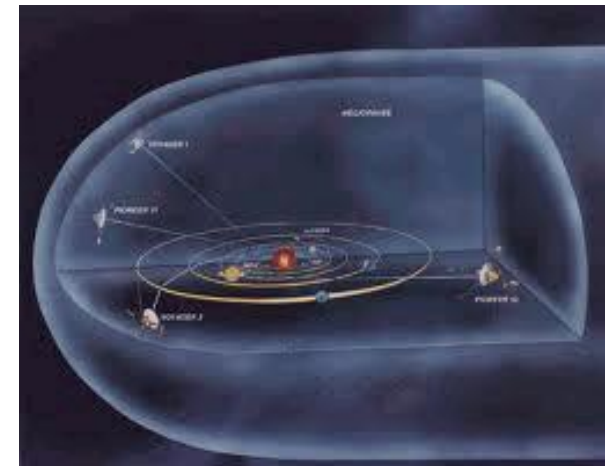
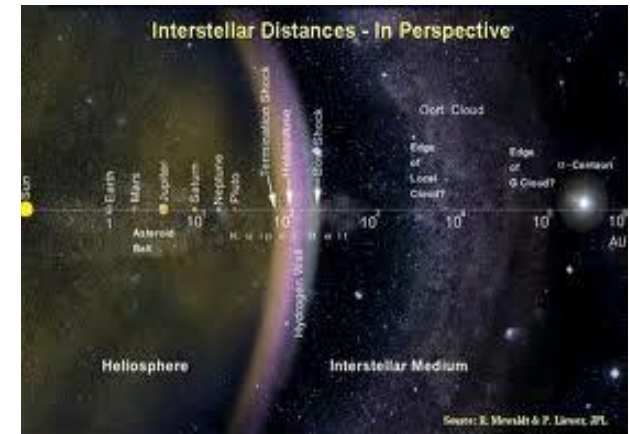


