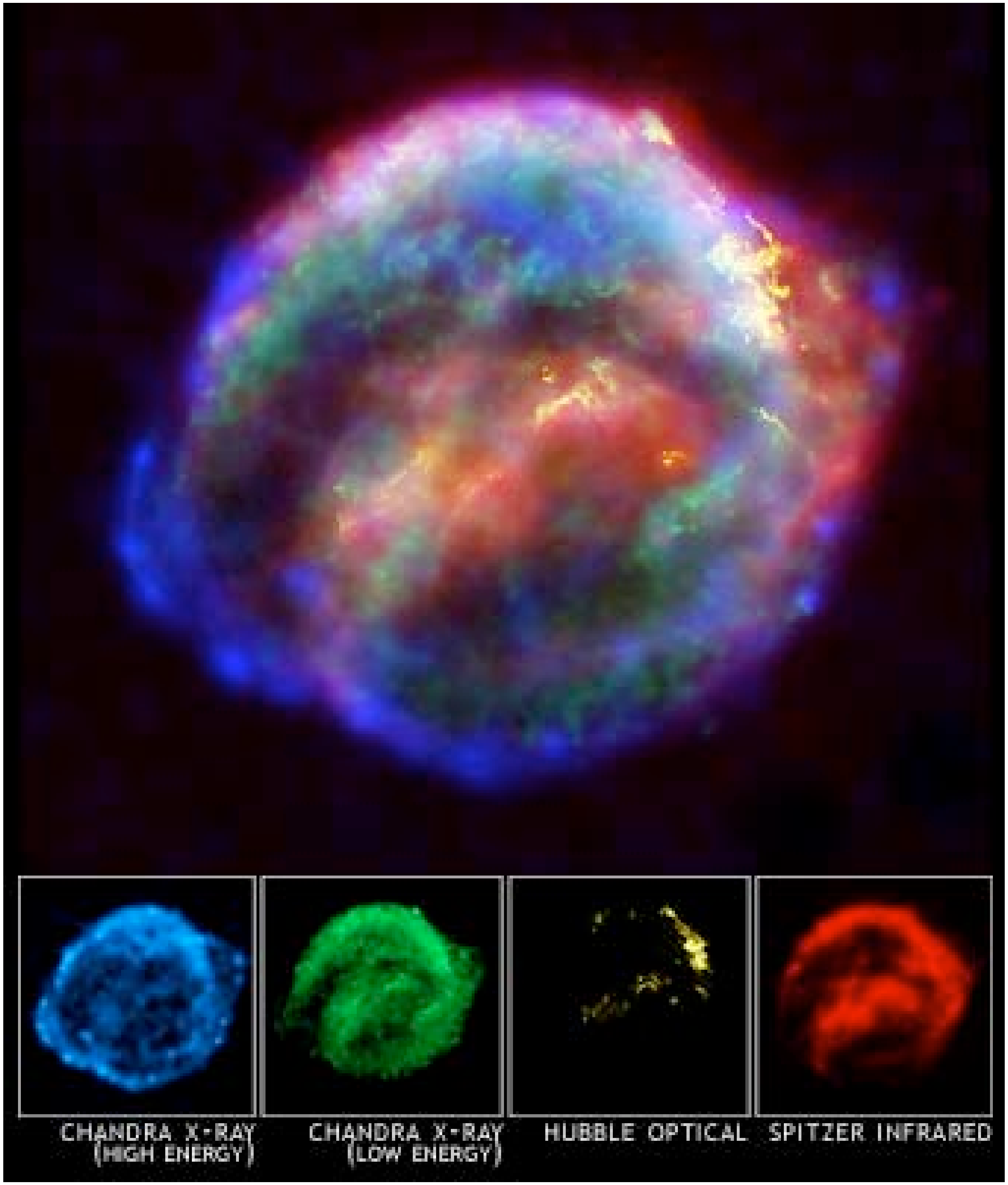
2/18/05

Key will be posted today

News? Keep an eye out Saturday

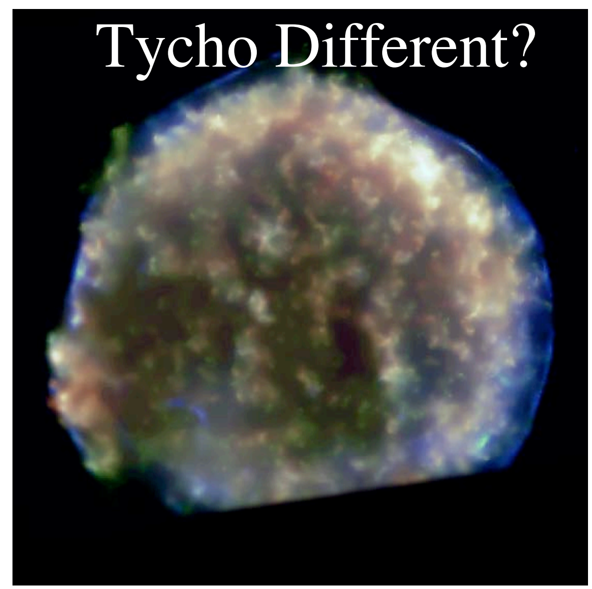
Pic of the day - Big Dipper



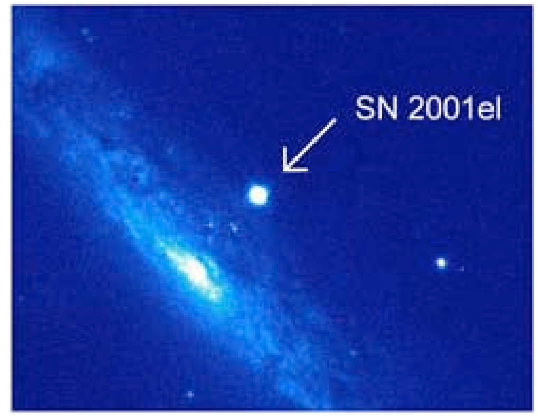
NASA Great Observatories composite of Kepler’s supernova 1604

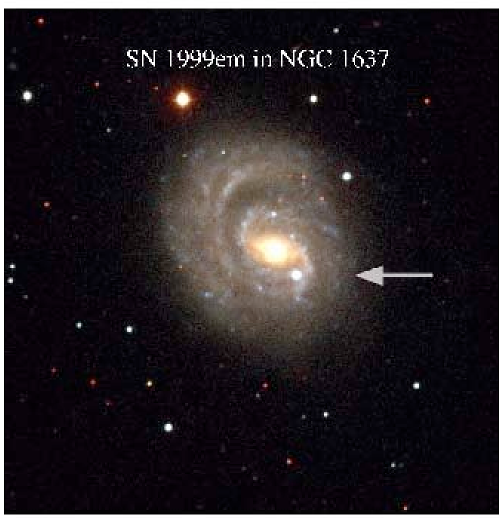
No sign of neutron star

