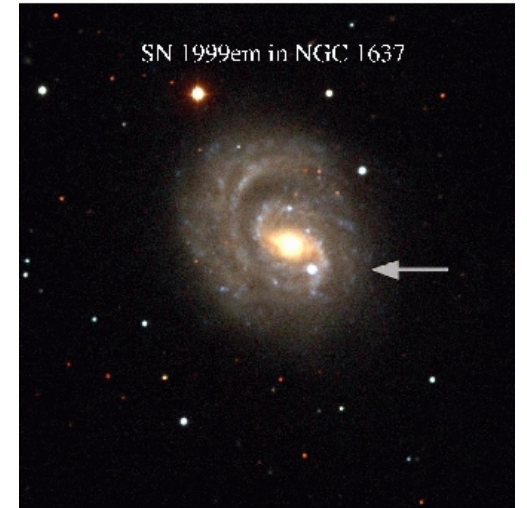
Led to the recognition and naming of “super” novae.

Sample of extragalactic supernovae

SN1994D



SN1999em



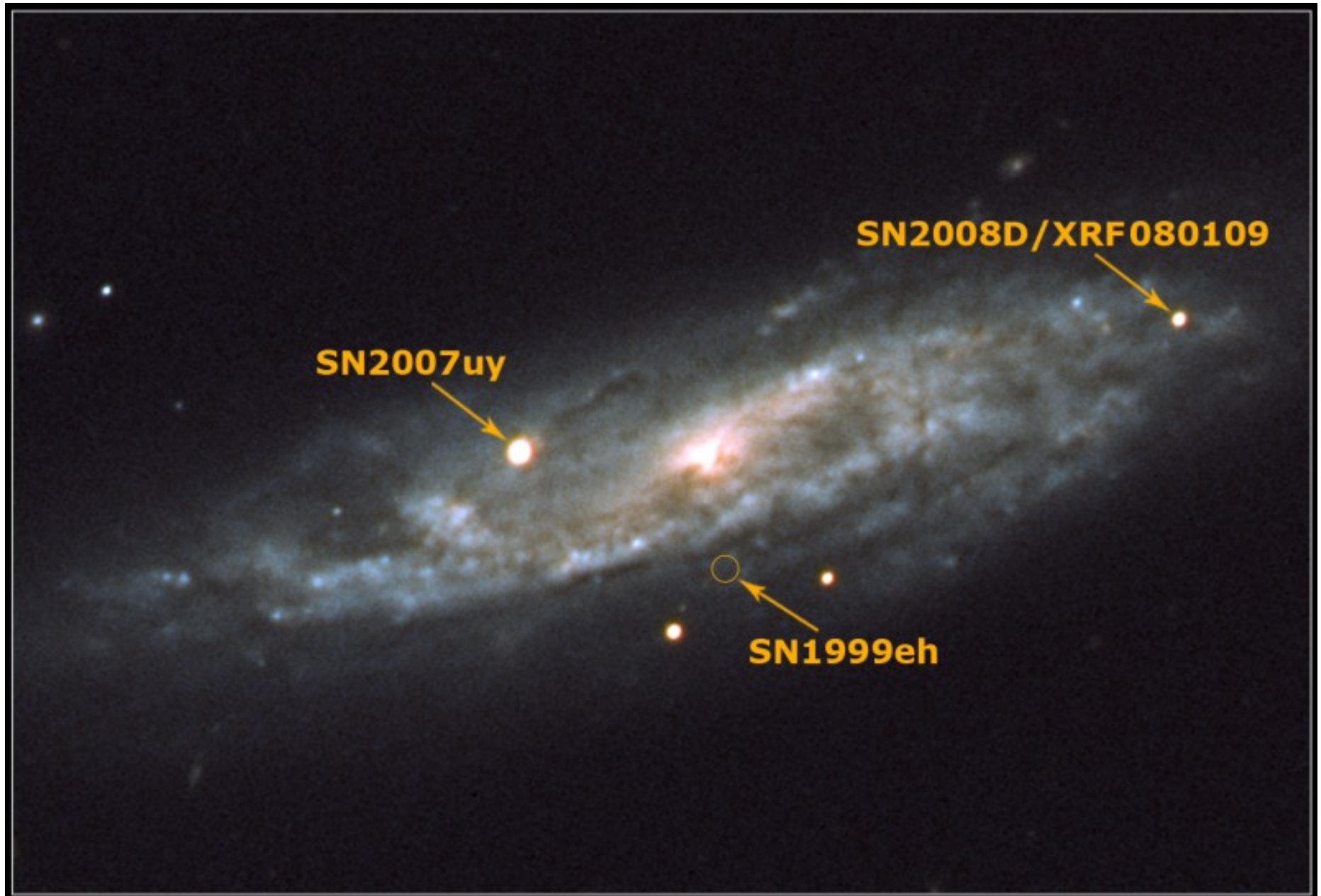
SN 2011fe

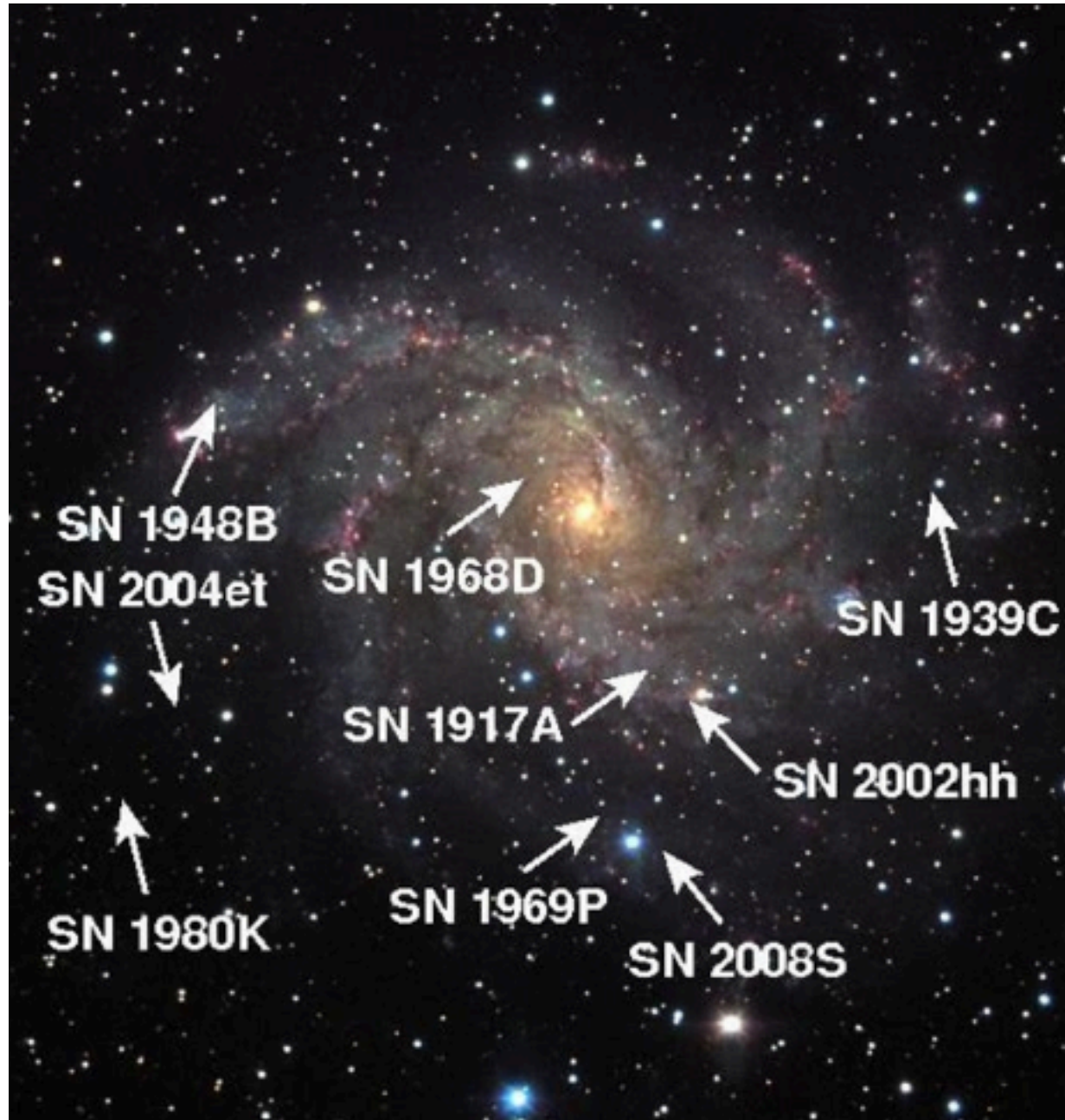


SN 2014J



Some galaxies are rapid producers of supernovae.





SN 1948B
SN 2004et

SN 1968D

SN 1939C

SN 1917A

SN 2002hh

SN 1980K

SN 1969P

SN 2008S

Extra-galactic Supernovae: the basis for modern astronomy of supernovae.

Supernovae explode about once per second somewhere in the Universe, most unseen.

Cannot predict which galaxies will produce a supernova, so watch lots of galaxies, now days with robotic telescopes.

