

9/25/06

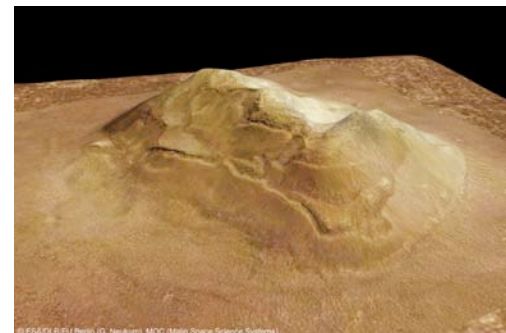
Exam grades, answer key will be posted tomorrow,
exams returned Wednesday

Absence/Failing notices for first exam - formality

First Sky Watch extra credit reports due today.

News? NASA Administrator
Griffin visits China

Pic of the day - “Face on
Mars”



Saturday September 23, 2006

Remarkable Astronomical Conjunctions

Equinox - the date in the northern hemisphere) when night and day are nearly of the same length and the Sun crosses the celestial equator. The autumnal equinox marks the first day of the season of Autumn.

Ramadan is the ninth month of the Islamic calendar. Islam uses a lunar calendar so that each month begins with the sighting of the new moon. Because the lunar calendar is about 11 days shorter than the solar calendar, Ramadan moves each year. In 2006 Ramadan began on Sept. 23/24.

Rosh Hashanah, commonly known as the Jewish New Year occurs 163 days after the first day of Passover, not before before September 5 and not later than October 5. ,Jewish Year 5767 :
sunset September 22, 2006 - nightfall September 24, 2006

Sky Watch Extra Credit - location of supernovae

SN 1006 - Centaurus (not this time of year)

SN 1054 Crab Nebula - Taurus

SN 1572 Tycho - Cassiopeia

SN 1604 Kepler - Ophiuchus

Cassiopeia A - Cassiopeia

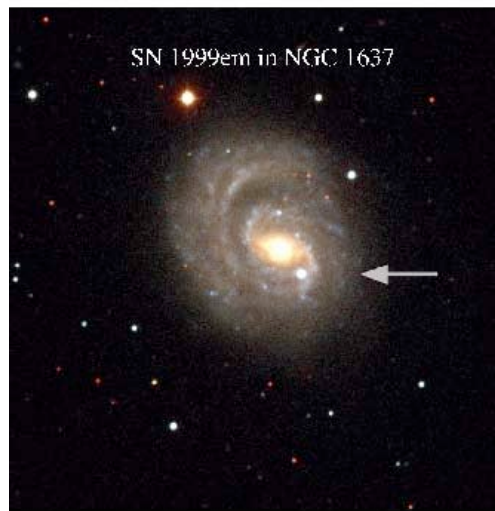
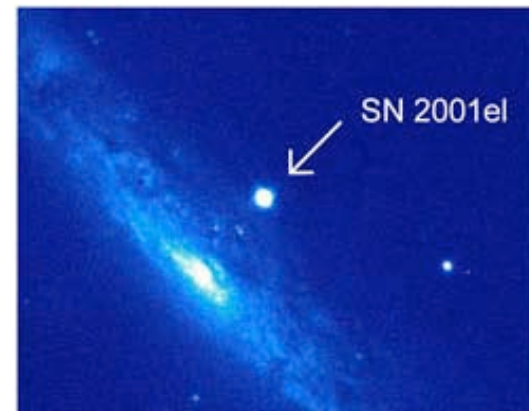
Vela supernova - Vela (not this time of year)

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

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

Can only count each objects once for credit, but can do any objects missed earlier in later reports. Add relevant objects I don't specifically mention in class.

