Stars 101

And Constellations

What are stars made of?

(by mass)

- 70-80 % Hydrogen
- 20-30% Helium
- 1-2% Metals (everything else)

Stars are born in Nebulae

We classify stars based on their spectra, which provide us with information on:

- Temperature
- Composition
- Brightness
- (and in some cases, distance)

Some example spectra below:

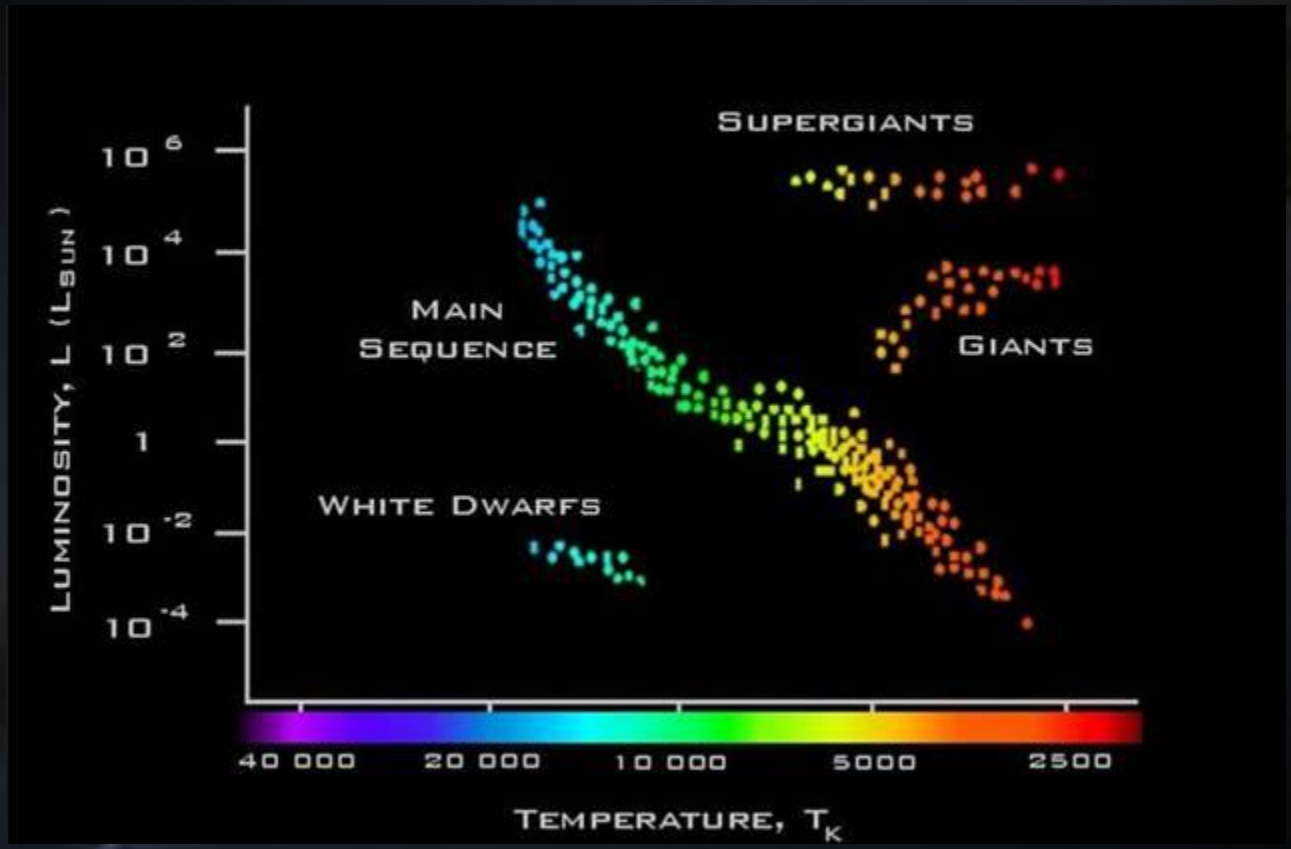