# **Interstellar Space: What is Beyond Our Solar System?**

**Dr. Ugur GUVEN**

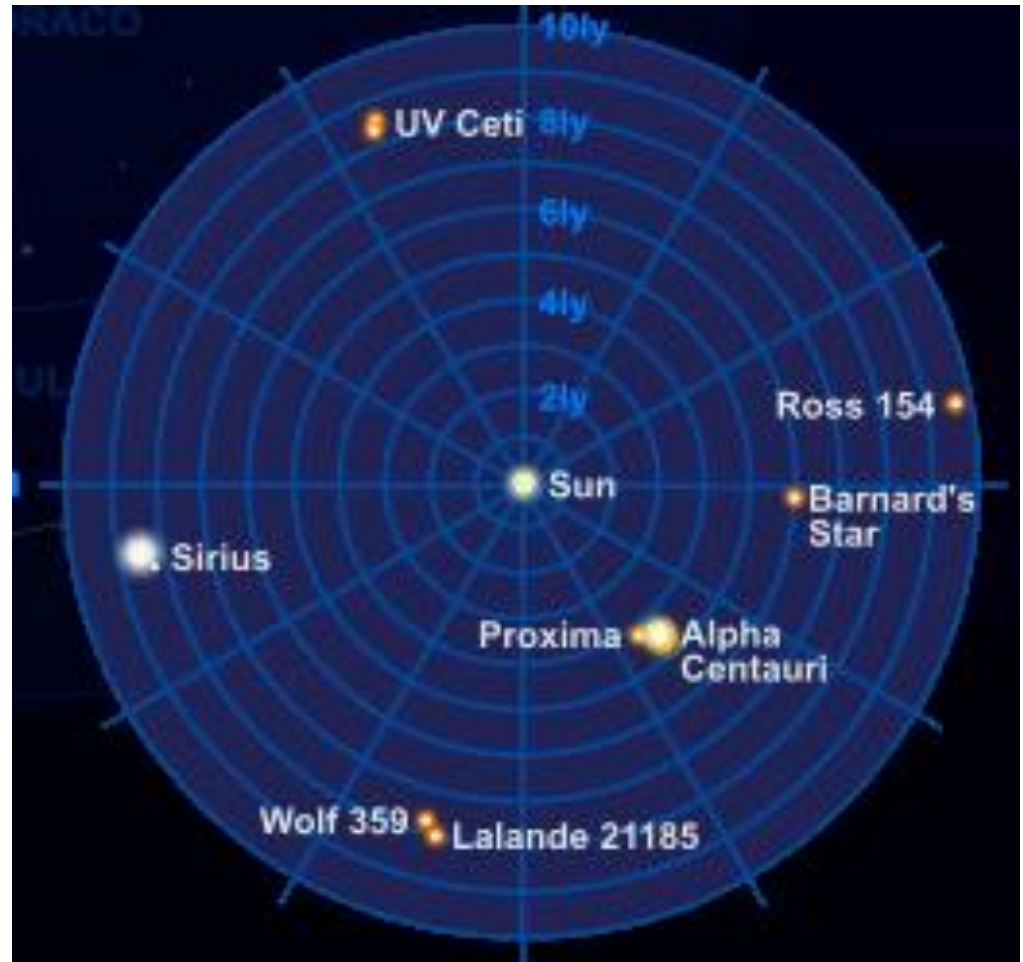
# Interstellar Space

- Interstellar space is the physical space within a galaxy not occupied by stars or their planetary systems
- The average density of matter in this region is about  $10^6$  particles per  $m^3$
- Nearly 70% of this mass consists of lone hydrogen atoms. This is enriched with helium atoms as well as trace amounts of heavier atoms



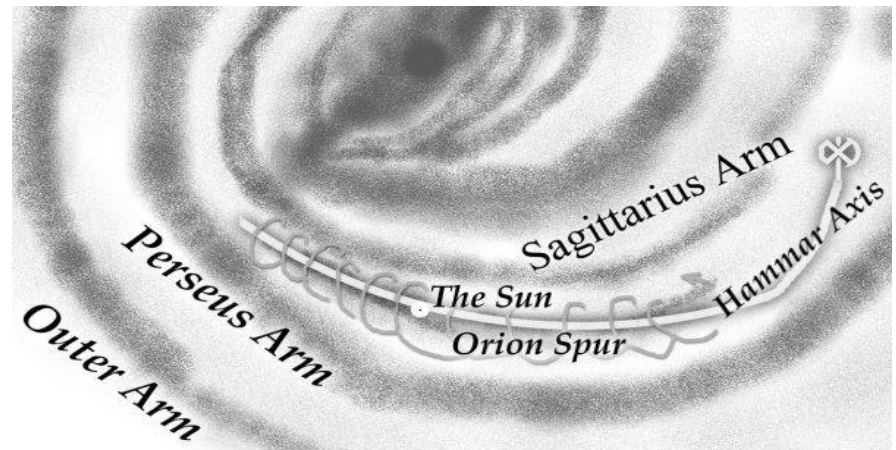
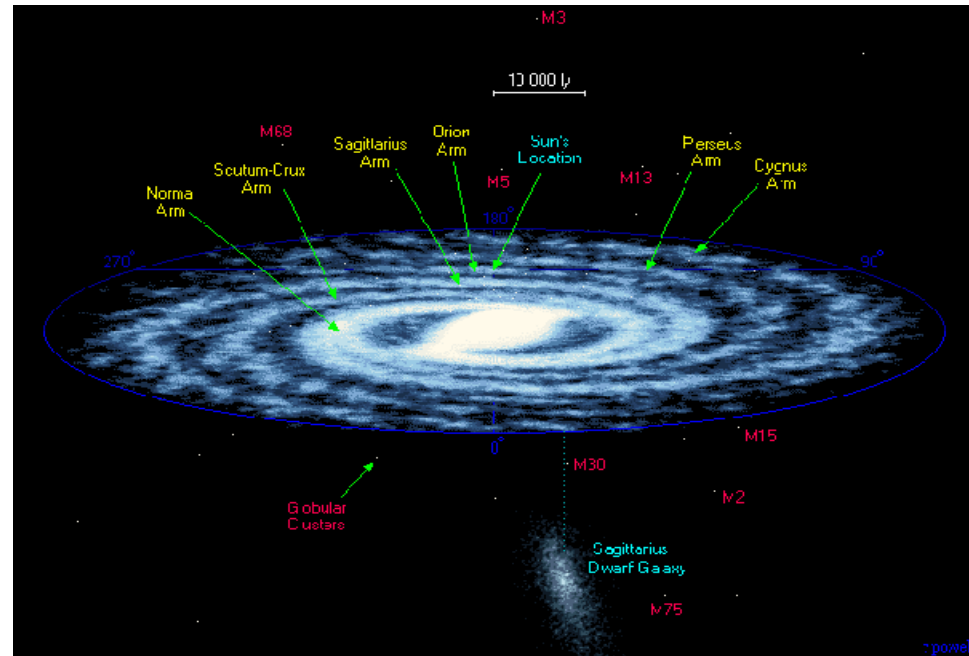
# Nearby Star Systems

