

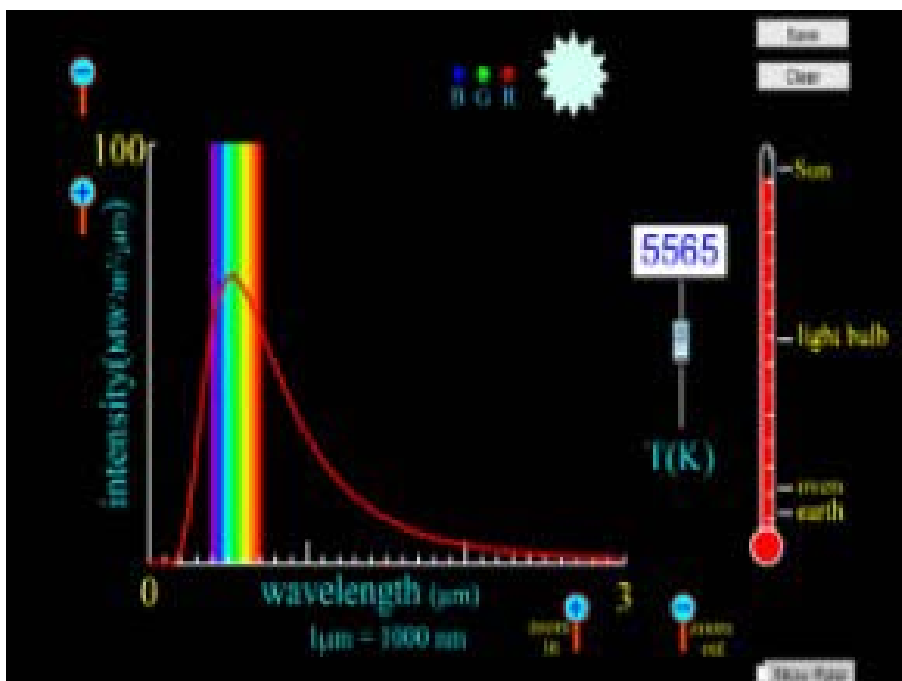
Erol Chandler

John Lenyo

Nathan Perkins

Star Formation/Life Cycle Notes

Star- huge ball of ionized gas(plasma) which produces energy that it gives off as light by nuclear fusion

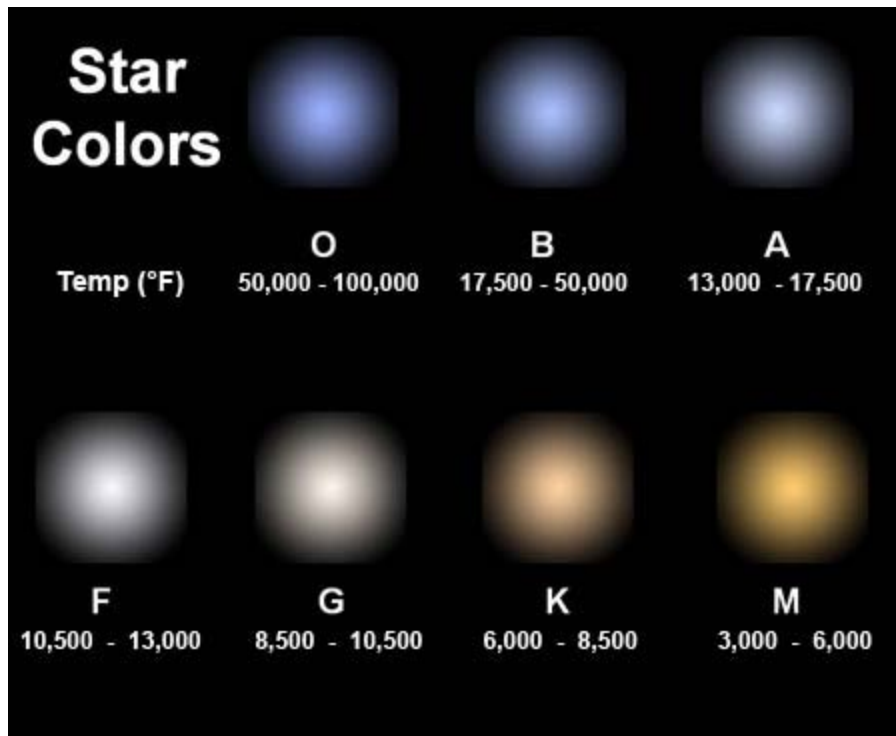


<http://scienceblogs.com/dotphysics/2009/04/why-are-sparks-blue.php>

Our sun's "surface" is at about 5700K (green/yellow light)

What is Light?

