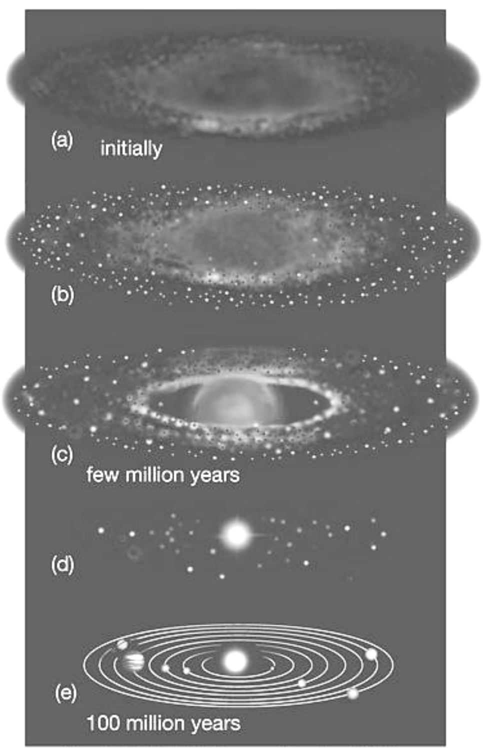
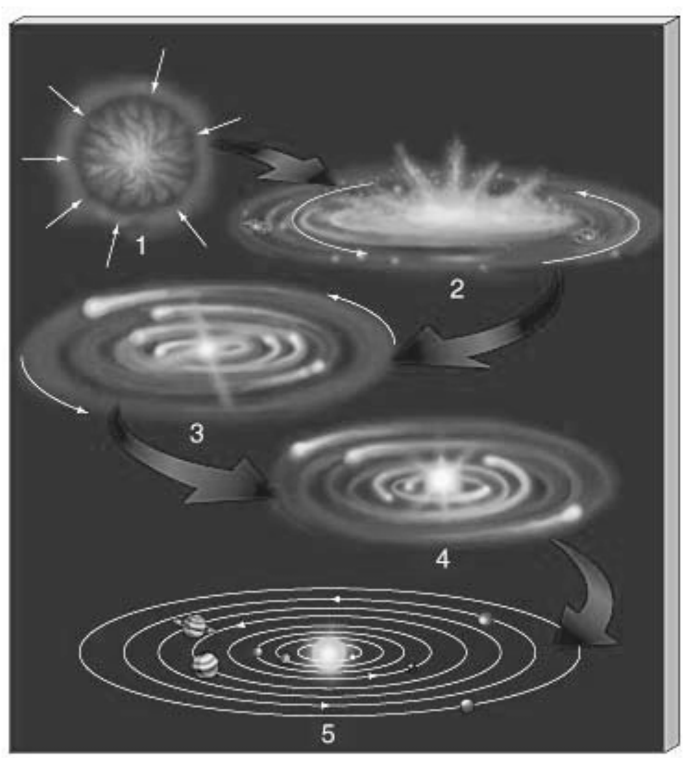
PSSA ASTRONOMY

Space is not as empty as most people believe. Space is full of gas and dust; mostly hydrogen and helium, but there are other elements and dust particles. When a cloud of this gas and dust begins to contract under its own gravity, the temperature of the gas rises. If there is enough gas to start with, the temperature can get so high that thermonuclear fusion of the hydrogen begins. This fusion produces energy, which is released as electromagnetic radiation. Much of it is visible light, which we can see with our eyes; but some is also released as infrared, ultraviolet, and x-ray radiation.