- The nearest star to our solar system is the Alpha Centauri system which is a star system with Proxima Centauri as the closest star with 4.3 light years of distance. It would take 40,000 years with our propulsion technology to travel there.
- Barnard's star is the second closest star to our solar system with 6 light years of distance



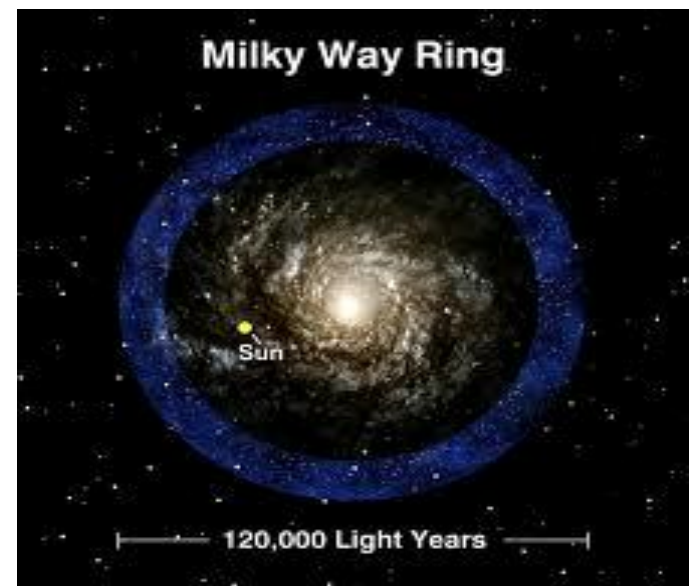
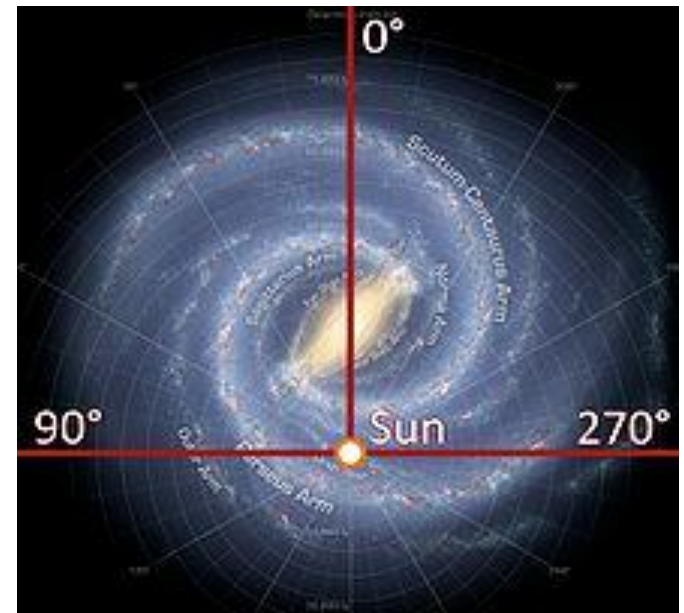
# Orion Arm