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



SN 2006X

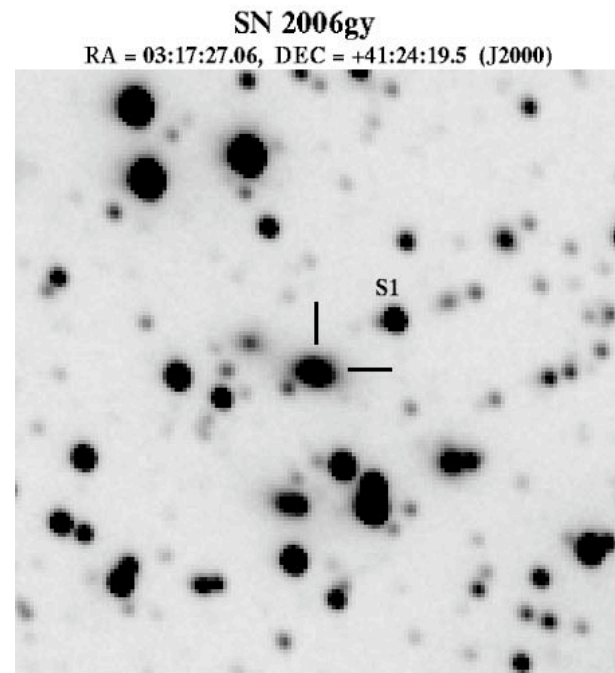
Latest:

SUPERNOVA 2006gy IN NGC 1260

R. Quimby, University of Texas,

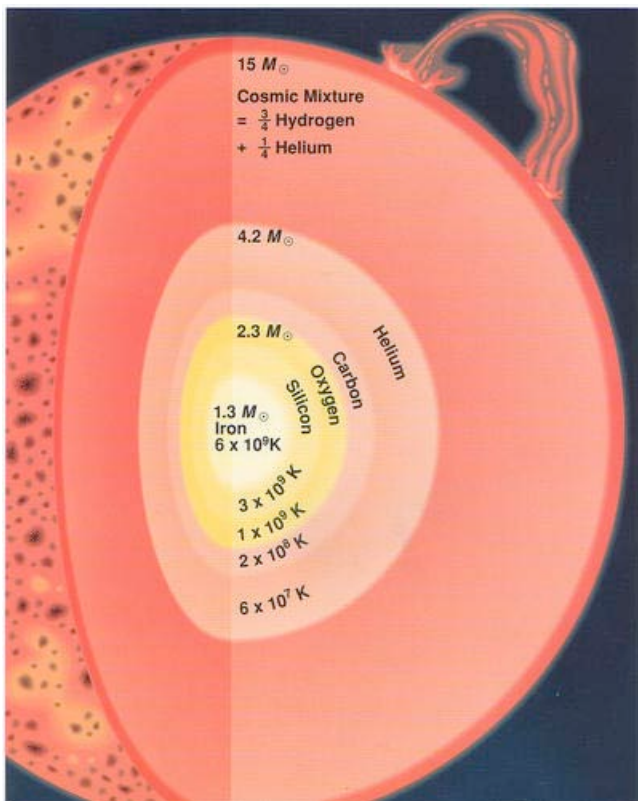
Discovered Sunday, September 24.

<http://grad40.as.utexas.edu/~quimby/tss/>



From S1: 63.4" east, 42.4" south

Physics: in massive stars (more than about 12 - 15 times the Sun) the core of Helium or heavier elements, Carbon, Oxygen, Magnesium, Silicon, Calcium, finally Iron, continues to be hot even as it gets dense,
 ⇒ always supported by thermal pressure
 ⇒ continues to evolve, whether the Hydrogen envelope is there or not.



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)

6 Helium → Magnesium (12 protons, 12 neutrons)

7 Helium → Silicon (14 protons, 14 neutrons)

Common elements forged in stars are built on building blocks of helium nuclei

Categories of Supernovae

1st category discovered

Type Ia - no detectable Hydrogen in the spectrum, rather “intermediate mass elements” like 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*

