Fast Facts about the Milky Way

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A brief astronomy lesson on objects that can be found in our Milky Way will leave pieces missing. But for you to make an intelligent choice about what part of the galaxy to observe, you must comprehend some of the important aspects about our galaxy.

Of course you understand that we live on a planet that has a moon, and that this whole planet-moon system orbits around a star, our sun. You also know that there are other planets in our solar system, eight at last count with assorted other objects including asteroids, meteors, Plutoids (dwarf planets in a belt found beyond Neptune), and an Oort Cloud made up of ice bodies that may go half way to the nearest star. What you may not realize is that all of these pieces of the solar system collapsed down from a cloud of material about 4.5 billion years ago making our star and its planets. This is happening elsewhere in our galaxy where solar systems and stars condense out of clouds mainly composed of hydrogen and dust.

Our galaxy itself collapsed from a cloud of material about 13.2 billion years ago and may be nearly as old as the Universe itself. Nearby we have two smaller galaxies orbiting around us as we orbit in the Local Group of galaxies. Galaxies come in different sizes and shapes. Our Milky Way is a barred spiral, our nearest large neighbor, the Andromeda, Galaxy, is a spiral, and others are elliptical. The shape may have something to do with age, as the further back the Hubble Space Telescope looks; the more disorganized the galaxies become.

Just as galaxies have structure, our Milky Way has structure. We have a central bulge with a bar through it, arms that spiral outward from the center, and a halo of material surrounding the outer limits. The center of our galaxy has a supermassive black hole. We have between 200 to 400 billion stars which occupy an area that is between 100,000 to 120,000 light years across. (A light year is the distance light travels in a year at 186,000 miles per second, equaling about 6 trillion miles.) Most of the stars are in the central bulge, but many also reside in the spiral arms like our sun.

Age is a factor with galaxies and stars. Galaxies evolve. Stars are born and die. When new stars are born they collapse from clouds of hydrogen and dust and eventually obtain enough mass to start their nuclear furnace. How long they exist depends on their size and rate at which they are consuming their fuel (between a few 10,000 years to billions of years). Upon reaching the end of their life cycle, their nuclear furnace turns off, and depending on the star's size, the end results varies.

If the star is huge, much larger than our sun, a supernova explosion results from the stars death, spreading left over star material back into space and possibly leaving a black hole. If a black hole is not produced by a supermassive star's death, a pulsar may result where the star use to reside. They are rotating neutron stars. They emit jets of particles from their poles and seem to blink on and off at constant frequencies. Some even emit x-rays. When stars the size of

our sun die, they create Planetary Nebula (these have nothing to do with planets) which also eject material back into space and leave behind small compact core spinning where the star use to live.

All these events, black holes, neutron stars, pulsars, and areas of turbulent gas where new stars are forming emit radiation and make an area that will be too noisy for a signal to be seen from Earth.

So looking into the galactic bulge you will have an area with a black hole emitting radiation as it consumes material around it; you have supernova releasing great energies both during and after their stars end their lives; and other areas that are sources of noisy forms of radiation. So as you pick your coordinates to turn the radio telescope to search for a sign from an extraterrestrial source, you must be careful in your choice. You must search for a quiet area of our galaxy.

We make several assumptions here.

1. Intelligent life is less common than planetary systems. Many planetary systems have been discovered by both ground and space based telescopes, and many more will be discovered in the near future.
2. In those planetary systems, intelligent life that can transmit a radio wave signal is even less common.
3. The assumption is that if we discover a radio signal from a distant planetary system, there is the possibility of intelligent life.

What are we going to look with?

We will search for radio waves which turn out to be the most effective way to detect an extraterrestrial signal. They do not require a lot of energy to transmit over long distances, and they are distinguishable from other noise being emitted throughout the Milky Way.

There are many radio wavelengths from 300GHZ to 3KHz or from 1 millimeter to 100 kilometers. A GHz or gigahertz refers to the frequency that a wave cycles from crest to trough. A gigahertz cycles in billions of wavelengths per second. A radio wave that has a frequency of 1 GHz has a wavelength of 300 millimeters or about a foot. A radio wave that is 100 GHZ is about the size of 1/8 an inch. For our search we will use a frequency range from 0.5 GHz to 14 GHz. In this range there is less background noise for us to sift through.