Aryabhat Astronomy Quiz

Study Material Part 2

Stars and Constellations

The whole sky has been divided into star groups that move together. In ancient astronomy, there were 48 constellations but in 1930, the astronomers of the entire world decided to reorganise the stellar objects, and modern astronomy goes with 88 constellations. A list of all constellations is given here :

Names of 88 constellation in the whole sky			
Andromeda	Circinus	Lacerta	Pisces Austrinus
Antlia	Columba	Leo	Puppis
Apus	Coma Berenices	Leo Minor	Pyxis
Aquarius	Corona Australis	Lepus	Reticulum
Aquila	Corona Borealis	Libra	Sagitta
Ara	Corvus	Lupus	Sagittarius
Aries	Crater	Lynx	Scorpius
Auriga	Crux	Lyra	Sculptor
Bootes	Cygnus	Mensa	Scutum
Caelum	Delphinus	Microscopium	Serpens
Camelopardalis	Dorado	Monocerus	Sextans
Cancer	Draco	Musca	Taurus
Canes Venatici	Equuleus	Norma	Telescopium
Canis Major	Eridanus	Octans	Triangulum
Canis Minor	Fornax	Ophiuchus	Triangulum Australe
Capricornus	Gemini	Orion	Tucana
Carina	Grus	Pavo	Ursa Major
Cassiopeia	Hercules	Pegasus	Ursa Minor
Centaurus	Horologium	Perseus	Vela
Cepheus	Hydra	Phoenix	Virgo
Cetus	Hydrus	Pictor	Volans
Chamaeleon	Indus	Pisces	Vulpecula

Brightest Stars

Each star is an individual with its own personality. Thousands are visible on any clear night far removed from city lights. Together, with the faint glow of myriad others, the tapestry of the celestial sphere is fashioned. Stars come in assorted colors, sizes, shapes and ages. One trait that makes a star unique is its brightness.

Astronomers measure the brightness of a celestial object according to a system originally devised by Hipparchus in 120 B.C. Hipparchus ranked the brightness of stars in the sky on a scale of 1 to 6 as seen from the Earth. The brightest stars he could see were classified as first magnitude and the faintest were sixth magnitude.

Centuries later we still use the magnitude scale of Hipparchus, although it has since been modernized.

The magnitude scale is logarithmic; one magnitude difference is equal to a brightness difference of about 2.5 times. So, a magnitude 1 star is about 100 times brighter than a magnitude 5 star. The brighter planets and stars have negative magnitudes. The Sun, being the brightest object in the sky, has a magnitude of –26, followed by the full Moon at magnitude –11. Objects with a magnitude of 6 or less can be seen without optical aid under ideal observing conditions away from all local lighting.

The following is a catalog of the ten brightest stars that grace the celestial sphere, an imaginary projection of Earth into space. All the stars are drawn on the inside of this sphere, even though stars of course exist in space at varying distances. As on Earth, the celestial sphere is split into northern and southern half's, called hemispheres.

As seen from our corner of the galaxy, these are lighthouses of the heavens and can be enjoyed even from the heart of metropolitan areas.

1. Sirius

All stars shine but none do it like Sirius, the brightest star in the night sky. Aptly named, Sirius comes from the Greek word Seirius, meaning, "searing" or "scorching." Blazing at a visual magnitude of –1.42, it is twice as bright as any other star in our sky.

Sirius resides in the constellation Canis Major, the Big Dog, and is commonly called the Dog Star. In ancient Greek times the dawn rising of Sirius marked the hottest part of summer. This is the origin of the phrase "dog days of summer."

Because of Earth's 26,000-year precession cycle, in which the planet's axis slowly wobbles due to the gravitational attraction of the Sun and Moon on the Earth's equatorial bulge, Sirius no longer marks the hottest part of summer, rising later in the year. Precession gradually changes the location of stars on the celestial sphere.

Sirius is best seen at a favorable time during the winter months for northern hemisphere observers. To find the Dog Star, use the constellation of Orion as a guide. Follow the three-belt stars -- obvious targets even for casual skywatchers -- 20 degrees southeast to the brightest star in the sky. Your fist at arm's length covers about 10 degrees of sky.

Sirius, the red giant star Betelgeuse, and Procyon in Canis Minor form a popular asterism known as the Winter Triangle.

Intrinsically, Sirius is 23 times more luminous and about twice the mass and diameter of the Sun. Of course, it is farther away from Earth than the Sun. But not too far, cosmically speaking. At a mere 8.5 light-years away, Sirius seems so bright in part because it is the fifth closest star to the Sun.