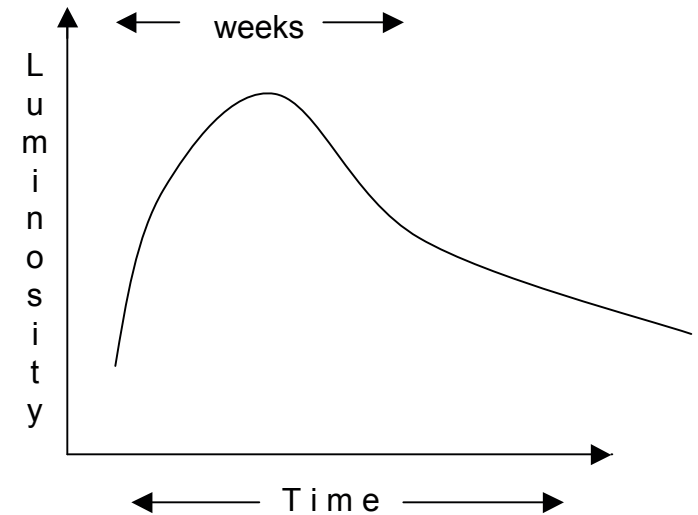
In **irregular galaxies**

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, probably a white dwarf.

SN 1006, almost definitely Type Ia

Tycho, SN 1572 almost definitely Type Ia

Kepler, 1604, some argue yes (no sign of neutron star), but some ambiguities suggesting a massive star progenitor (evidence for jet?)

If U Sco becomes a supernova it will probably be a Type Ia

One minute exam

Why do the elements carbon, oxygen, magnesium, and silicon frequently appear in the matter ejected from supernovae?

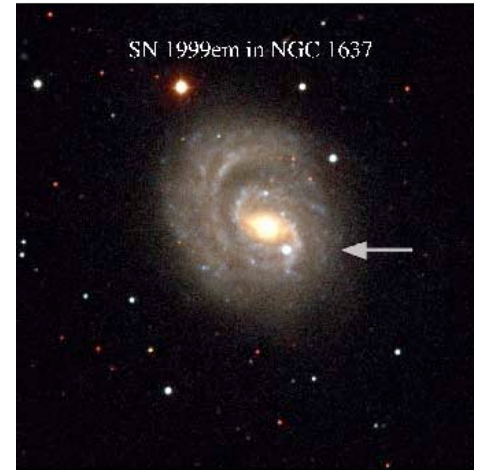
- A) They are built up from the element iron
- B) They are built up from the element hydrogen
- C) They are built up from the element helium

Type II Supernovae - “other” type discovered early, show Hydrogen in the spectrum early, Oxygen, Magnesium, Calcium, later

Most occur in spiral galaxies, *in the spiral arms, they have no time to drift from the birth site* sometimes in irregular galaxies *never in elliptical galaxies*

→ *The progenitor stars are young, short-lived massive stars*

We expect such stars to evolve to form iron cores and collapse to a neutron star or black hole
(physics to come)



SN 1999em

Light curves of Type II supernovae are consistent with explosion in a Red Giant

Betelgeuse is a massive red giant, 15 solar masses: we expect it to become a Type II supernova. *Maybe tonight!* Rigel probably burning He to C/O, explode later.

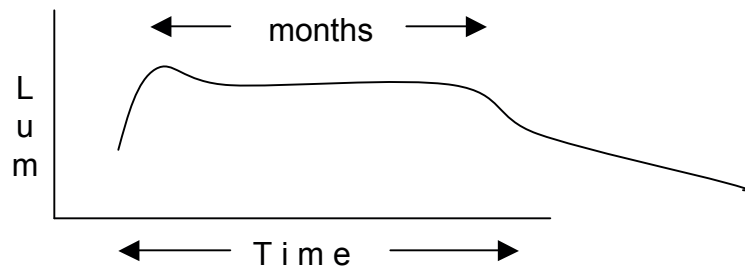
SN 386, 1181 records are sparse, might have been Type II

Crab was a “peculiar” Type II (high helium abundance, slow explosion)

Cas A was probably something else (next topic),

SN1987A was a “peculiar” Type II.

Not obvious that any of the historical supernovae were a “normal” Type II, although Type II are common in other galaxies



One Minute Exam

SN 2006gy shows evidence for the elements oxygen, magnesium, silicon, sulfur, calcium near its peak of light output. What type of supernova is it?

- A) Type Ia
- B) Type II
- C) Insufficient information