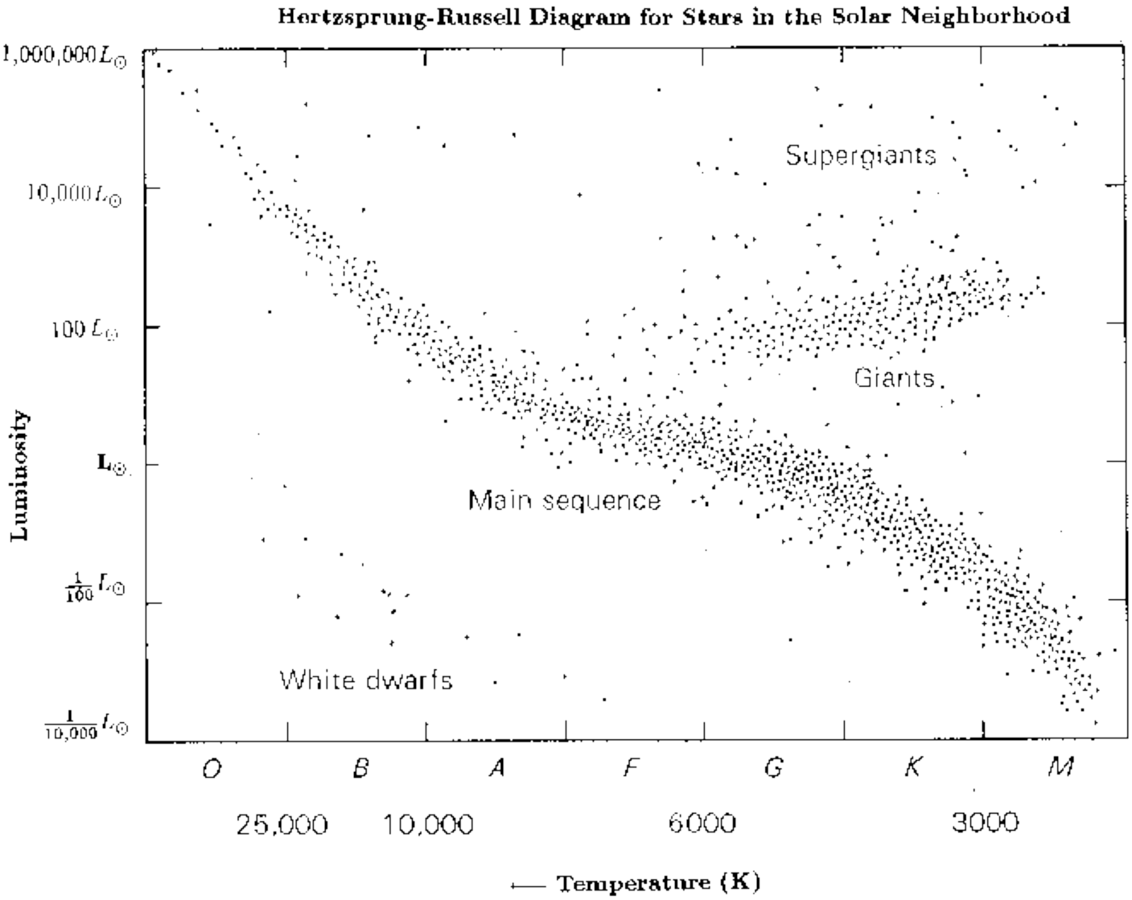
Sometimes the gas and dust leave a "debris disk" around the star as it begins to shine. The debris can eventually come together into smaller bodies we call planets. A couple of illustrations show the process below. The final stage in each would be called a "solar system."

What causes the gas to begin contracting may be a nearby supernova explosion, or a collision between galaxies, which are large collections of millions of stars.





Astronomers use a system of classification to differentiate stars. All the stars in the universe appear on a diagram called a Hertzsprung-Russel diagram, or H-R diagram for short.



To interpret this diagram, you need to know what the descriptions are on each axis. The vertical axes describe how "bright" the star is. Luminosity refers to how much energy the star puts out, and much of it is visible light, so a more luminous star is brighter. Notice that stars get brighter on the diagram as you go up the vertical axis. The symbol L□ refers to the luminosity of the sun.

The horizontal axis shows the surface temperature of the star, in Kelvin (a "Kelvin" is similar to a degree in Celsius measure). Notice that the temperature goes *down* from left to right.

The letters also along the horizontal axis are called "spectral classes" and they are associated with color. O stars are violet, B stars are blue, A and F stars are white, G stars are yellow, K stars are orange, and M stars are red. The sun is a G-class yellow star.

So a very hot, very bright star would be on the upper left portion of the H-R diagram. A very hot star that is small and dim would be on the lower left – notice that these are called "white dwarf" stars. A relatively cool, bright star would appear on the upper right – these are giants and supergiants. A cool, dim star would be on the lower right.

The curving line that goes from the upper left to the lower right is called the "main sequence." Around 90% of all the stars in the sky fall along this line. When a star begins to fuse hydrogen, it ends up somewhere on the main sequence and burns hydrogen for a long time, depending on how much mass the star has. Low mass stars end up on the lower right, and high mass stars end up on the upper left. The sun is on the main sequence, in the region labeled "G."

The giants, supergiants, and white dwarfs are stars that have used up their hydrogen fuel, and they move off the main sequence into other regions of the H-R diagram.