The brilliance of Sirius illuminates not only our night skies, but also our comprehension of them. While observing it in 1718, Edmund Halley, of comet Halley fame, discovered that stars move in relation to one another – a principle now known as proper motion.

In 1844, German astronomer Friedrich Bessel observed that Sirius had a wobble, as if being tugged by a companion. While testing his new 18.5-inch lens in 1862 (the largest refracting telescope in the world at that time), Alvan Clark solved this mystery by discovering that Sirius was not one star but two; the first compact stellar remnant had been discovered, and it would prove to be a pioneer of what would be later referred to as a whole class of white dwarf stars.

The companion, dubbed Sirius B, has the mass of the Sun in a package as small as the Earth, having collapsed after depleting its hydrogen. A single cubic inch of matter from this companion star would weigh 2.25 tons on Earth. At magnitude 8.5, it is 1/400th as luminous as the Sun. The brighter and larger companion is now known as Sirius A

2. Canopus

Canopus resides in the constellation Carina, The Keel. Carina is one of three modern-day constellations that formed the ancient constellation of Argo Navis, the ship Jason and the Argonauts sailed in to search for the Golden Fleece. Two other constellations form the Sail (Vela) and Stern (Puppis).

In modern odysseys, spacecraft such as Voyager 2 used the light from Canopus to orient themselves in the sea of space.

Canopus is a true powerhouse. Its brilliance from our terrestrial vantage point is due more to its great luminosity than its proximity. Though 316 light-years away, No. 2 on our list is 14,800 times the intrinsic luminosity of the Sun. (Recall that the brightest star, Sirius, is just 8.5 light-years distant.)

With a magnitude of –0.72, Canopus is easy to find in the night sky, though it is only visible at latitudes south of 37 degrees north (roughly south of Pittsburg).

To catch a glimpse of it from middle and southern locations in the United States, look for a bright star low on the southern horizon during the winter months. Canopus is located 36 degrees below the brightest star in the sky, Sirius. The further south you are, the better your view will be.

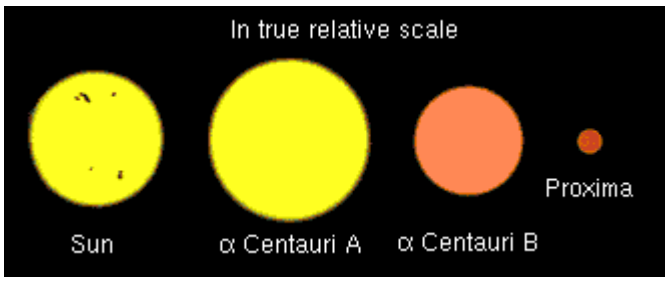
Canopus is a yellow-white F super giant -- a star with a temperature from 10,000 to 14,000 degrees Fahrenheit (6,000 to 8,000 Kelvin) -- that has ceased hydrogen fusion and is now in the process of converting its core helium into carbon. This process has led to its current size, 65 times that of the Sun. If we were to replace our Sun with Canopus, it would almost envelope Mercury.

Canopus will eventually become one of the largest white dwarfs in the galaxy and may just be massive enough to fuse its carbon, turning into a rare neon-oxygen white dwarf. These are rare because most white dwarfs have carbon-oxygen cores. But a massive star like Canopus can begin to burn its carbon into neon and oxygen as the star evolves into a small, dense and cooler object.

Canopus lost its place in the celestial hierarchy for a brief time in the 1800s when the star Eta Carinae underwent a massive outburst, surpassing Canopus in brightness and briefly becoming the second brightest star in the sky.

3. Rigil Kentaurus

Alpha Centauri (or Rigel Kentaurus, as it is also known) is actually a system composed of three gravitationally bound stars. The two main stars are Alpha Centauri A and Alpha Centauri B. The tiniest star in the system is a red dwarf known as Alpha Centauri C.



The Alpha Centauri system is a special one. At an average distance of 4.3 light-years, these stars are our nearest known neighbors in space beyond the solar system.

Centauri A and B are remarkably Sun-like, with Centauri A being a near twin of the Sun (both are yellow G stars). In comparison to the Sun, Alpha Centauri A is 1.5 times as luminous and shines at magnitude -0.01 while Alpha Centauri B is half as luminous and shines at magnitude 1.3.

Alpha Centauri C is 7,000 times fainter and shines at 11th magnitude.