Temperature is a measurement of how quickly the atoms vibrate



<http://www.clarkplanetarium.com/blog/cosmic-quiz-lets-talk-about-star-colors/comment-page-1>

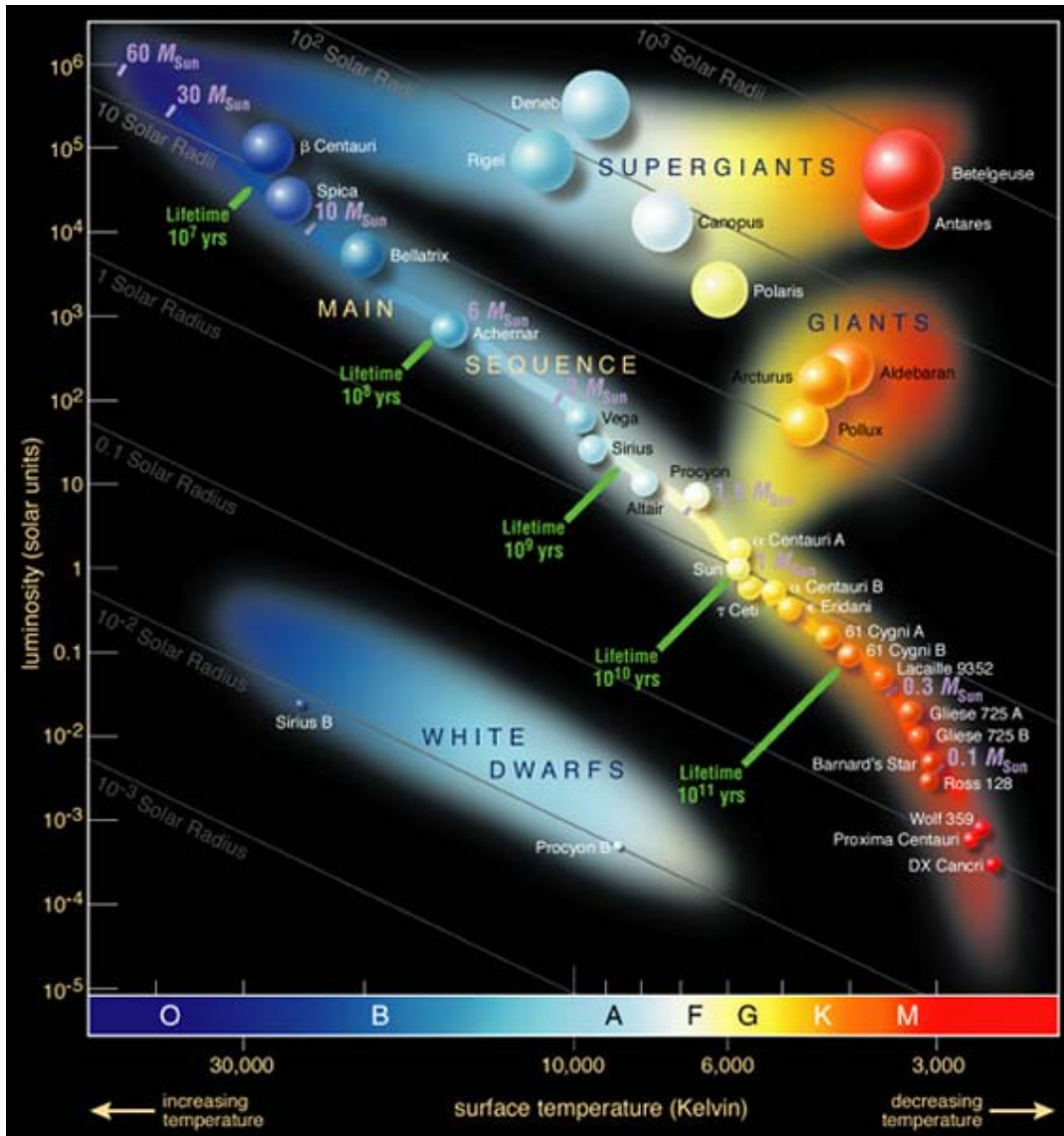
That vibration level correlates to a color of light (on opaque bodies)