Calcium

Hydrogen

Iron

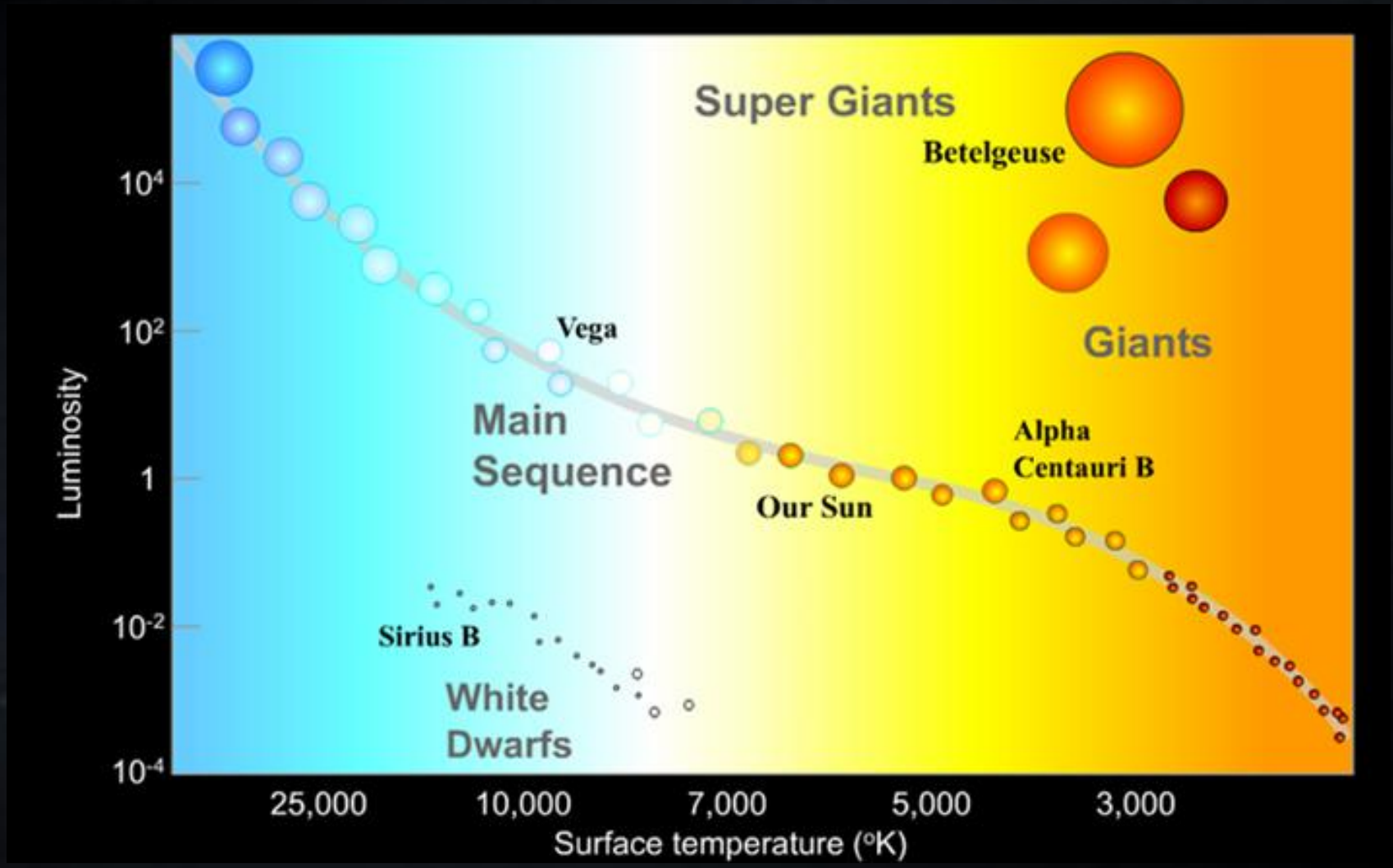
Magnesium

This is how we organize stars



This is VERY important in astronomy. Kind of like the periodic table for astronomy.

The Hertzprung-Russell Diagram




There are three types of stars

Remember!

The most important factor in how a star evolves and eventually dies is its initial mass.