Of the three stars, the littlest is the closest star to the Sun. At 4.22 light-years away, it would take 4.22 years traveling at light speed to get to Alpha Centauri C. Because of its proximity, it is known as Proxima Centauri.

When night falls and the skies are clear, the Alpha Centauri system shines at a magnitude of –0.27 low in the southern sky during the summer months. You can find it at the foot of the Centaur in the constellation of Centaurus.

Because of its position in the sky, the Alpha Centauri system is not easily visible in much of the Northern Hemisphere. An observer must be at latitudes south of 28 degrees north (or roughly from Naples, Florida and locations further south) to see the closest stellar system to us.

The two brighter components of the system make a wonderful double star to observe in a small telescope.

Naked-eye Alpha Centauri appears so bright because it is so close. This also means that it has a large proper motion – the drifting of stars relative to each other due to their actual motion and direction in space. In another 4,000 years Alpha Centauri will have moved near enough to Beta Centauri for the two to form an apparent double star.

4. Arcturus

Arcturus is the brightest star in the northern celestial hemisphere. (The first three stars on this list are actually in the southern celestial sphere, though seasonally they are visible from the northern hemisphere of Earth).

Known as the Bear Watcher, Arcturus follows Ursa Major, the Great Bear, around the north celestial pole. The name itself derives from the Greek word arktos, meaning bear.

Arcturus is an orange giant, twice as massive and 215 times as bright as the Sun. It takes 37 years for the light of Arcturus to reach us, so when we gaze upon it, we are seeing the star as it looked 37 years ago. It glows at magnitude –0.04 in our night skies.

A variable star, Arcturus is in the last stages of its normal life.

During a struggle between gravity and pressure, it has swelled to 25 times the Sun's diameter. Eventually the outer envelope of Arcturus will be peeled away, and the material ejected as a planetary nebula similar to the famed Ring Nebula in Lyra. What will be left behind is a white dwarf.

Arcturus is the Alpha (meaning brightest) star of the springtime constellation Bootes, The Herdsman. You can find it by using the Big Dipper as your celestial guidepost. Follow the arc of the handle until you come to a bright orange star. This is Arcturus, forming the point of a pattern of stars resembling a kite.

In the spring, if you keep following the arc, you will encounter another bright star, Spica. If this all sounds a bit confusing remember this phrase: "Arc to Arcturus, speed on to Spica."

In the 1930's when astronomers were busy measuring the distance to nearby stars, Arcturus was believed to be 40 light-years distant. With emergent photocell technology employed at the 1933 World Fair in Chicago, the light from Arcturus was collected and used to activate a series of switches. Light believed to originate at the time of the previous Chicago World Fair -- the city had hosted it 40 years prior -- was used to illuminate and officially open the Fair in 1933.

We now know Arcturus is 37 light-years away, however.

5. Vega

The name Vega derives from the Arabic word for Swooping Eagle or Vulture. Vega is the luminary of Lyra, the Harp, a small but prominent constellation that is home to the Ring Nebula and the star Epsilon Lyrae.

The Ring is a luminous shell of gas that was ejected from an old star. It resembles a smoke ring or donut. Epsilon Lyrae appears to the naked-eye as a double star, but through a small telescope you can see that the two individual stars are themselves double! Epsilon Lyrae is popularly known as the "double double."

Vega is a hydrogen-burning star, 54 times more luminous and 1.5 times more massive than the Sun. At a distance of 25 light-years, it is relatively close to us. It shines with a magnitude of 0.03 in the night sky.

In 1984, a disk of cool gas surrounding Vega was discovered -- the first of its kind. The disk extends 70 Earth-Sun distances from the star. The discovery was important because a similar disk is theorized to have played an integral role in planet development within our own solar system.

Interestingly, a 'hole' was found in the Vega disk, indicating the possibility that planets might have coalesced and formed around the star. It was not by random choice that Carl Sagan selected Vega as the source of radio transmissions received from an advanced alien culture when he authored the book that was the basis for the movie "Contact.

Together with the bright stars Altair and Deneb, Vega forms the popular Summer Triangle asterism that announces the beginning of summer in the Northern Hemisphere. The asterism crosses the hazy band of the Milky Way, which is split into two near Deneb by a large dust cloud called the Cygnus Rift.

This area of the sky is ideal for sweeping with binoculars of any size in dark-sky conditions.

