Monday, September 12, 2011

Exams, Sky Watch back Wednesday.

Fiasco with missing page, but grades were very high.

Facebook: now 138 members of group and growing. Please check your security settings. If set to "public," then all in group can see.

Astronomy in the news?

Pic of the day: Mars rock rich in zinc, indicates past presence of liquid water.

Goal:

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

Type Ia
no Hydrogen or Helium
intermediate mass elements (oxygen, magnesium, silicon, sulfur, calcium) early on, iron later
avoid spiral arms, occur in elliptical galaxies
peaked light curve
all consistent with thermonuclear explosion in white dwarf that has waited for a long time to explode, total disruption

Type II
Hydrogen early on, Oxygen, Magnesium, Calcium later
explode in spiral arms, never in elliptical galaxies
"plateau" light curve
consistent with massive, short-lived star that has an explosion deep within a hydrogen-rich Red Giant envelope by core collapse to leave behind a neutron star (or maybe a black hole).

New type of supernova

Ask me about its properties, vote about type of explosion.
Analogous to astronomers querying nature with their telescopes

➡ Massive star, core collapse, neutron star

⬅ Exploding white dwarf

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

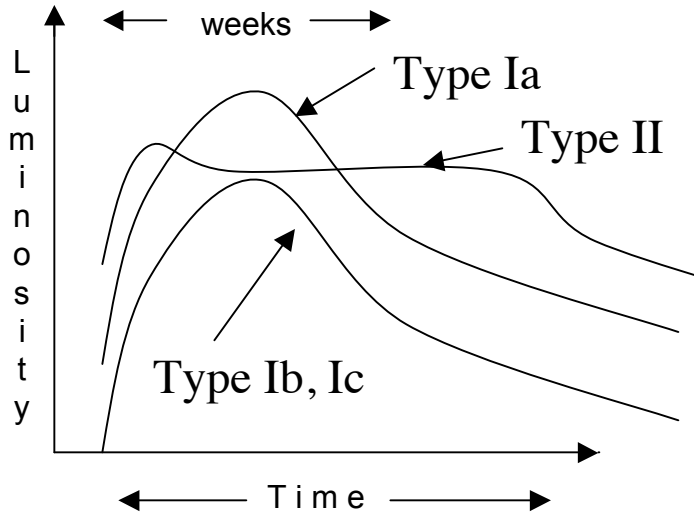
Type Ic: no Hydrogen no (or *very* little) Helium early, near maximum brightness;
Oxygen, Magnesium, Calcium later on

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

Like Type II, but have somehow lost their outer layers of Hydrogen or even Helium ⇒ wind (§2.2) or binary mass transfer (Chapter 3).

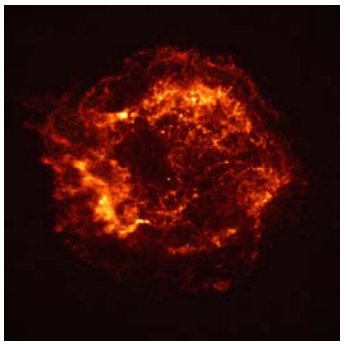
Type Ib, Type Ic Light Curve

Similar to a Type Ia, usually, but not always, 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, some evidence for a little Hydrogen in the remnant now. Recent spectrum of light from peak reflected from dust, arriving "now" shows it was closely related to a Type Ib.



Type Ia:

No Hydrogen or helium, intermediate mass elements (oxygen, magnesium, silicon, sulfur, calcium) early on, Iron later.

Not in spiral arms, do occur in elliptical galaxies -> old when blow

Peaked light curve

All consistent with explosion in Chandrasekhar mass carbon/oxygen white dwarf in binary system, total disruption

Original mass on the main sequence M < 8 solar masses so that quantum pressure takes over from thermal pressure in the carbon/oxygen core that forms after the helium-burning phase.

Type II: Hydrogen early, Oxygen, Magnesium, Calcium, later.

Type Ib: no Hydrogen, but Helium early, Oxygen, Magnesium, Calcium later. ***H envelope lost, by stellar wind or binary star transfer.***

Type Ic: no Hydrogen no (or *very* little) Helium early, Oxygen, Magnesium, Calcium later. ***Even more mass loss, by stellar wind or binary star transfer.***

In spiral arms, never in elliptical galaxies -> short lived -> massive star -> expect core collapse, neutron star or black hole.

Original mass on the main sequence M > 12 solar masses, so that thermal pressure always dominates.

One Minute Exam

A supernova that explodes within the spiral arm of a spiral galaxy and shows no evidence for hydrogen or helium in its spectrum is probably a


Type II supernova


Type Ia supernova


Type Ib supernova


Type Ic supernova