Low Mass Stars

1/8th to a little smaller than the mass of our Sun

Low Mass Stars

- These stars are not big enough to do much of anything.
- Sometimes, there is not enough mass to even start shining so it goes directly to a brown dwarf.
- Once the star gets on the main sequence, it burns for a VERY long time
- Once fusion stops, it slips into a white dwarf

Medium Mass Stars

Our Sun to about 8 times
the mass of our Sun

Life of a Medium Mass Star

- Once the star starts turning hydrogen into helium, it goes on the main sequence.
- On the main sequence, these stars will burn for a long time (like several billion years)
- This is where the Sun is currently (and will be for about 5 billion years give or take)

Nearing the End

- Star has now used up its hydrogen supply
- Core starts turning helium into carbon
- Outer layers of star expand and will start to glow red
- Star is now a red giant
- Star will spend several million years converting helium into carbon

The End

- Once all the helium is used up, the star will shed its outer layers creating a planetary nebula.
- The carbon core is left behind and is called a white dwarf
  - White dwarfs are about the size of Earth
  - Much, much more dense, though

Really, Really the End

- A white dwarf can pick up material from another star
  - Explodes into a nova
    - Nova is where the star gets bright for about a week then goes back to original brightness
- Once all energy has been used up, white dwarf will turn into a black dwarf ending any hope of becoming anything else