Vega was the first star to be photographed, on the night of 16-17 July 1850 by photographer J.A. Whipple. With the daguerreotype camera used at the time, he made an exposure of 100

seconds using a 15-inch refractor telescope at Harvard University. Fainter stars (those of 2nd magnitude and dimmer) would not have registered at all given the technology of the time.

Vega used to be the North Star, but 12,000 years of Earth's precession has altered its place in the celestial sphere. Precession is the 26,000-year wobble of the Earth's axis due to the gravitational attraction of the Sun and Moon on the Earth's equatorial bulge. In another 14,000 years, Vega will be the North Star once again.

6. Capella

Capella is the primary star in the constellation Auriga the "Charioteer" and the brightest star that is near the north celestial pole.

Capella is a fascinating star system comprised of two similar class G yellow giant stars and a pair of much fainter red dwarf stars. The brighter yellow giant, known as Aa, is 80 times more luminous and nearly three times more massive than our Sun. The fainter yellow giant, known as Ab, is 50 times more luminous than the Sun and two-and-a-half times as massive. The combined luminosity of the two stars is about 130 suns.

The Capella system is 42 light-years away, its light reaching us with a magnitude of 0.08.

It is highest in the winter months and circumpolar (meaning it never sets) at latitudes higher than 44 degrees north (or roughly north of Toronto, Canada).

To locate it, follow the two top stars that form the pan of the Big Dipper across the sky. Capella is the brighter star in the irregular pentagon formed by the stars in the constellation Auriga. South of Capella is a small triangle of stars known as the Kids. One of the most ancient legends had Auriga as a goat herder and patron of shepherds. The brilliant golden yellow Capella was known as the She-Goat Star. The nearby triangle of fainter stars represents her three kids.

Both yellow giants are in the process of dying and will eventually become a pair of white dwarf stars.

7. Rigel

On the western heel of Orion, the Hunter, rests brilliant Rigel. In classical mythology, Rigel marks the spot where Scorpio, the Scorpion stung Orion after a brief and fierce battle. Its Arabic name means the Foot.

Rigel is a multiple star system. The brighter component, Rigel A, is a blue super giant that shines a remarkable 40,000 times stronger than the Sun! Although 775 light-years distant, its light shines bright in our evening skies, at magnitude 0.12.

Rigel resides in the most impressive of the winter constellations, mighty Orion. With the exception of the Big Dipper, it is the most recognized and easiest to identify constellation. It helps too that the shape made by Orion's stars match what the mythical figure represents. Three bright stars are lined up together to form the belt of the hunter. The other 4 stars surrounding the belt compose its shoulders and legs.

Telescope observers should be able to resolve Rigel's companion, a fairly bright 7th magnitude star. However, the jewel in Orion is the "Great Orion Nebula", a vast stellar nursery where new stars are still being born. It can be found six moon widths south of the belt stars.

A heavy star of 17 solar masses, Rigel is likely to go out with a bang some day, or it might become a rare oxygen-neon white dwarf.

8. Procyon

Procyon resides in the small constellation of Canis Minor, the Little Dog. The constellation symbolizes the smaller of Orion's two hunting dogs (Canis Minor and Canis Major).

The word Procyon is Greek for Before the Dog, for the reason that in the Northern Hemisphere, Procyon announces the rise of Sirius, the Dog Star.

Procyon is a yellow-white main sequence star, twice the size and 7 times more luminous than the Sun. With the exception of Alpha Centauri, it is the least intrinsically luminous star on this list. Like Alpha Centauri it appears so bright only because at 11.4 light-years, it is relatively close.

Procyon is an example of a main sequence "sub giant" star, one that is beginning the death process by converting its remaining core hydrogen into helium. Procyon is currently twice the diameter of the Sun, one of the largest stars within 20 light-years.

Canis Major can be found relatively easy east of Orion during the Northern Hemisphere winter months. Procyon, along with Sirius and Betelgeuse, form the Winter Triangle asterism.

Procyon is orbited by a white dwarf companion detected visually in 1896 by John M. Schaeberle. The fainter companion's existence was first noted in 1840, however, by Arthur von Auswers who observed irregularities in Procyon's proper motion best explained by a massive albeit faint companion.

At just one-third the size of Earth, the companion dubbed Procyon B contains 60 percent of the Sun's mass. The brighter component is now known as Procyon A.

9. Achernar

Achernar is derived from the Arabic phrase meaning "the end of the river," an appropriate name for a star that marks the southernmost flow of the constellation Eridanus, the River.

