

## Graphic view of our Milky Way Galaxy

The Milky Way is the galaxy that contains our Solar System. The name describes the galaxy's appearance from Earth: a hazy band of light seen in the night sky formed from stars that cannot be individually distinguished by the naked eye. The term Milky Way is a translation of the Latin *via lactea*, from the Greek *galaxías kýklos*, "milky circle".

From Earth, the Milky Way appears as a band because its disk-shaped structure is viewed from within. **Galileo Galilei** first resolved the band of light into individual stars with his telescope in 1610. Until the early 1920s, most astronomers thought that the Milky Way contained all the stars in the Universe. Following the 1920 Great Debate between the astronomers **Harlow Shapley** and **Heber Curtis**, observations by **Edwin Hubble** showed that the Milky Way is just one of many galaxies. **The Milky Way is a barred spiral galaxy with a diameter between 150,000 and 200,000 light-years and is estimated to contain 100–400 billion stars and quite possibly more than 100 billion planets.**

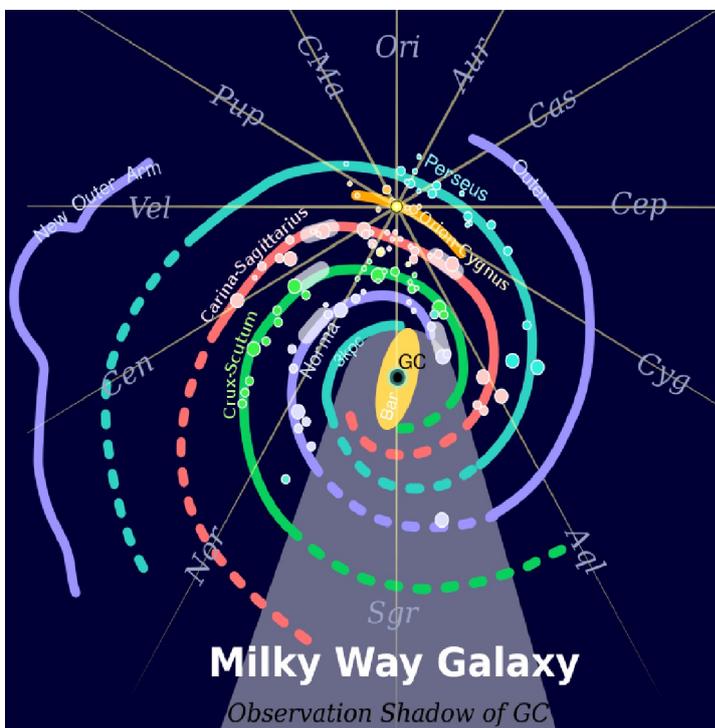
**The Solar System is located at a distance of 26,490 light-years from the Galactic Centre, on the inner edge of the Orion Arm, one of the spiral-shaped concentrations of gas and dust.** The stars in the innermost 10,000 light-years form a bulge and one or more bars that radiate from the bulge. At the galactic centre is an intense radio source known as Sagittarius A\*, assumed to be a supermassive black hole of some 4 million solar masses.

Stars and gases at a wide range of distances from the Galactic Centre orbit at approximately 220 kilometres per second. This constant rotation speed is a puzzle, for it contradicts the laws of Newtonian dynamics and suggests that much (up to 90%) of the mass of the Milky Way is invisible to our telescopes, neither emitting nor absorbing electromagnetic radiation. This conjectural mass has been termed "dark matter". **The rotational period at the location of the Sun is about 240 million years. That is, it takes 240 million years for the Solar System to rotate the galaxy once.** The Milky Way as a whole then seems to be moving at a velocity of approximately 600 km per second with respect to extragalactic frames of reference. The oldest stars in the Milky Way are nearly as old as the Universe itself and thus probably formed shortly after the Big Bang.

The Milky Way has several satellite galaxies and is part of the Local Group of galaxies that include the Andromeda Galaxy, which form part of the Virgo Supercluster,

The disk of stars in the Milky Way does not have a sharp edge beyond which there are no stars. Rather, the concentration of stars decreases with distance from the centre of the Milky Way. **For reasons that are not yet understood, beyond a radius of roughly 40,000 ly from the centre, the number of stars per cubic parsec drops much faster with radius. Surrounding the galactic disk is a spherical Galactic Halo of stars and globular clusters that extends further outward but is limited in size by the orbits of two Milky Way satellites, the Large and Small Magellanic Clouds, whose closest approach to the Galactic Centre is about 180,000 ly.** At this distance or beyond, the orbits of most halo objects would be disrupted by the Magellanic Clouds and such objects would probably be ejected from the vicinity of the Milky Way.

