

# Supernovae: Past and Present



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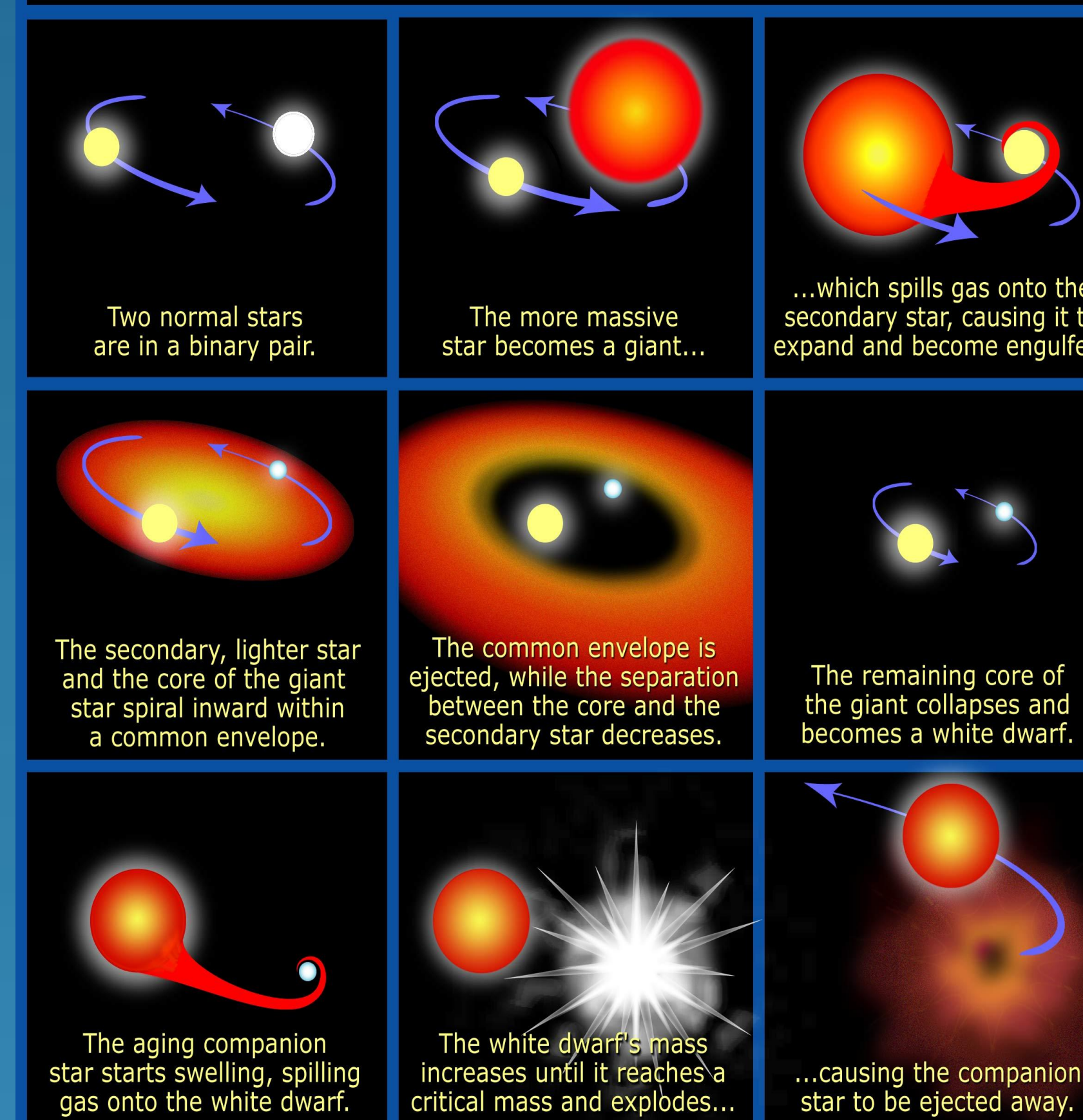
## ~Abstract~

We, The Procrastinators, observed a Supernova named SN 1975A that had a maximum luminosity appearance that occurred from January 21-24, 1975. By looking at this particular supernova, we compared the luminosity from the time it exploded to how it is at the present moment. We used Dyer Observation Plates and the Hubble Space Telescope for close up photographs of SN 1975A to differentiate the visible luminosity change. We were then able to classify the supernova to be a Type Ia, in Population II, because the spectrograph corresponded with the Type Ia silicon absorption band and the basic Ia luminosity graph explained the rapid decrease in brightness (this ultimately proves valid).