“sideways” alignment?

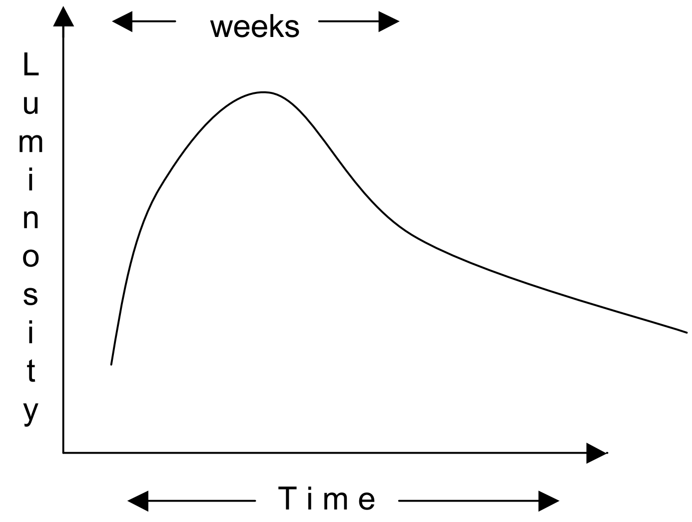


All SN since 1680, since invention of telescope, modern astronomy, have been discovered in other galaxies.





***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.

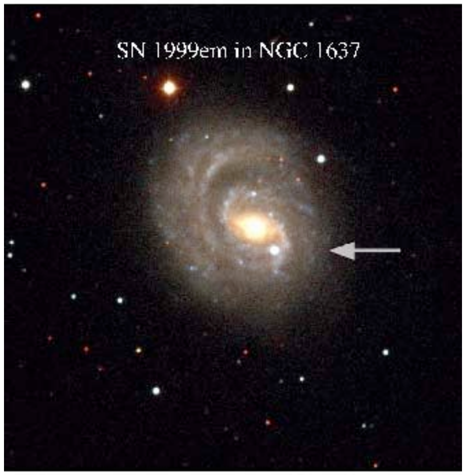
SN 1006, almost definitely Type Ia

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?)