The Milky Way contains at least one planet per star, resulting in 100–400 billion planets, On November 4, 2013, astronomers reported, based on Kepler space mission data, that there could be as many as 40 billion Earth-sized planets orbiting stars and red dwarfs within the Milky Way. 11 billion of these planets may be orbiting Sun-like stars. The nearest only 4.2 light-years away.



The Milky Way Galaxy is organized into spiral arms of giant stars that illuminate interstellar gas and dust. The Sun is in a finger called the Orion Spur. Overlaid is a graphic of galactic longitude in relation to our Sun.

## SUN'S LOCATION AND NEIGHBOURHOOD

The apex of the Sun's way, or the solar apex, is the direction that the Sun travels through space in the Milky Way. The general direction of the Sun's Galactic motion is towards the star Vega near the constellation of Hercules, at an angle of roughly 60 sky degrees to the direction of the Galactic Center. The Sun's orbit about the Milky Way is expected to be roughly elliptical with the addition of perturbations due to the Galactic spiral arms and non-uniform mass distributions. In addition, the Sun passes through the Galactic plane approximately 2.7 times per orbit. This is very similar to how a simple harmonic oscillator works with no drag force (damping) term. **Until recently these oscillations were thought to coincide with the mass lifeform extinction periods on Earth. However, a reanalysis of the effects of the Sun's transit through the spiral structure based on CO data has failed to find a correlation.**

## MYTHOLOGY

In Greek mythology, the Milky Way was formed after the god Hermes tried to suckle the infant Heracles at the breast of Hera, the queen of the gods, while she was asleep (Heracles was the son of Zeus and Alcmen and the divine hero Hercules in Greek mythology. Yes, he was the one that killed the lion with his bare hands). When Hera awoke, she tore Heracles away from her breast and splattered her breast milk all across the heavens.

## OK, WHERE ARE THEY?

Another way to appreciate the true size of the Milky Way Galaxy is to try and answer the question that has been troubling space enthusiasts for some time now. In 1950, while working at Los Alamos National Laboratory, the physicist **Enrico Fermi** had a casual conversation with colleagues about Aliens while walking to lunch discussing a recent spate of UFO reports and a cartoon facetiously blaming the disappearance of municipal trashcans on marauding aliens. **When Fermi suddenly exclaimed, OK, where are they?** He followed up on his comment with a series of calculations on the probability of Earth-like planets, the probability of life, the likely rise and duration of high technology, and then concluding, if Alien exist then Earth ought to have been visited long ago and many times over. Other names for the Fermi's question "Where are they?" include: the "Great Silence" and "Silence of the Universe" (Latin silentium universi).

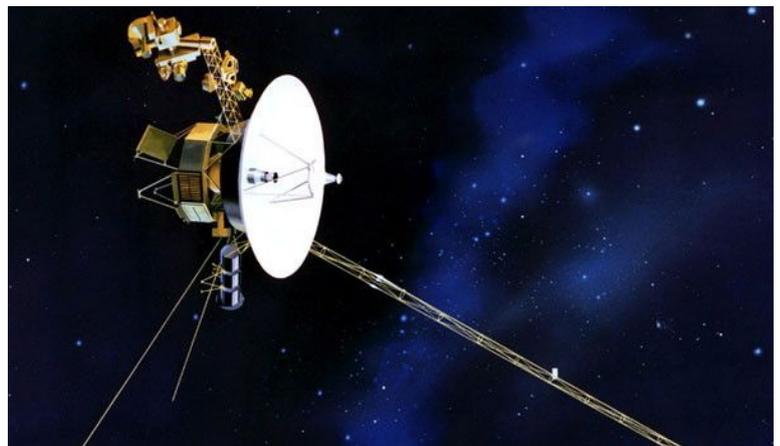
The Great Silence is today often quoted still as a mystery. If other advanced civilisations exist in our Milky Way Galaxy, why do we not hear their broadcasts? Why have they not responded to ours? Quite apart from not visiting us!

**It is no mystery if you remember the distances involved we have mentioned above. One light year is roughly 10 trillion km.** NASA's Voyager 1 launched in 1977 will reach the first habitable star system in another 40,000 years. Now at a distance of 22 billion km from Earth it is the most distant human-made object from Earth. And our ability to communicate with it is already stretched to the limit. Remember, the stars in our Milky Way galaxy are spread over some 180,000 light years away from us. Way beyond any possibility of communicating with them, much less for them travelling to us in our lifetime, even at the speed of light.

AK, with EarthSky and Wikipedia Notes



Splattered all across the Heavens!



An artist's illustration of NASA's Voyager 1 spacecraft, the farthest human-built object from Earth, which launched in 1977 and is headed for interstellar space