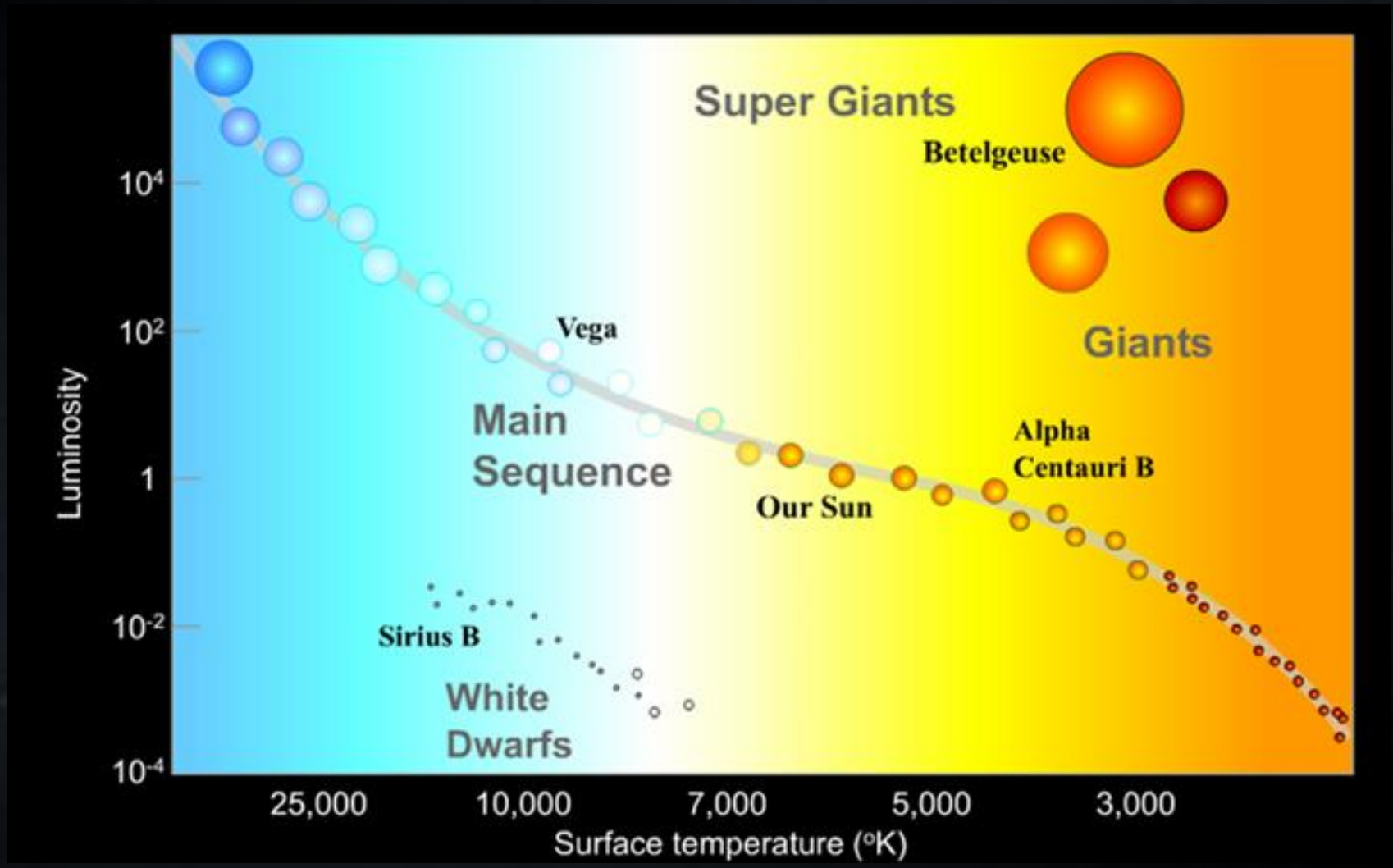
High Mass Stars

More than 8 times
the mass of our Sun

Life of a High Mass Star

- Main sequence (H → He) as a Blue Giant
- Red Supergiant (He → C)
- Core starts to shrink getting hotter and more dense