- The **Orion Arm** is a minor spiral arm of the Milky Way galaxy some 3,500 light-years (1,100 parsecs) across and approximately 10,000 light-years (3,100 parsecs) in length. [2] The Solar System and therefore the Earth lies within the Orion Arm. It is also referred to by its full name, the **Orion–Cygnus Arm**, as well as **Local Arm**, **Orion Bridge**, **Local Spur** and **Orion Spur**.
- The Orion Arm is named for the Orion constellation, which is one of the most prominent constellations of Northern Hemisphere winter (Southern Hemisphere summer). Some of the brightest stars and most famous celestial objects of this constellation (Betelgeuse, Rigel, the stars of Orion's Belt, the Orion Nebula) are located within the Orion Arm
- Within the Orion Arm, our Solar System and Earth are located close to the inner rim in the Local Bubble, about halfway along the Orion Arm's length, approximately 8,000 parsecs (26,000 light-years) from the Galactic Center



# Milky Way Galaxy

- The Milky Way is a spiral galaxy 100,000-120,000 light-years in diameter containing 200–400 billion stars.
- Earth is located within the galactic plane of this disk, around two thirds of the way out from the center, on the inner edge of a spiral-shaped concentration of gas and dust called the Orion–Cygnus Arm
- The galaxy is also moving at a velocity of 552 to 630 km per second
- It is estimated to be about 13.2 billion years old



# Andromeda Galaxy

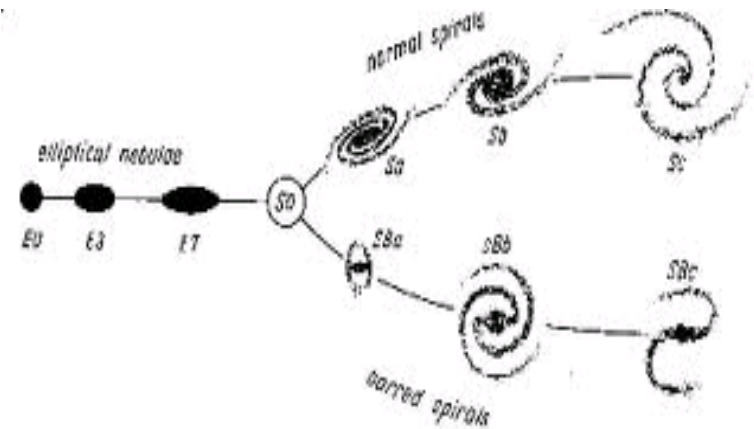
- Closest galaxy to our galaxy is the **Andromeda Galaxy**. (2.6 million light years)
- **Type:** Spiral
- **Distance from Milky Way:** 2.5 million light-years
- **Diameter:** 260,000 light-years
- **Mass:** 400 billion solar masses
- **Number of Stars:** 1 trillion
- While Andromeda is the largest galaxy in the Local Cluster it is not thought to be the most massive as the Milky Way is thought to contain more dark matter making it the most massive
- The Andromeda Galaxy is approaching the Milky Way at approximately 100 to 140 kilometres per second



# Other Galaxies



- There are probably more than 170 billion ( $1.7 \times 10^{11}$ ) galaxies in the observable universe
- **Elliptical galaxy** has an ellipse-shaped light profile. **Spiral galaxies** are disk-shaped with dusty, curving arms. Those with irregular or unusual shapes are known as **irregular galaxies** and typically originate from disruption by the gravitational pull of neighboring galaxies.



# Universe

- The observable universe is about 46 billion light years in radius.
- The Big Bang theory is the prevailing cosmological model that describes the early development of the Universe, which is calculated to have begun  $13.798 \pm 0.037$  billion years ago.
- Observations of a supernovae have shown that the Universe is expanding at an accelerating rate.
- It is thought that one day the universe will contract.

