Moving Outward: The Larger Structures of the Universe
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Solar Systems - A star (ex: the sun) and planets and other bodies that travel around the star/sun.

Diameter of Solar System is \( \approx 9 \text{ billion km} \) (to Neptune’s orbit) \( \approx 60 \text{ AU} \)

Diameter of Solar System is \( \approx 9.5 \times 10^{-4} \text{ light years} \) \( \approx 1/1,000^{\text{th}} \text{ ly} \)
Solar Systems - A star and planets

Diameter of Solar System $\approx 180$ AU (still only $\approx 3/1,000^{th}$ ly!)
(to edge of heliosphere/magnetic field)
12.5 Light Years* – Our Nearest Neighbor Stars

1 Light Year (ly) ≈ 9.5 trillion km ≈ 60,000 AU ≈ 1,000 Solar Systems across!
12.5 Light Years – Our Nearest Neighbor Stars

1 Light Year (ly) \approx 9.5\text{ trillion km} \approx 60,000\text{ AU} \approx 1,000\text{ Solar Systems}
Nearby Arms of Milky Way Galaxy

- 5000 light years from Sun and Solar System

- Sagittarius Arm
- Perseus Arm
- Orion Spur
- Betelgeuse
- Orion's Belt
- Polaris
- 12.5 ly
Solar System’s place in the Milky Way

100,000 Light Years* Diameter

50,000 ly

50,000 ly

100,000 ly ≈ 950 trillion km !!
Beyond the Milky Way

(in order from smaller to larger)
500,000 Light Years - Satellite Galaxies to the Milky Way - Our Closest Neighbors
1. Galaxy Group

The Milky Way is part of the Local Group of Galaxies that includes the large Andromeda Galaxy and the smaller Magellanic Clouds.
2. Galaxy Cluster

Larger group of galaxies that are bound together by gravity.
2. Galaxy Cluster

**Galaxy Cluster** – larger group of galaxies; a nearby example is the **Virgo Cluster**.
2. Galaxy Cluster

Galaxy clusters are bigger than galaxy groups & much, much bigger than the Open Clusters and Globular Clusters found inside a galaxy!!
Virgo Cluster

Local Group
3. Galaxy Supercluster

An even larger group of galaxies made up of two or more clusters.
The Virgo Cluster and the Local Group are part of the Virgo Supercluster.
3. Galaxy Supercluster

Local Group

Virgo Cluster

This is also known as the Local Supercluster.
Nearby Galaxy Superclusters

The Shapley Supercluster is a large, nearby supercluster.
The **Shapley Supercluster** is a large, nearby supercluster.
Turbulence causes clusters and superclusters to clump together into thick zones called walls connected by thin filaments.
There are about a dozen walls and filaments that subdivide the universe, such as the Sloan Great Wall.
Great Walls and Galactic Filaments

1 Billion Light Years across

Largest structures in the universe clump together.
In between the congested filaments are wide swatches of outer space made of nothing at all – the Galactic Voids.
There may be a few galaxies and stars but voids are mostly vacuums. Examples include the Local Void and the Giant Void.
Voids are vast tracts of empty space between the walls.
The Visible Universe – 13.7 billion l.y.

The Visible Universe – 13.7 billion light years is as far as we can see in any direction.

Smooth or LUMPY??
How Did You Do?

- Universe
- Galaxy Cluster
- Galaxy
- Nebula
- Globular Cluster
- Open Cluster
- Solar System
- Asteroid Belt
- Star (Our Sun)
- Planet
- Moon/Satellite
- Asteroid
Asteroid Belt

Most asteroids orbit the sun in this area between the orbit of Mars and Jupiter. The belt is 180 million km in width and contains thousands of asteroids that are constantly in motion, crashing into each other at high speeds and sending clouds of dust into space.

The combined mass of all the asteroids would only be 1/1000 the mass of the earth and if all the asteroids were combined together their diameter would be only half the diameter of our moon.