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

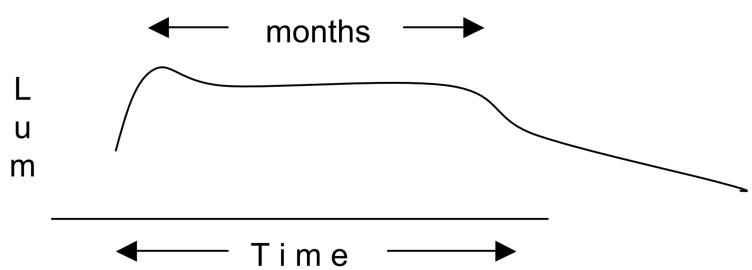
We expect such stars to evolve to form iron cores and collapse to a neutron star or black hole (physics to come)

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

Betelgeuse is a massive red giant, 15 solar masses: we expect it to become a Type II supernova. ***Maybe tonight!***

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



New Types, blurring the old categories, identified in the 1980's, defined by elements observed in the ***spectrum***.

Type Ib: no Hydrogen, but Helium early, near maximum brightness; Oxygen, Magnesium, Calcium later on

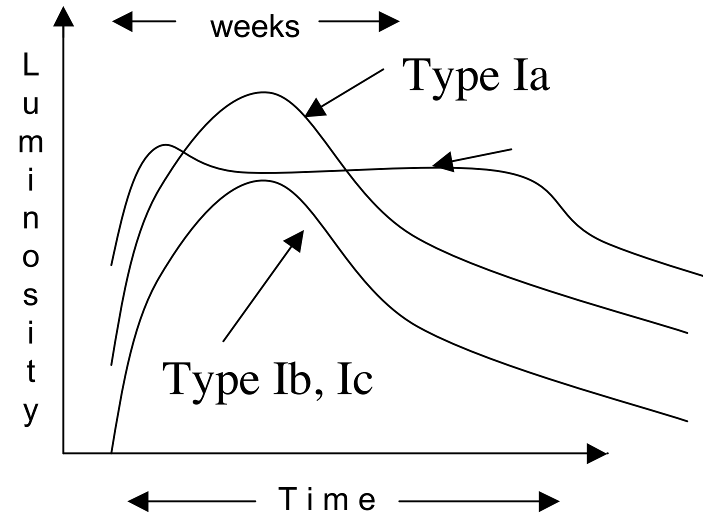
Type Ic: no Hydrogen no (or *very* little) Helium early, near maximum brightness;
Oxygen, Magnesium, Calcium later on

Explode in the spiral arms of spiral galaxies $\Rightarrow$ massive stars,
Never in elliptical galaxies expect neutron star or black hole

Like Type II, but have somehow lost their outer layers of Hydrogen or even Helium $\Rightarrow$ wind § 2.2, or binary mass transfer

Type Ib, Type Ic Light Curve

Similar to a Type Ia, but dimmer, consistent with a star that has lost its outer, Hydrogen envelope (or even Helium for a Type Ic)
[will explain why dimmer later]

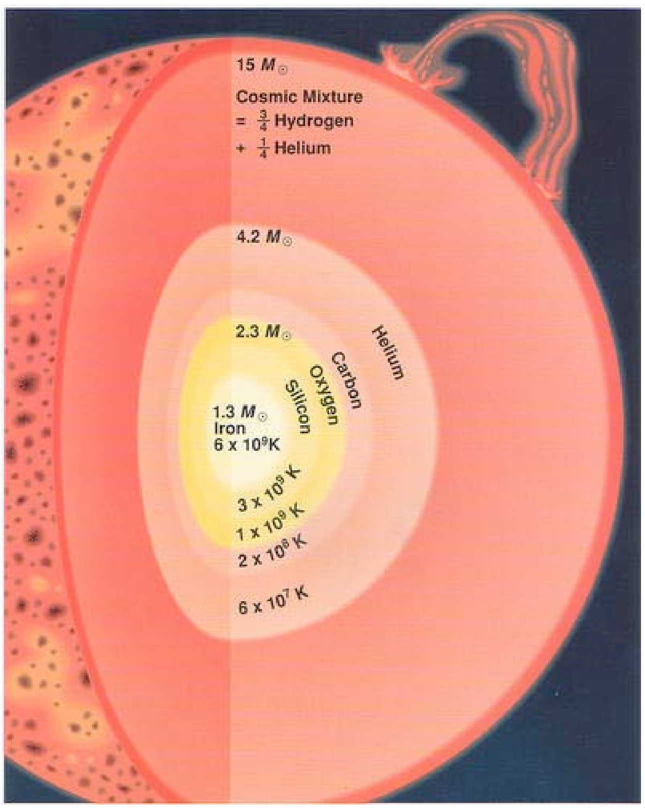


Crab might have had a light curve like this, but probably too much Hydrogen to qualify as a Type Ib

Cas A seems to have been dim at explosion, might have been a Type Ib, despite some evidence for a little Hydrogen in the remnant now

Kepler light curve not a “Type II,” could be consistent with Type Ia, b, c.

Physics: 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 (Type II) or not (Type Ib, Type Ic).



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