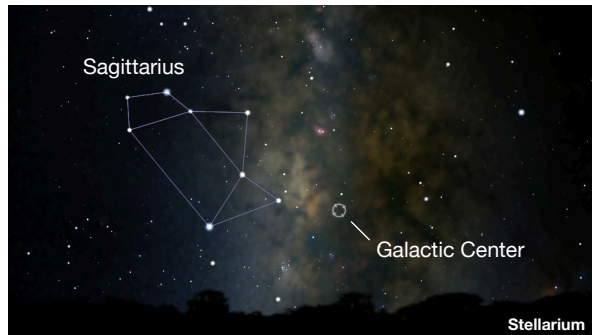


## How to view the Milky Way

The light from the Milky Way's hundreds of billions of stars appears in the night sky as a faint band of light, streaked with dark patches caused by obscuring clouds of dust and gas. Because of the Earth's rotation, the Milky Way rises and sets in the sky at different times during the year, where Summer and Fall are best for evening viewing. Dark sky viewing locations are also important: bright skies due to light pollution from cities or Moonlight will hinder your view. Try to find an isolated stargazing location away from city lights (>75-100 miles from major cities) during moonless nights for the ideal viewing.



## The Galactic Center

Do you know the way to the center of the Milky Way? If you can spot the constellation Sagittarius ("The Teapot"), you can imagine it pouring a hot brew into the center of the Galaxy that lies 27 thousand light years away. At the Galactic center lies a supermassive black hole that is 4 million times the mass of our Sun. Although hidden from view in visible light due to obscuring dust, astronomers can study the black hole and its influence on surrounding stars using light from the infrared and radio portions of the electromagnetic spectrum.

## What's going on at Northwestern?

### The Effect of Stars on Galaxies

CIERA astronomers use the FIRE supercomputer simulations to learn how individual stars inside galaxies shape how they form and evolve over time. <https://fire.northwestern.edu/>

### Gravitational Waves

CIERA scientists study the stellar graveyard of binaries in the Milky Way, the most numerous source of gravitational waves for the **LISA observatory**.

### Life of Stars

CIERA scientists work on understanding the formation of stars from molecular clouds in the Milky Way and contribute to international observatories such as **SOFIA**.

### Globular Clusters

CIERA astronomers study the intertwined birth and evolution of globular clusters within the Milky Way. <https://ciera.northwestern.edu/research/stellar-populations/>

## Learn more...

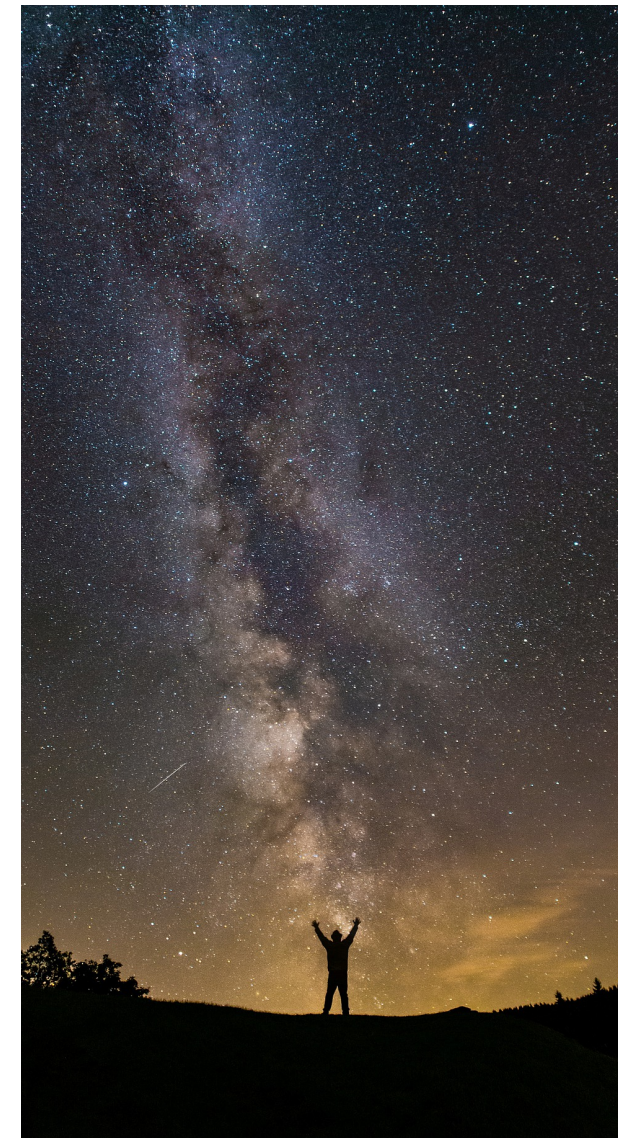
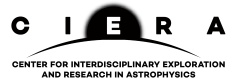
These are some great resources you can use to learn more about the Milky Way.