Achernar is the hottest star on this list. Its temperature has been measured to be between 24,740 and 33,740 degrees Fahrenheit (14, 000-19,000 Kelvin). Its luminosity ranges from 2,900 to 5,400 times that of the Sun. Shining at magnitude 0.45, its light takes 144 years to reach your eye.

Achernar is more or less tied with Betelgeuse (No. 10 on the list) for brightness. However, Achernar is generally listed as the ninth brightest star in the sky because Betelgeuse is a variable whose magnitude can drop to less than 1.2, as was the case in 1927 and 1941.

For Northern Hemisphere observers, Achernar rises in the southeast during the winter months and is visible only from latitudes south of 32 degrees north; those further north only see a portion of the constellation.

For Star Trek fans: Eridanus is home to Epsilon Eridanus, the star around which Mr. Spock's home planet of Vulcan revolves.

Achernar is a massive class B star containing up to eight solar masses. It is currently burning its hydrogen into helium and will eventually evolve into a white dwarf star.

10. Betelgeuse

Do not let Betelgeuse's ranking as the tenth brightest star in the sky fool you. Its distance -- 430 light-years -- hides the true scale of this supergiant. With a whopping luminosity of 55,000 suns, Betelgeuse still shines brightly in our skies at a magnitude of 0.5.

Betelgeuse (pronounced beetle juice by most astronomers) derives its name from an Arabic phrase meaning "the armpit of the central one."

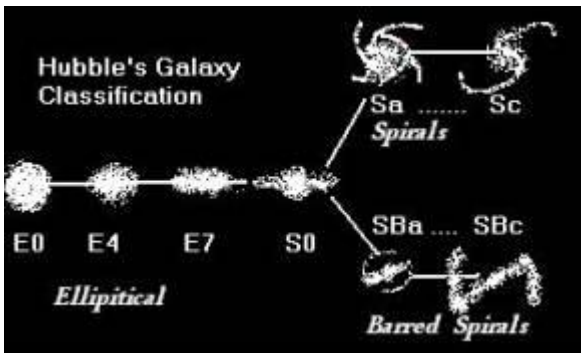
The star marks the eastern shoulder of mighty Orion, the Hunter. Another name for Betelgeuse is Alpha Orionis, indicating it is the brightest star in the winter constellation of Orion. However, Rigel (Beta Orionis) is actually brighter. The misclassification happened because Betelgeuse is a variable star (a star that changes brightness over time) and it might have been brighter than Rigel when Johannes Bayer originally categorized it.

Betelgeuse is an M1 red supergiant, 650 times the diameter and about 15 times the mass of the Sun. If Betelgeuse were to replace the Sun, planets out to the orbit of Mars would be engulfed!

Betelgeuse is an ancient star approaching the end of its life cycle. Because of its mass it might fuse elements all the way to iron and blow up as a supernova that would be as bright as the crescent Moon, as seen from Earth. A dense neutron star would be left behind. The other alternative is that it might evolve into a rare neon-oxygen dwarf.

Betelgeuse was the first star to have its surface directly imaged, a feat accomplished in 1996 with the Hubble Space Telescope.

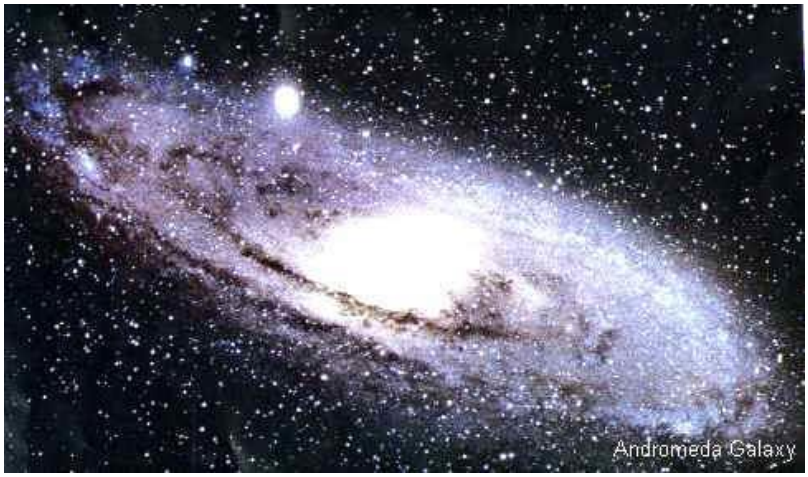
Galaxies



Edwin Hubbell assigned a naming convention to galaxies, which remains in use today. Galaxies come in three main forms, irregular galaxies with shapes that are amorphous, elliptical galaxies with a large core and almost no disk, and spiral galaxies which come in two forms, those with a large central cylinder of stars (barred) and those where the spirals go all the way to the core.