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

Nomenclature of Supernovae in other galaxies:

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

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

Currently discover several per day. Individual groups discover batches, give them their own names, and may or may not announce them publically.

New techniques will discover thousands of supernovae per year, new nomenclature.

Before announced, search groups often use internal names. We have used characters from Star Wars and Southpark and most recently Nepali spirits.

Discussion Point:

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

Goal:

To understand the observed nature of supernovae and determine whether they came from white dwarfs or massive stars that undergo core collapse.

Goal:

Certain elements show up in supernova:

Oxygen, Magnesium, Silicon, Sulfur, Calcium, Iron.

Why those elements?

Chapter 2, §2.1

Discussion point:

What is a proton?

What is a neutron?

If you looked at an atom, where would you find them?

What is an important difference between them?

Why do protons repel one another?

Chapter 1, §1.2.1

H → He (2 protons, 2 neutrons - Chapter 1, figure 1.6)

2 Helium → unstable, no such element

3 Helium → Carbon (6 protons, 6 neutrons)

4 Helium → Oxygen (8 protons, 8 neutrons)

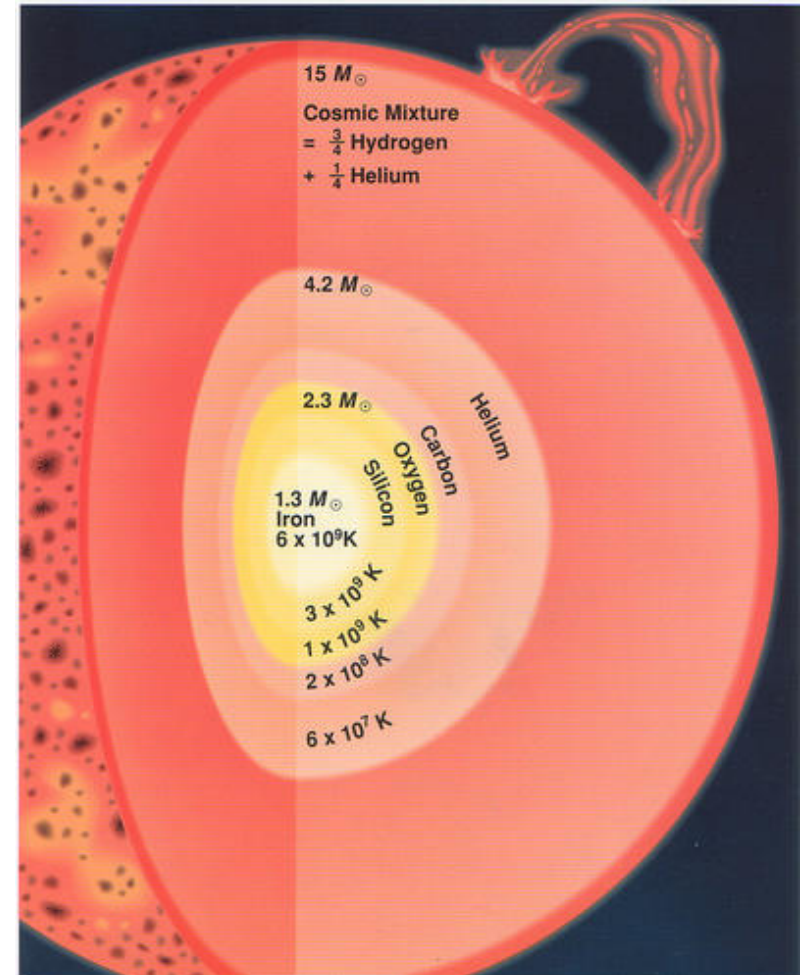
5 Helium → Neon (10 protons, 10 neutrons)

6 Helium → Magnesium (12 protons, 12 neutrons)

7 Helium → Silicon (14 protons, 14 neutrons)

Then Sulfur, Calcium, Titanium.

Common “intermediate mass” elements (heavier than hydrogen and helium, lighter than iron) that are forged in stars, and in their explosions, are built on building blocks of helium nuclei.



Production of the Elements:

In massive stars (more than about 12 - 15 times the Sun) the core is composed of Helium or heavier elements: Carbon, Oxygen, Magnesium, Silicon, Calcium, finally Iron.

The intermediate-mass elements are produced in the star before the explosion and then expelled into space.

In exploding white dwarfs (arising in stars with mass less than about 8 times the Sun), the core is composed of Carbon and Oxygen, and **the explosion creates the intermediate-mass elements, Magnesium, Silicon, Calcium, and also Iron.**

(between about 8 and about 12 solar masses, different story, maybe collapsing white dwarfs)