- Fusion keeps going until core is iron (Fe)

Main Sequence



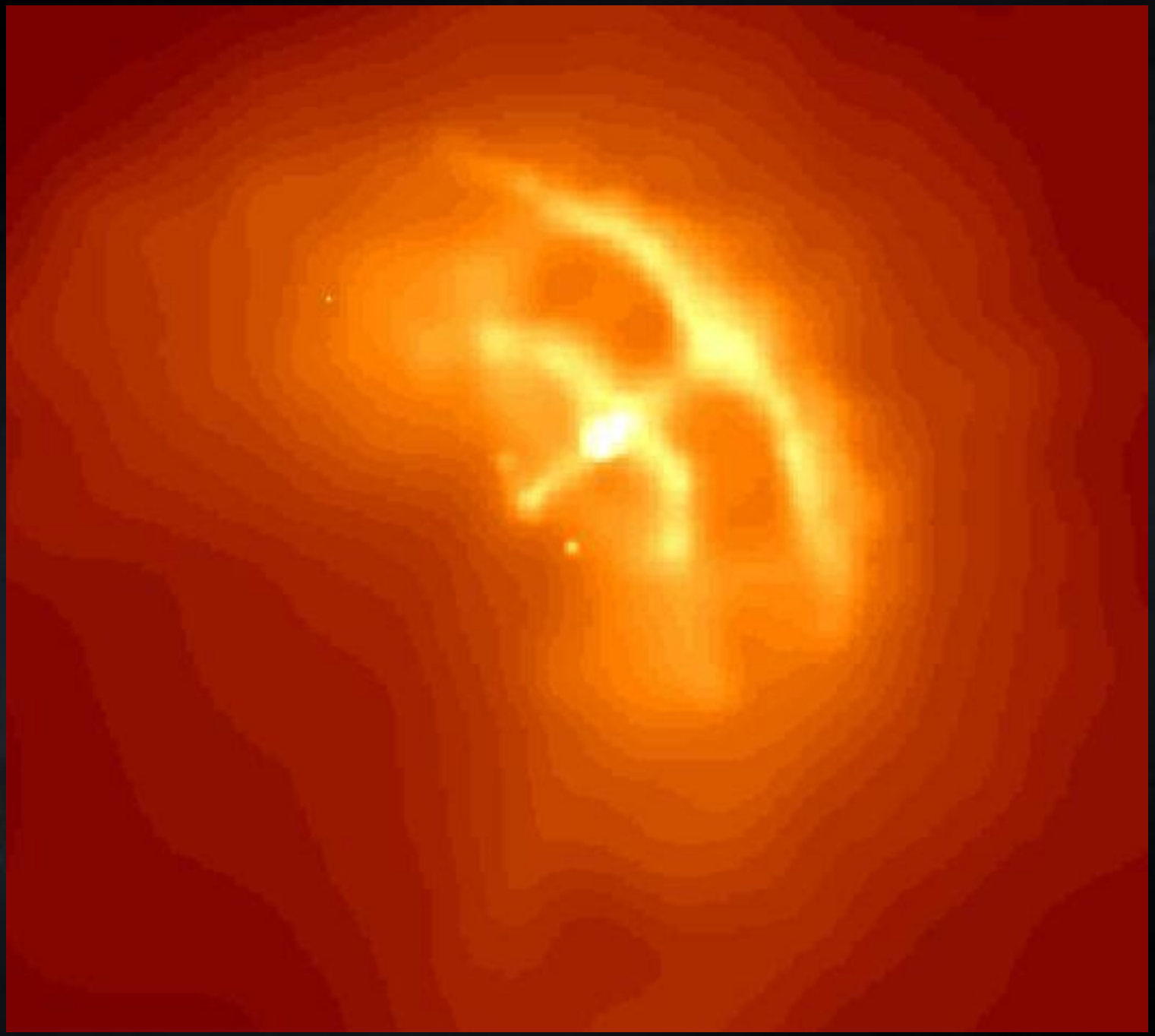
And Things Get Interesting…

- Iron core gets extremely hot (over 100 billion degrees)
- Star explodes in a supernova
- Can be seen for a few weeks to a month
- Supernova remnant