The shapes of galaxies appear to start as spirals of one sort or the other. Over time galaxies pas near or actually through each other. Currently, a small galaxy [the Sagittarius Galaxy] is colliding with our Milky Way. When they do this the smaller galaxy loses many of its stars to the larger galaxy. If the smaller galaxy comes into too close a contact, it may be simply swallowed by the greater galaxy. If it is somewhat farther away it may escape badly tattered as an irregular galaxy. This is what seems to have happened to the Large and Small Magellanic Clouds. After swallowing enough smaller galaxies, the spiral shape disappears and the galaxy assumes an ever more elliptical shape.

The Great Andromeda is a classic spiral galaxy. At the leading edges of reaching rotating arm, a wave of gas compression occurs triggering areas of star formation. Andromeda is nearly edge on in this image, but it would look like M74 if we saw it face on.

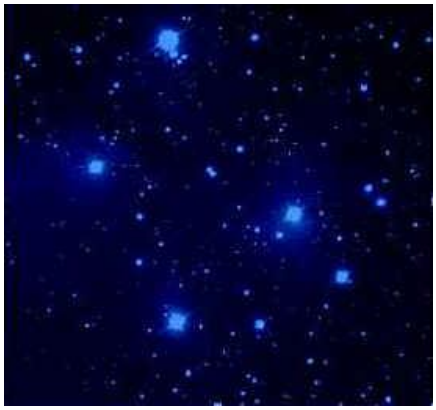


Virgo A, also known as M87, is many hundred times the mass of our own galaxy. Trillions of stars are believed to populate this great object. Virgo A is the largest of the galaxies in the so-called Realm of the Galaxies, which spans parts of Virgo, Coma Berenices and Leo. This area has more galaxies to see than it has stars visible to your eye. While it looks rather like a globular cluster, it is billions of times as large.

NGC1300 is a clear example of a barred spiral. Unlike a traditional spiral, the swirling arms star at the ends of a cylinder of stars, which extends for many tens of thousands of light years from the center of the barred spiral.

Star Clusters

Open clusters of stars are formed in a common stellar nursery. In time birthing grounds like M42 and the Omega Nebula in the southern hemisphere will drive out gas which has not been included in the newly formed stars. In some open clusters like the Pleiades traces of the gas can still be seen in photographs sensitive to blue and ultraviolet light. [This gauzy gas is not visible to the human eye]. When the stars were formed, they were densely packed. However, they each had their own motions, which over time caused them to disperse.



Globular clusters are effectively satellites of the galaxy in which they reside. They travel as units into the central areas of the galaxy on orbits somewhat like comets around the Sun. Stars in globular clusters are quite unlike stars in the main disk of the galaxy. Main disk stars like the Sun carry a great deal of heavier elements (metals to astronomers no matter what the chemists call them). Sun-like stars are called Population I stars. Stars found in globular clusters lack more than a tiny percentage of heavy elements and form the Population II stars. The thin halo of stars outside the plane of the galaxy are also Population II stars. Population II stars formed before there had been many supernovae to create heavier elements. They are first generation stars for the most part. Population I stars form in the wake of supernovae and contain the heavier elements.

As the globular clusters orbit about the central core, they tend to be densest near the core and sparser farther out. In our galaxy, the great concentration of globular clusters in Sagittarius confirms that this constellation harbors the center of the Milky Way. Further tests have shown that the exact center is a small volume in Sagittarius with at least a mass of 2 billion Suns. This dense area is believed to be a black hole and is called Sagittarius A*.

Nebulae

An emission nebula is gas excited by ultraviolet radiation from fierce new blue violet stars. This is the same condition, which occurs in fluorescent and neon lamps. This type of nebula is typified by M42, the Great Nebula in Orion. The Trapezium as well as many unseen embedded stars provide sources of ultraviolet radiation.

An absorption nebula is a mixture of gas and particularly dust dense enough to absorb, redden and even blot out light. These cause dark nebulae like the Horsehead and the Coal Sack. They cause dark areas like Sagittarius and the Sombrero. However, they do not include "empty lanes" in the Milky Way.