## ~Procedure~

We began by brainstorming ideas. We sought after basic info on Supernovae. We proved that Hyper Physic's information is conclusively incorrect. We looked up Supernovae that had been previously recorded. We chose a rather interesting supernova, SN 1975A. We inquired upon Thurburn Barker for more info on this particular supernova. He explained the process of calibrating and scanning Dyer Observations Plates. Once we successfully scanned them, we observed the SN near the two merging galaxies. We then found a photograph of the SN site taken by the Hubble telescope. We created a timeline of the SN site dating back from 1953 to the present day. We then created a graph, using excel, from recorded absorption dips of the SN the week during its maximum magnitude in 1975. We then calculated the absolute magnitude of SN 1975A with the equation  $M=m+5 \times \log(D)-5$ . Configuring all of these observations, recordings, and studies into one, we were able to classify the supernova.

## The progenitor of a Type Ia supernova



This portrays the process of a forming Type Ia Supernova

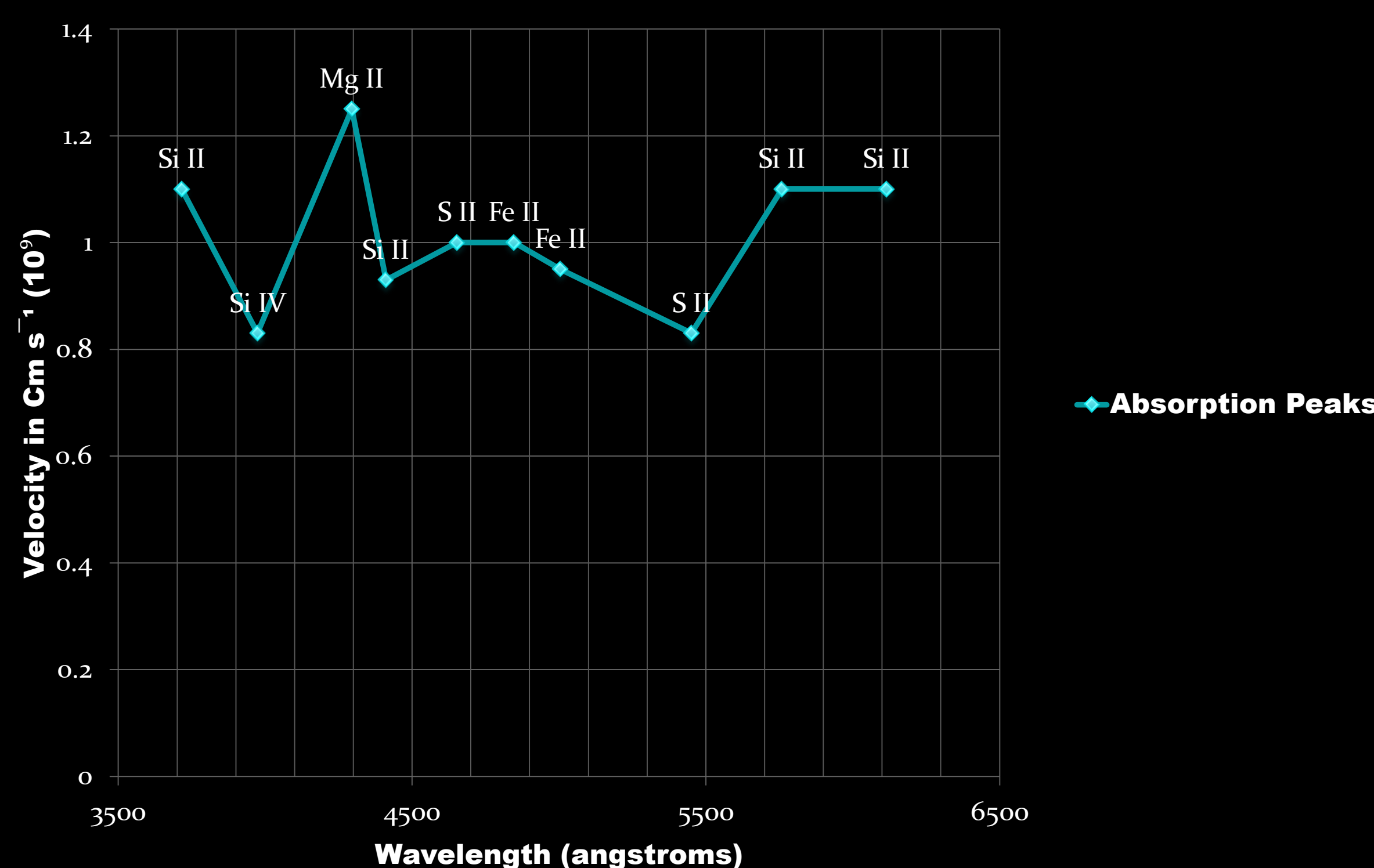
## ~Supernova Classification~

Type I supernovae have a light curve that spikes sharply and then dies away rapidly. They have been thought to start with two stars. One of the stars would form into a white dwarf while the other becomes a red giant. Then the white dwarf would suck in the red giant by its gravitational pull and tear apart the red giant. With the increasing mass of the red giant, the white dwarf collapses from the electron degeneracy. Thus creates the phenomena known as a Supernova. They are usually found in Population II stars, which are white dwarfs in a binary system with a red giant.

There are three types of Type I Supernovae. The three types are Ia, Ib, and Ic. An Ia supernova is fifteen billion times brighter than the sun and has a high silicon absorption. An Ib supernova does not have a high silicon absorption but instead a high helium absorption. Ic on the other hand does not absorb either of the two.

Type II supernovae form much like the Type I supernovae, but its light curve dies away more gradually forming a plateau within the first few months. In turn, they are brighter than a Type I, and stay bright for a longer duration of time. These supernovae are known as Population I stars, which are massive red or blue supergiants.