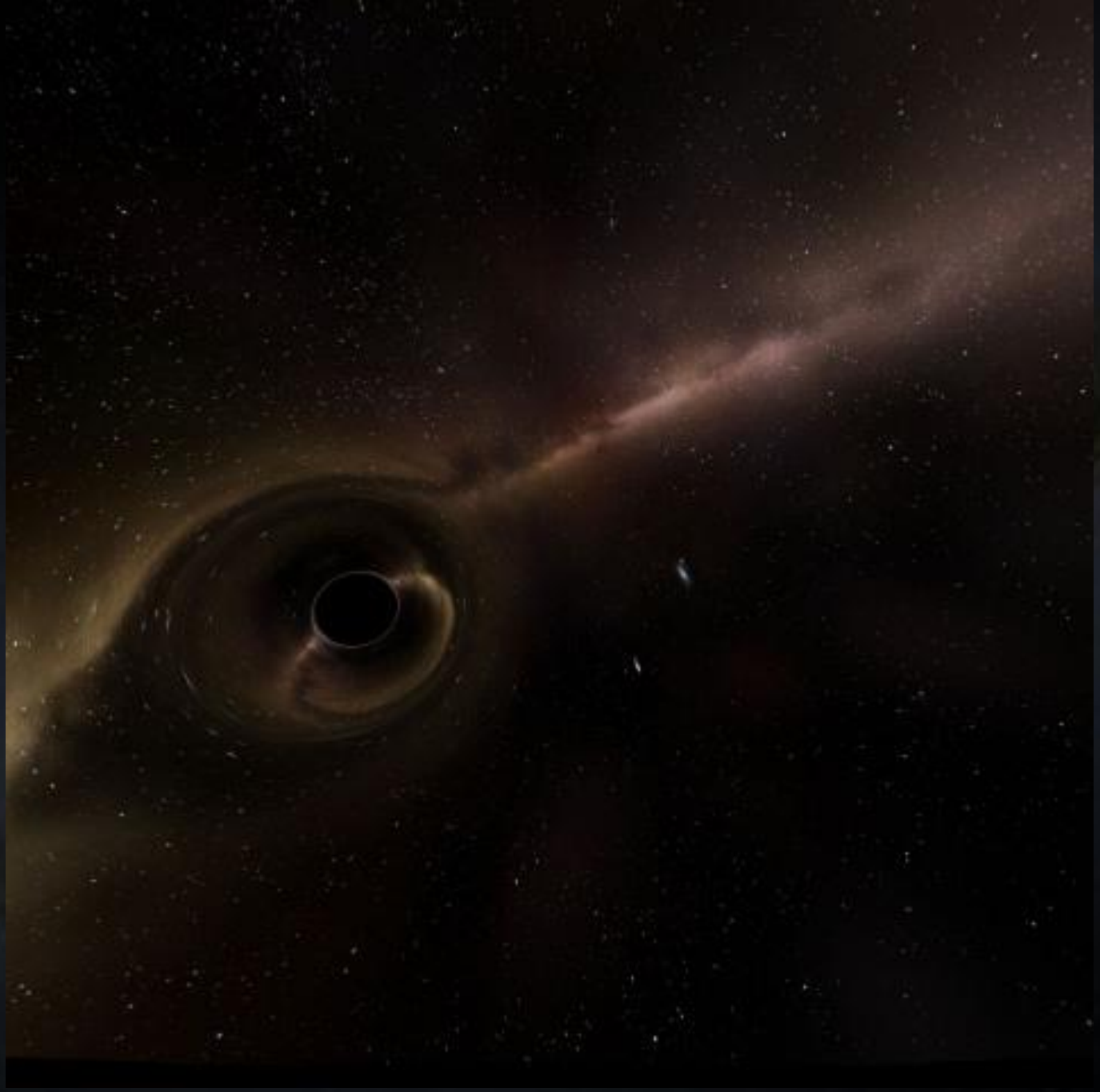
Even More Interesting…

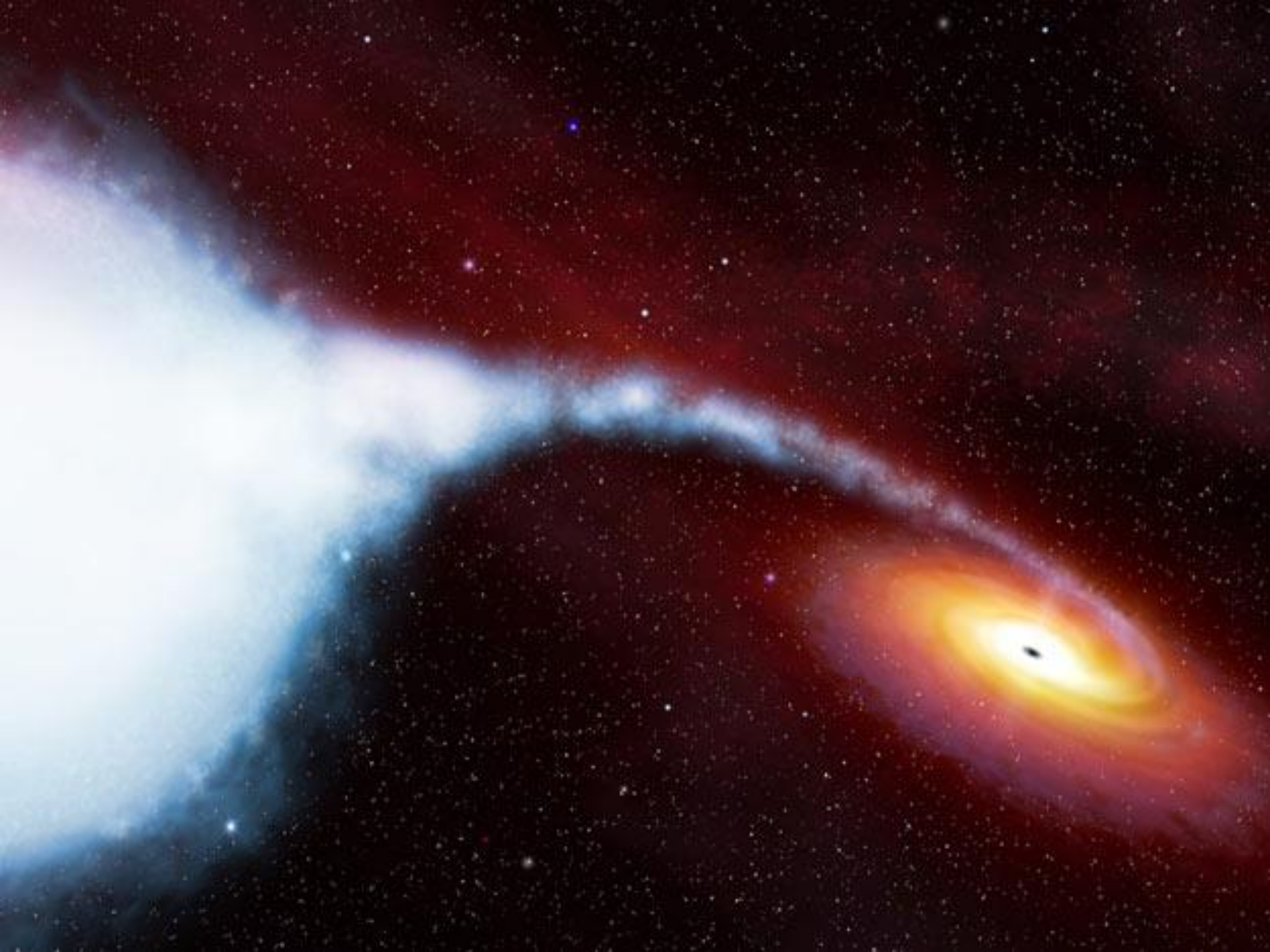
There are two options (based on mass)