Sometimes a nebula can have regions, which emit while other regions absorb. This is the case in the Horsehead Nebula shown here. The dark regions are areas where light has been absorbed so heavily that the area looks like a dark cloud. The bright regions are where hydrogen gas is fluorescing emitting a reddish frequency called the hydrogen beta line. Near the edges of the dark region areas absorb much but not all of the light and it is possible to use a spectrograph to determine the clouds chemical make up.

When light from the foreground stars shines on background clouds, a reflection nebula is formed. In some cases, an absorbing nebula can hide the foreground star. Reflection nebula can sometimes be precisely mapped and measured by timing the pulses of light from a variable star or a supernova.

Planetary nebulae arise when an aging stars sheds shells of gas as the fusing of hydrogen leaves the core and moves towards the star's surface. Large explosions (but not as large as supernovae), progressively strip the star of material. If the star manages to shed enough material, then it will end up as a white dwarf with a ring about it, which grows year by year. Eventually these rings become so large and thin that they are no longer illuminated by the hot central white dwarf.

Messier Objects

Charles Messier, a resolute comet hunter, often came across fuzzy objects that caused confusion. He started to compile a list of these objects which eventually became known as the Messier Catalogue. Ironically, Charles Messier is now more famous for his list of galaxies, nebulae and clusters than for his comet discoveries.

Identification Number(s)		Popular Name	Constellation	Description
M1	NGC1952	Crab Nebula	Taurus	supernova remnant
M2	NGC7089		Aquarius	globular cluster

Identification Number(s)		Popular Name	Constellation	Description
M3	NGC5272		Canes Venatici	globular cluster
M4	NGC6121		Scorpius	globular cluster
M5	NGC5904		Serpens	globular cluster
M6	NGC6405	Butterfly Cluster	Scorpius	open cluster
M7	NGC6475	Ptolemy's Cluster	Scorpius	open cluster
M8	NGC6523	Lagoon Nebula	Sagittarius	diffuse nebula
M9	NGC6333		Ophiuchus	globular cluster
M10	NGC6254		Ophiuchus	globular cluster
M11	NGC6705	Wild Duck Cluster	Scutum	open cluster
M12	NGC6218		Ophiuchus	globular cluster
M13	NGC6205	Great Globular Cluster	Hercules	globular cluster
M14	NGC6402		Ophiuchus	globular cluster
M15	NGC7078		Pegasus	globular cluster
M16	NGC6611	Eagle Nebula	Serpens	diffuse nebula and open cluster
M17	NGC6618	Horseshoe Nebula, Mega Nebula, Swan Nebula	Sagittarius	diffuse nebula
M18	NGC6613		Sagittarius	open cluster
M19	NGC6273		Ophiuchus	globular cluster
M20	NGC6514	Triffid Nebula	Sagittarius	diffuse nebula
M21	NGC6531		Sagittarius	open cluster
M22	NGC6656		Sagittarius	globular cluster
M23	NGC6494		Sagittarius	open cluster
M24	NGC6603	part of the Milky Way	Sagittarius	star cloud
M25	IC4725		Sagittarius	open cluster
M26	NGC6694		Scutum	open cluster
M27	NGC6853	Dumbbell Nebula	Vulpecula	planetary nebula
M28	NGC6626		Sagittarius	globular cluster
M29	NGC6913		Cygnus	open cluster
M30	NGC7099		Capricornus	globular cluster
M31	NGC224	Andromeda Galaxy	Andromeda	spiral galaxy
M32	NGC221		Andromeda	elliptical galaxy
M33	NGC598	Triangulum Galaxy	Triangulum	spiral galaxy
M34	NGC1039		Perseus	open cluster
M35	NGC2168		Gemini	open cluster
M36	NGC1960		Auriga	open cluster
M37	NGC2099		Auriga	open cluster
M38	NGC1912		Auriga	open cluster
M39	NGC7092		Cygnus	open cluster
M40	WNC4	Winnecke 4	Ursa Major	binary star
M41	NGC2287		Canis Major	open cluster
M42	NGC1976	Great Orion Nebula	Orion	diffuse nebula
M43	NGC1982	part of the Orion Nebula	Orion	diffuse nebula
M44	NGC2632	Beehive Cluster Praesepe	Cancer	open cluster
M45		Pleiades	Taurus	open cluster
M46	NGC2437		Puppis	open cluster
M47	NGC2422		Puppis	open cluster
M48	NGC2548		Hydra	open cluster
M49	NGC4472		Virgo	elliptical galaxy
M50	NGC2323		Monoceros	open cluster
M51	NGC5194	Whirlpool Galaxy	Canes Venatici	spiral galaxy
M52	NGC7654		Cassiopeia	open cluster
M53	NGC5024		Coma Berenices	globular cluster
M54	NGC6715		Sagittarius	globular cluster
M55	NGC6809		Sagittarius	globular cluster
M56	NGC6779		Lyra	globular cluster
M57	NGC6720	Ring Nebula	Lyra	planetary nebula
M58	NGC4579		Virgo	barred spiral galaxy