Cool stars give off infrared: red

Hot stars give off ultraviolet: blue

Mid range stars give off all: white

Spectra of stars based on color (temp) and spectral features



<http://picasaweb.google.com/lh/photo/kmKfT2WD3FVwvSXXGOJQwQ>

Luminosity (brightness) $L = \sigma T^4 A$

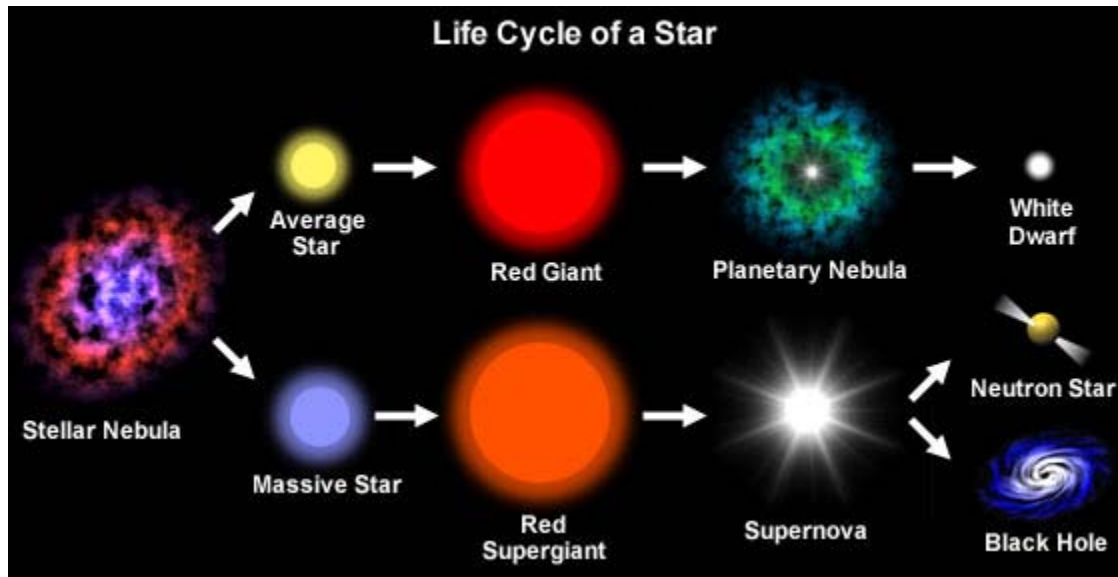
$A = 4\pi r^2$ (constants 4 and π) and ($r =$ radius of the star)

$L =$ brightness

$\sigma =$ a constant

$T =$ temperature

Life of a Star



<http://www.seasky.org/celestial-objects/stars.html>

Constant battle against gravity....gravity always wins through time

-High mass stars will create every element, and live and die quickly (due to high fusion rate to battle gravity)