## SN 1975A Spectrum Analysis

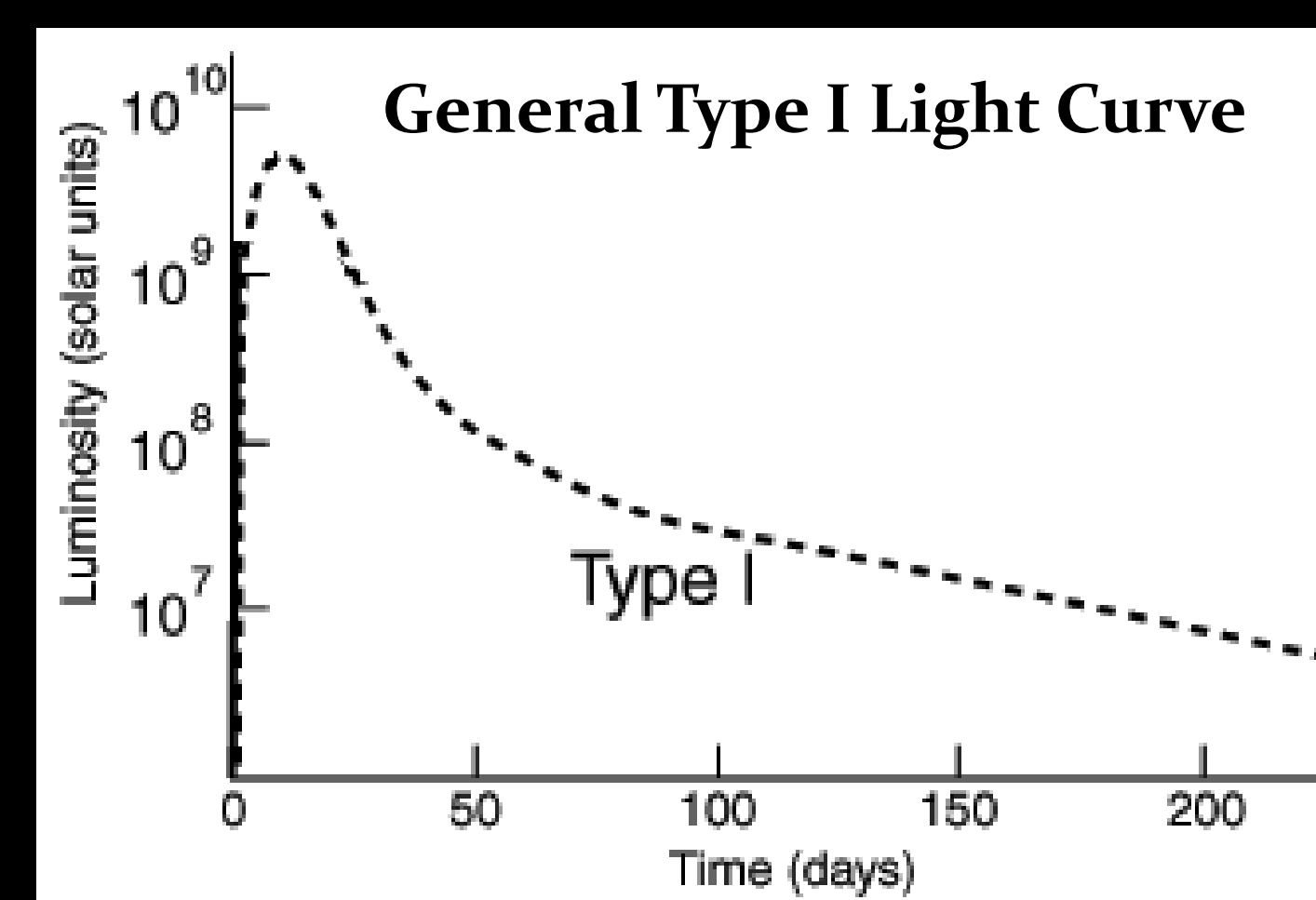


A spectrograph displaying the supernova's multi-element absorption bandwidth

## ~SN 1975A Facts~

- Found within the vicinity of merging galaxies, NGC 2207 and IC 1263
- The only supernova ever to be observed in NGC 2207
- Located in the Canis Major constellation
- A recently classified type Ia supernova
- A recently classified type II population supernova
- The supernova was a white dwarf that collapsed due to immense pressure
- This supernova could, in theory, be used as a *standard candle* (no longer there)

## General Type I Light Curve



## ~Distance Modulus Equation~

$$M = m + 5 \times \log(D) - 5$$

$M$  = absolute magnitude  
 $m$  = apparent magnitude (14.90)  
 $D$  = distance (55 lyrs/3.26 lyrs/pc) ( $1.46 \times 10^2$  pc)

$$M = 14.90 + 5 \times \log(1.46 \times 10^2) - 5$$

$$M = -20.9$$

## ~Hubble's Law~

$$D = v / H_0$$

$D$  = distance  
 $v$  = speed  
 $H_0$  = 71 km/s/mpc

$$D = 1.46 \times 10^2$$

## ~Discussion~

As a result, the timeline that we created proves that this celestial being is in fact a one-time event that portrays a supernova in action. Though the supernova is incredibly brighter than a normal supernova, because a normal supernova's absolute magnitude would be approximately -19.6, SN 1975A has an absolute magnitude of -20.9. By using the original distance that was given to us from the Hubble site, which is 16.8 Mpc, the brightness was way too high compared to Hubble's law and the velocities of the matter absorbed from the recorded spectra. We figured out a deduced distance of 146.131 Mpc. Thus, by using this distance in the Distance Modulus formula, we were able to figure out a definite, absolute magnitude of the supernova, Type I, Population II, SN 1975A.



A supernova remnant

## ~Summary~

In conclusion, we have used a spectra graph, a light curve graph, and infallible timeline of SN 1975A to display our findings in a straightforward portrayal so that the average Joe and even a qualified intellectual may comprehend it. We can attest to the fact that we have surpassed NASA scientists in calibrating and coordinating the bona fide classification of the supernova that we now know of today as SN 1975A.

## Supernova 1975A Host Galaxy: NGC 2207