Identification Number(s)		Popular Name	Constellation	Description
M59	NGC4621		Virgo	elliptical galaxy
M60	NGC4649		Virgo	elliptical galaxy
M61	NGC4303		Virgo	spiral galaxy
M62	NGC6266		Ophiuchus	globular cluster
M63	NGC5055		Canes Venatici	spiral galaxy
M64	NGC4826	Blackeye Galaxy	Coma Berenices	spiral galaxy
M65	NGC3623		Leo	spiral galaxy
M66	NGC3627		Leo	spiral galaxy
M67	NGC2682		Cancer	open cluster
M68	NGC4590		Hydra	globular cluster
M69	NGC6637		Sagittarius	globular cluster
M70	NGC6681		Sagittarius	globular cluster
M71	NGC6838		Sagitta	globular cluster
M72	NGC6981		Aquarius	globular cluster
M73	NGC6994		Aquarius	asterism of four stars
M74	NGC628		Pisces	spiral galaxy
M75	NGC6864		Sagittarius	globular cluster
M76	NGC651	Butterfly Nebula Little Dumbbell Nebula	Perseus	planetary nebula
M77	NGC1068		Cetus	spiral galaxy
M78	NGC2068		Orion	diffuse nebula
M79	NGC1904		Lepus	globular cluster
M80	NGC6093		Scorpius	globular cluster
M81	NGC3031	Bode's Galaxy	Ursa Major	spiral galaxy
M82	NGC3034	Cigar Galaxy	Ursa Major	irregular galaxy
M83	NGC5236		Hydra	spiral galaxy
M84	NGC4374		Virgo	lenticular galaxy
M85	NGC4382		Coma Berenices	lenticular galaxy
M86	NGC4406		Virgo	lenticular galaxy
M87	NGC4486	Virgo A	Virgo	elliptical galaxy
M88	NGC4501		Coma Berenices	spiral galaxy
M89	NGC4552		Virgo	elliptical galaxy
M90	NGC4569		Virgo	spiral galaxy
M91	NGC4548		Coma Berenices	barred spiral galaxy
M92	NGC6341		Hercules	globular cluster
M93	NGC2447		Puppis	open cluster
M94	NGC4736		Canes Venatici	spiral galaxy
M95	NGC3351		Leo	barred spiral galaxy
M96	NGC3368		Leo	spiral galaxy
M97	NGC3587	Owl Nebula	Ursa Major	planetary nebula
M98	NGC4192		Coma Berenices	spiral galaxy
M99	NGC4254		Coma Berenices	spiral galaxy
M100	NGC4321		Coma Berenices	spiral galaxy
M101	NGC5457	Pinwheel Galaxy	Ursa Major	spiral galaxy
M102		There is some controversy as to the identity of this object. Some think that Messier made a mistake and re-identified M101 as M102. Others believe that this object is actually the lenticular galaxy NGC5866 in the constellation Draco.		
M103	NGC581		Cassiopeia	open cluster
M104	NGC4594	Sombrero Galaxy	Virgo	spiral galaxy
M105	NGC3379		Leo	elliptical galaxy
M106	NGC4258		Canes Venatici	spiral galaxy
M107	NGC6171		Ophiuchus	globular cluster
M108	NGC3556		Ursa Major	spiral galaxy
M109	NGC3992		Ursa Major	barred spiral galaxy
M110	NGC205		Andromeda	elliptical galaxy

Quasars

Quasars are extremely bright objects, which can be seen across the universe. The only known source of such power would be a huge black hole swallowing the gas from stars unfortunate enough to get too near the black hole. The light is not emitted by the black hole itself, but a disk of material spiraling into the black hole. Quasars normally have long jets of material shooting out at nearly the speed of light. These jets can be luminous for years.

Active galactic nuclei are suspected of containing black holes in their centers. In fact, some theories say that all galaxies arose around a central black hole formed at the big bang [a pure guess so far]. Those, which are so suspected, have something very energetic at the core.