February 2, 2011

First exam a week from Friday, February 11.

Astronomy in the news? NASA will announce new planet discoveries by the Kepler Satellite this afternoon. The goal is to find Earth-size planets. Local astronomers Bill Cochran and Michael Endl are deeply involved.

Pic of the day: Moon and Venus over Switzerland.

***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 Red Giant envelope by core collapse to leave behind a neutron star (or maybe a black hole).***

One minute exam

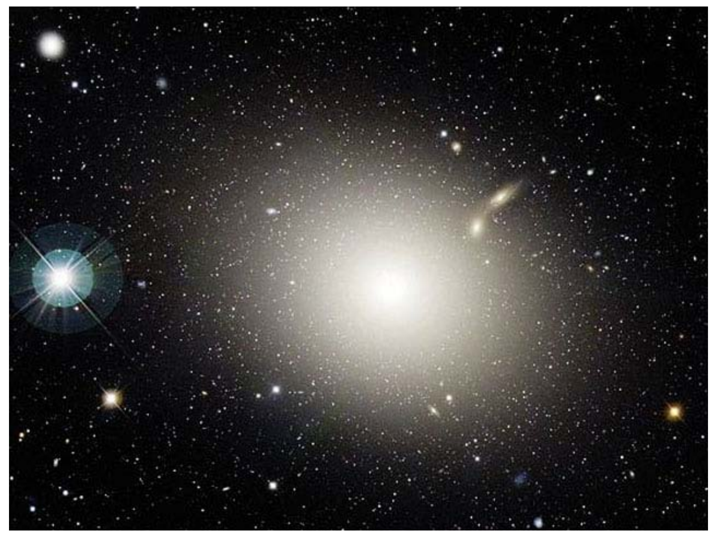
A supernova explodes in an elliptical galaxy. Near peak light what element do you expect to see in the spectrum?

➡ Hydrogen

⬅ Helium

⬆ Silicon

⬇ Iron



Goal:

We have talked about certain elements showing up in supernova:

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

Why those elements?

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

2 Helium -> unstable, no such element

3 Helium -> Carbon (6 protons, 6 neutrons)

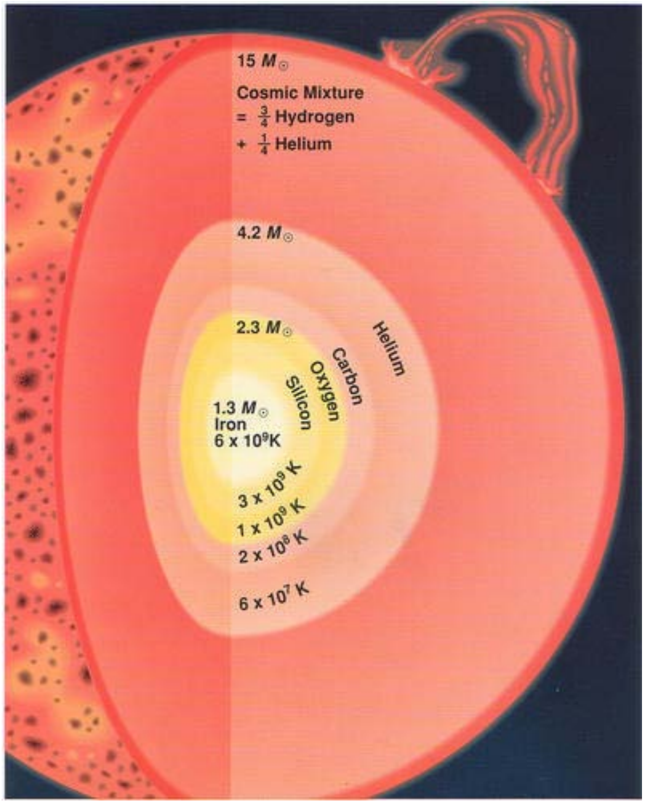
4 Helium -> Oxygen (8 protons, 8 neutrons)

5 Helium -> Neon (10 protons, 10 neutrons)

6 Helium -> Magnesium (12 protons, 12 neutrons)

7 Helium -> Silicon (14 protons, 14 neutrons)

Common elements forged in stars, and in their explosions, are built on building blocks of helium nuclei



Physics: 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 core continues to be hot even as it gets dense,

$\Rightarrow$ always supported by thermal pressure

$\Rightarrow$ continues to evolve, whether the Hydrogen envelope is there or not.

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

In exploding white dwarfs, the core is composed of Carbon and Oxygen, and the explosion creates the intermediate-mass elements, Magnesium, Silicon, Calcium, and also Iron.

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

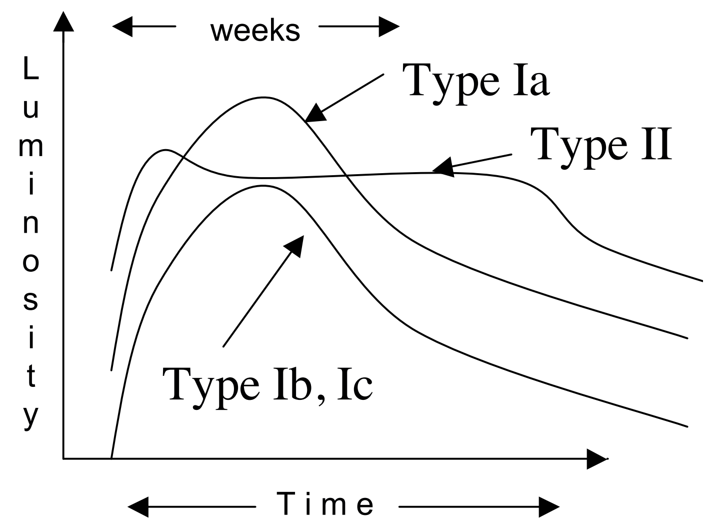
Explode in the spiral arms of spiral galaxies
Never in elliptical galaxies

$\Rightarrow$ massive stars, 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 (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.