-Low mass stars will create none, or few elements and live a very long life

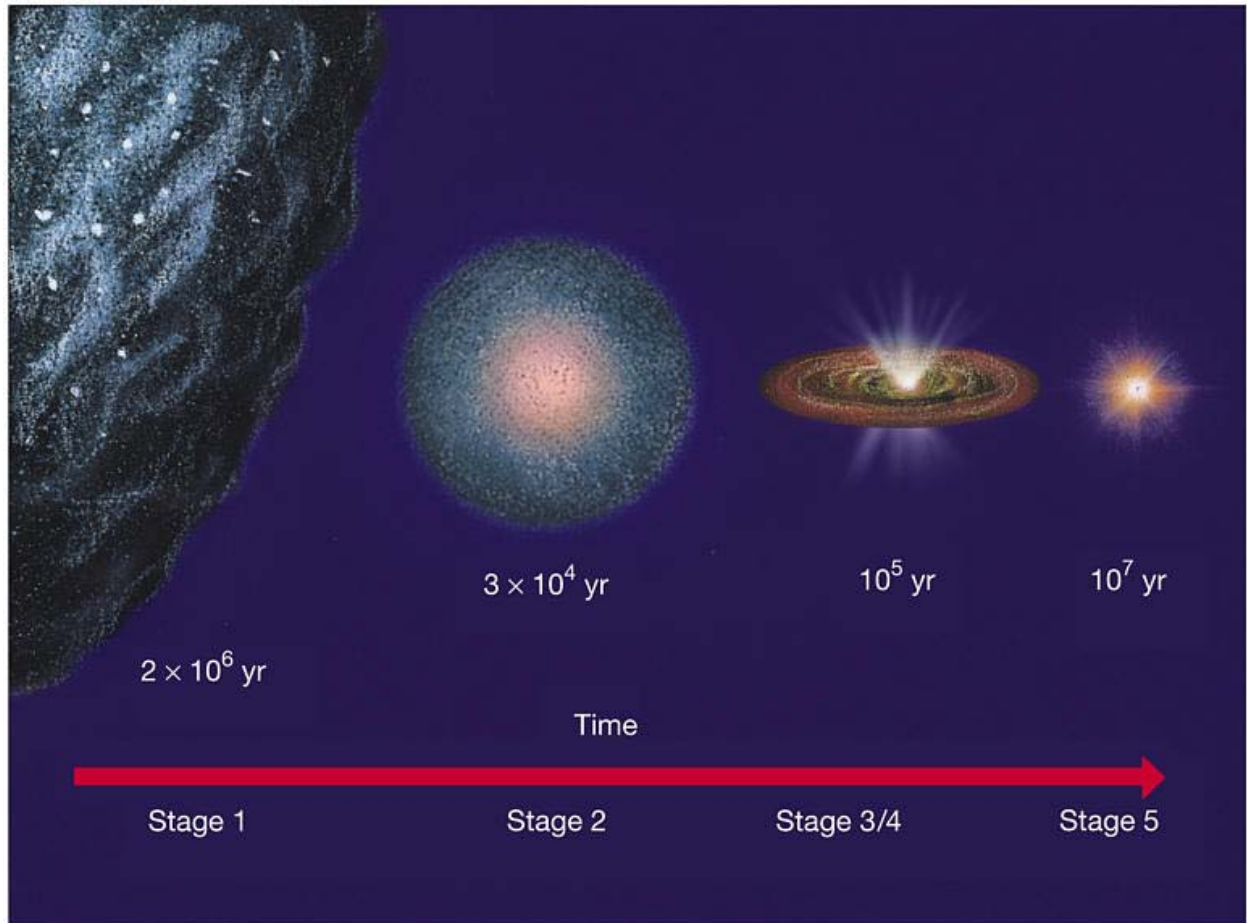
1) Nebula- a immense region of gas and dust of varying densities



http://wallpapers.free-review.net/49_The_Horsehead_Nebula_B33_Orion_Nebula.htm

- a. Due to mass, gravity operates on nebula and pulls inward toward denser areas
- b. If a nebula is not actively contracting or expanding, then gravity is in balance w/
thermal pressure
- c. To move from this stage nebula need a perturbation (trigger) to start collapse
 - i. Supernova
 - ii. Collisions between nebulae
 - iii. Anything that disturbs the balance
- d. In order to be dense enough to collapse it has to have cold molecular clouds.

2) Pre-star stages



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<http://physics.uoregon.edu/~jimbrau/astr122/Notes/Exam3rev.html>

- a. Free fall contraction
 - b. Kelvin-Helmoltz contraction-slows contraction (molecules begin to be forced into bouncing off each other, increasing pressure, and temp and slowing contraction)
 - c. Known as Protostar or YSO, before it reaches main sequence
 - d. Center of protostar gets dense enough and therefore hot enough (3000K+) to become luminous, however not visible due to exterior of gas and dust surrounding it.
- 3) Phophids- YSO's starting to disk
- a. start to get charged particles
- 4) Early star- Does a stutter step with nuclear fusion which blows large amounts of gasses out (like a stuttering engine and black smoke on a cold morning)
- 5) When Stabilizes if becomes a Main Sequence Star
- a. For Main Sequence stars (such as our Sun) nuclear fusion is **when 4 hydrogen atoms fuse into one helium atom.** ($4\text{H} \rightarrow 1\text{He}$)

- b. Our Sun has been a main sequence star for about 4.56 billion years and is believed to be roughly halfway through its lifetime.

-A careful balance of thermal pressure and gravity keep a star alive. When the interior of a star is hot enough for nuclear fusion, the thermal pressure can balance with gravity.

-The lifetime of a star is determined by the remaining hydrogen in the core. Once the hydrogen in the core depletes and all that is left is Helium, fusion stops and gravity takes over.

6) When the core contracts however, it brings with it the layer of hydrogen above it and when the hydrogen gets close enough to the superheated core it begins the fusion process known as "shell burning".

This provides the outer layers of the star with enough thermal pressure to keep them expanding.

This can become a Red Giant which then becomes a Planetary Nebula. Supernovas can result if the star is massive enough, but in most models, Red Giants are more common.