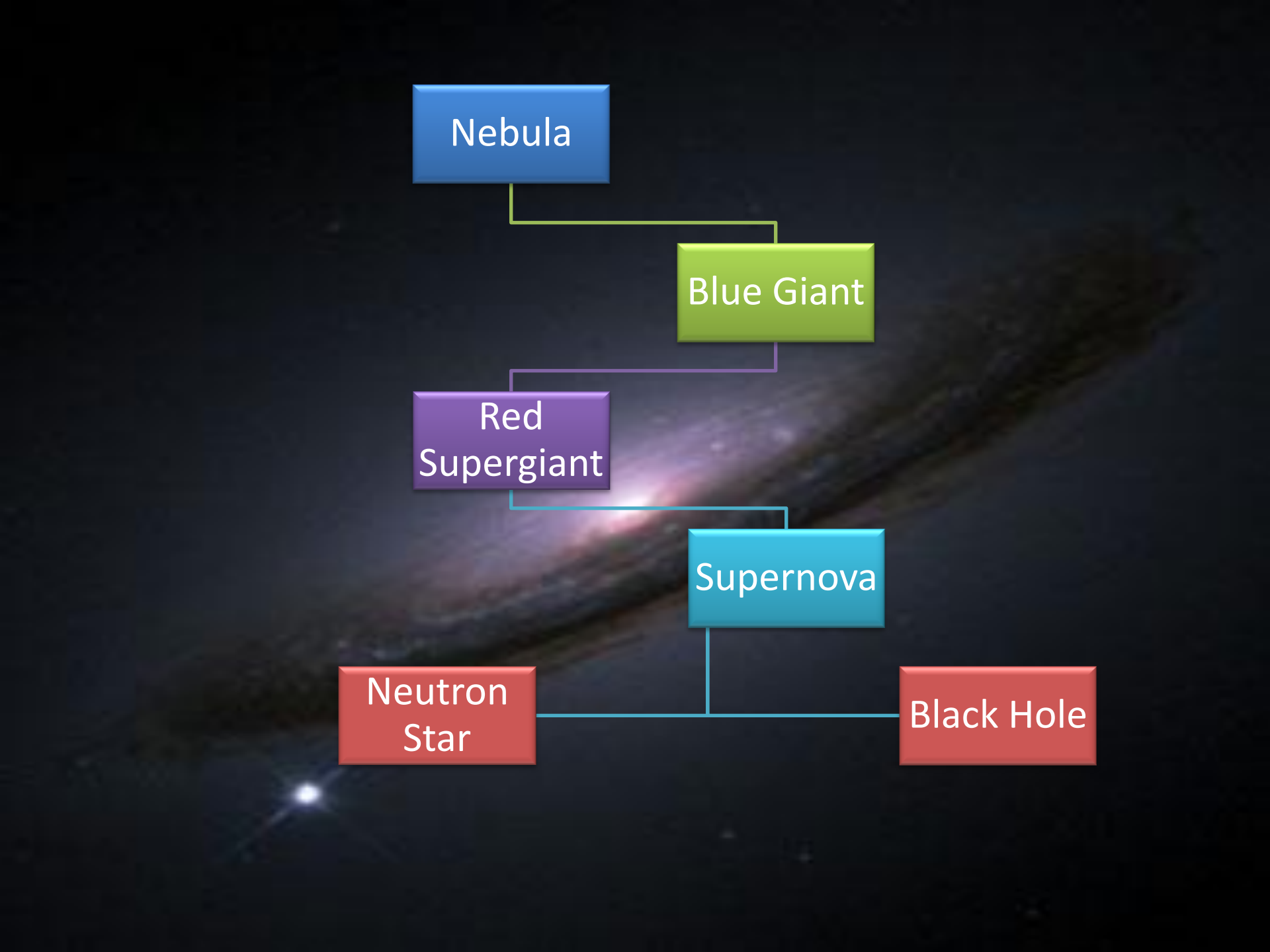
1. Core remains and becomes a neutron star
   - From large stars
   - About 10 miles in diameter but EXTERMELY dense
   - Spin rapidly (one rotation in mere seconds)
   - May “pulse” because of elections so sometimes called pulsars



2. Core collapses and a black hole forms
   - From massive stars
   - Nothing can escape (even light!)
   - Can't see them but see the evidence of them
   - Two types of black holes
     - The size of a star
     - The size of a galaxy






Nebula
Blue Giant
Red Supergiant
Supernova
Neutron Star
Black Hole

Constellations

Groups of Stars

Constellations

- A grouping of stars that, when viewed from Earth, make a pattern or shape
- Groupings of stars have changed through out the world and through history
- The IAU recognizes 88 constellations currently


http://www.iau.org/public/constellations/