Given the vastness of the universe, it is no surprise to find that we have other celestial neighbors aside from other planets.

1. Stars.

Stars are considered the building blocks of galaxies. Without stars, elements that are essential to the formation of life would not exist.

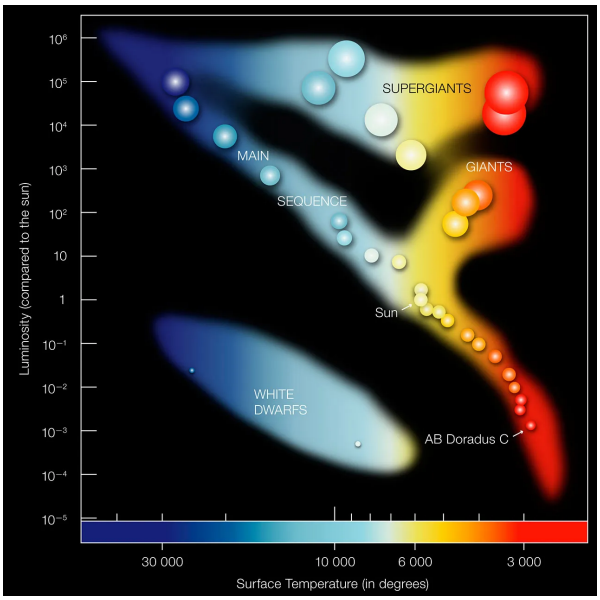
Much like the formation of the Sun, stars form from interstellar clouds of dust and gas that condense due to gravitational pull.

Nuclear fusion is the driving force behind the life of a star. At the very core of a star, hydrogen undergoes nuclear fusion to form helium, producing an outflow of energy that keeps a star from collapsing under its own weight.

A star nears the end of its life when it exhausts its fuel supply, leading to collapse and then a spectacular explosion in the form of a **supernova**. The materials produced by a supernova may be reused again in the formation of another star, repeating the cycle.

Stars are classified according to the relationship between their **absolute luminosities or magnitudes** and **temperatures** in a diagram called the **Hertzsprung-Russell diagram** (HR diagram). Depending on the star, it may be plotted along the middle diagonal line called the Main Sequence or fall above it (**giants and supergiants**) or below it (**white dwarfs**).

As mentioned in the previous chapter, our Sun falls on the Main Sequence and is classified as a Yellow Dwarf.



Hertzsprung-Russell Diagram. Credit: ESO/Creative Commons

2. Comets

Image of Comet NEAT captured by the Kitt Peak National Observatory in Arizona. Credit: NASA

Comets are small space bodies composed of dust, ice, and frozen gases. When comets come close to the Sun, it starts to heat up and releases gas through a process called **outgassing**, leaving long trails of gas and dust as it moves.

Comets have different **orbital periods** (the time it takes for a comet to complete one orbit around the Sun). Some famous comets are Halley's Comet (76-year orbital period), Comet Hale-Bopp (2,533-year orbital period), and Comet Hyakutake (113,782-year orbital period).

3. Asteroids

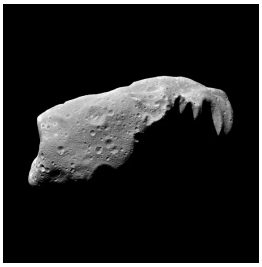
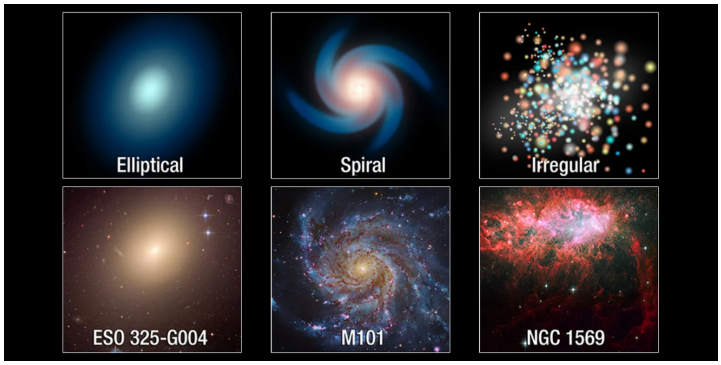


Image of the asteroid *Ida* taken by NASA's *Galileo* spacecraft. Credit: NASA/JPL-Caltech

These are small rocky bodies (planetesimals) that are leftovers from the formation of the Solar System. Most asteroids in the solar system can be found in a region called the **asteroid belt**. They are irregularly shaped and greatly vary in diameter.

When located in space, they are called asteroids (when more than one meter in diameter) or **meteoroids** (when less than a meter in diameter). When it enters the Earth's atmosphere, it becomes a **meteor**. If it reaches the Earth's surface, it is then called a **meteorite**.

4. Galaxies



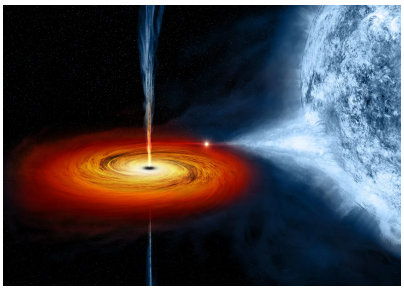
The different types of galaxies. Credit: A. Feild/STScI

Galaxies are large clusters of stars, solar systems, gas, and dust held together by gravity. Using the **Hubble Space Telescope**, astronomers estimate that there may be 100 billion galaxies and probably more.

Galaxies are classified based on their morphology and are divided into three major categories: **elliptical**, **spiral,** and **irregular galaxies**. As mentioned in previous chapters, we live in the **Milky Way galaxy, a spiral-type galaxy**. However, a lot of galaxies also appear in unusual forms, usually a combination of the main morphologies.

Galaxies tend to be bundled together in **groups**, **clusters**, and **superclusters**. For example, the Milky Way galaxy is part of the Local Group galaxy group which is part of the Virgo Supercluster, which is part of the even greater Laniakea Supercluster.

5. Black holes



A black hole refers to a region in space where the force of gravity is strong enough that even light cannot escape.

This is the result of matter being compressed beyond a certain density. Black holes are sometimes the result of extreme compression that happens when a star dies. Many galaxies are believed to contain massive black holes at their centers.

The Milky Way's very own massive blackhole is called the **Sagittarius A*** (pronounced as "Sag A star").