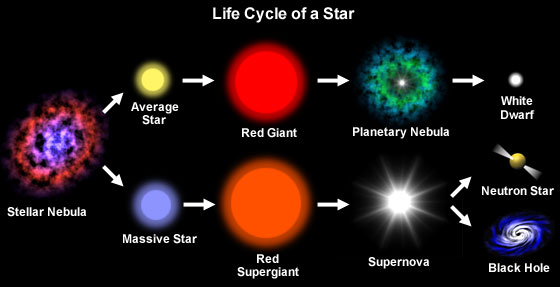
September 25, 2018

Key Question: How does where you live affect what you see in the sky?

Sub questions: How much light contamination do you have in the night sky?

What constellations can you see in the Northern Hemisphere?

How do the seasons affect what constellations you see in the sky?

1. The Universe
   1. The Universe is the totality of known or supposed objects and phenomena throughout space; the cosmos. This includes all the stars, comets, galaxies, asteroids, and any activity occurring throughout space.
   2. Within the universe we have many galaxies, which are a large system of stars held together by mutual gravitation and isolated from similar systems by vast regions of space.
2. Galaxies: Spiral, Elliptical, or Irregular (<https://space-facts.com/galaxy-types/>)
   1. Spiral Galaxy: the most common in the Universe. A large majority of galaxies have barred spirals. Their function is not completely understood, but is being studied by astronomers. In addition to bars, many spirals may also contain supermassive black holes in their cores. Subgroups of spirals are defined by the characteristics of their bulges, spiral arms, and how tightly wound those arms are. (observe in link)
   2. Elliptical Galaxy: roughly egg-shaped (ellipsoidal or ovoid) found largely in galaxy clusters and smaller compact groups. Most ellipticals contain older, low-mass stars, and because they lack a great deal of star-making gas and dust clouds, there is little new star formation occurring in them. Astronomers suspect that every elliptical has a central supermassive black hole that is related to the mass of the galaxy itself. There are some subgroups of ellipticals, including “dwarf ellipticals” with properties that put them somewhere between regular ellipticals and the tightly knit groups of stars called globular clusters. (observe in link)
   3. Irregular Galaxies: irregular in shape. Irregulars usually do not have enough structure to characterize them as spirals or ellipticals. They may show some bar structure, they may have active regions of star formation, and some smaller ones are listed as “dwarf irregulars,” very similar to the very earliest galaxies that formed about 13/5 billion years ago. The best example is the Small Magellanic Cloud. (observe in link)
3. Stars
   1. 
   2. Our Sun is a just a star, also considered a yellow dwarf star.
      1. The stellar nebula is a cloud mixture of gas and dust that grow into a star.
      2. As the image displayed above shows, nebulas will form two groups of stars, an average star and a massive star.
4. Life Cycles
   1. Average star/Yellow dwarf: peacefully pass through the planetary nebula phase to become a white dwarf, eventually cooling down to a brown dwarf.
   2. Massive Star: experience a violent and very energetic end, which sees their remains scattered about the cosmos in an enormous explosion, called a Super Nova. Once the dust clears, the only thing remaining will be a very dense star known as a neutron star, thee can often be rapidly spinning and are known as pulsars.
   3. If the star which explodes is especially large, it can even form a black hole.
5. Black Holes are very strange objects. They are formed when very [**massive**](https://www.schoolsobservatory.org/astro/esm/mass) stars come to the end of their [**lifetime**](https://www.schoolsobservatory.org/learn/astro/stars/cycle), in a [**supernova**](https://www.schoolsobservatory.org/learn/astro/stars/cycle/supernova) event.
6. Everything that remains of the star is crushed down into an incredibly small, dense object. Close to the object, [**gravity**](https://www.schoolsobservatory.org/learn/science/fandm/gravity) is so strong that **nothing** can get away, not even light. This means that we cannot see anything within that region - hence the name black hole.
7. Hertzsprung-Russell Diagram
   1. Enjar Hertzsprung and Henry Norris Russell plotted stars based on their absolute magnitude and relationship to surface temperature. Absolute magnitude is the true brightness of a star based on its actual luminosity, or light output. (See handout)