- **Imagine the Universe: The Milky Way**  
<https://imagine.gsfc.nasa.gov/science/objects/milkyway1.html>
- **Crash Course Astronomy: The Milky Way**  
[https://youtu.be/tj\\_QPnO8vpQ](https://youtu.be/tj_QPnO8vpQ)
- **Gaia Milky Way Virtual Reality Resources**  
<https://sci.esa.int/web/gaia/-/60036-gaia-data-release-2-virtual-reality-resources>

# The Milky Way

CIERA Pathfinder Series

Northwestern





# The Milky Way is Our Home



## Basic Facts

The Milky Way is vast. Roughly 100-400 billion stars and even more planets live here, bound by gravity. It takes light thousands of years to travel across from edge-to-edge. Viewed from the inside on Earth with a clear night sky, the Milky Way looks like a long silver river. But imagining we are floating in outer space far outside the Milky Way, it looks like a disk made with stars, gas and dust, with a bright bulge at the center with arms that spiral around.

Our Sun and Solar system are located about a third of the way between the center and the edge; in the Milky Way suburb, orbiting around the center of the Galaxy together with other stars. Unlike in the bulge where stars are very close to each other, the Solar neighborhood is sparsely populated with other stars and so we are safe from collision.

## Our Celestial Neighbors

The Milky Way is one out of a trillion of galaxies in the observable universe. These collections of stars, gas, and dust represent a standard grouping of matter and vary substantially in mass and size.

In the Local Group, our galactic neighborhood, the Milky Way and Andromeda are the two most massive galaxies. These systems are accompanied by three less massive galaxies, the Triangulum



## Tracing the Milky Way's Origin

How the Milky Way was formed is still very uncertain, but globular clusters, some of the oldest residents of the Milky Way, may be able to help answer this question.

Astronomers can tell that these dense spherical clumps of many stars bound by gravity formed around the same time as the Milky Way, some 10-13 billion years ago. They may even have formed from the same material that became our Galaxy and have lived at the outskirts, quietly orbiting the Milky Way's center all this time. Understanding the history of these elders will shed light on the Galaxy's past.

Galaxy and the Large and Small Magellanic Clouds. In addition to these there are also around 100 known nearby dwarf galaxies, and discoveries of new low mass galaxies continue even today. Many of these dwarf galaxies are satellites of the Milky Way and Andromeda, and are destined to eventually collide and merge with their larger host galaxy. As is the case in the Local Group, small galaxies are the most numerous throughout the universe.



## The Birth of the Sun

The Sun, like all stars do, formed out of a cold and dense cloud of gas and dust known as a molecular cloud. In these clouds, stars form in clumps that follow the filamentary, web-like structure of the gas.

Astronomers remain hard at work to understand the complex processes that drive the messy process of star formation. Observations from across the entire electromagnetic spectrum help us understand all of the important components. Radio and infrared light can help study the gas and dust, while infrared and visible light help study young stars and their planet-forming disks. Computer simulations are another important tool that allow us to study and test our understanding of these processes in action.