

# Watch the NIGHT SKIES

With Pushpa Gujral Science City



# Night Sky Watching

- Night Sky Watching, usually associated with astronomy from Earth, refers to the Night time appearance of celestial objects like stars, planets, and the Moon, which are visible in a clear sky between sunset and sunrise, when the Sun is below the horizon.



# The UNIVERSE

- It is believed that Big Bang Blast occurred about 14 billion years ago.
- The Giant explosion hurled matter in all directions and caused space itself to expand.
- As the Universe cooled, the material in it combined to form Galaxies, Stars and Planets.



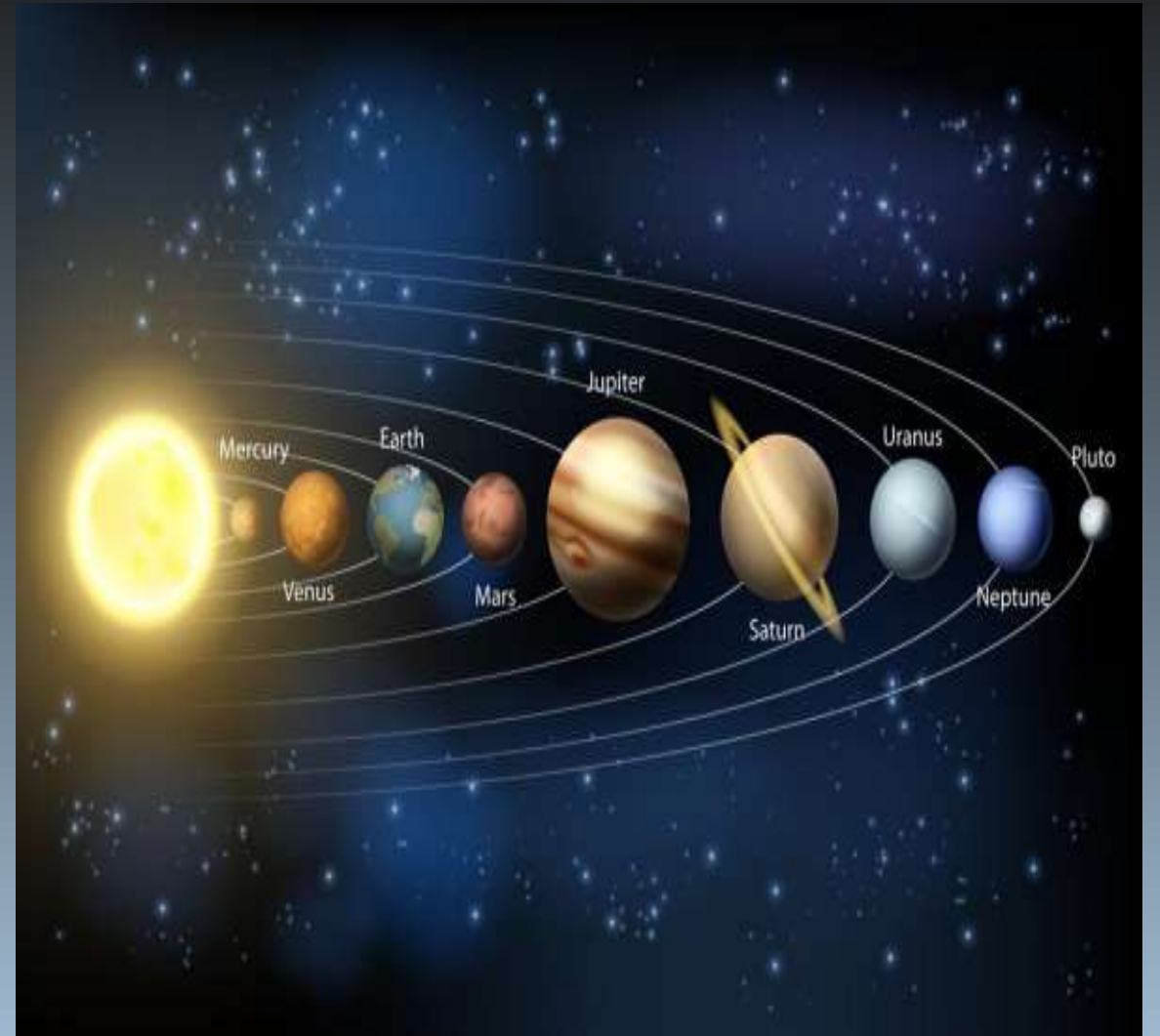
# GALAXIES

- Galaxies are huge collections of Gas, Dust, Billions of Stars and their Solar systems. A Galaxy is held together by gravity.
- There are many galaxies in the Universe.
- Our Galaxy's name is **Milky Way**. It has a *Super massive Black hole* in the Middle.

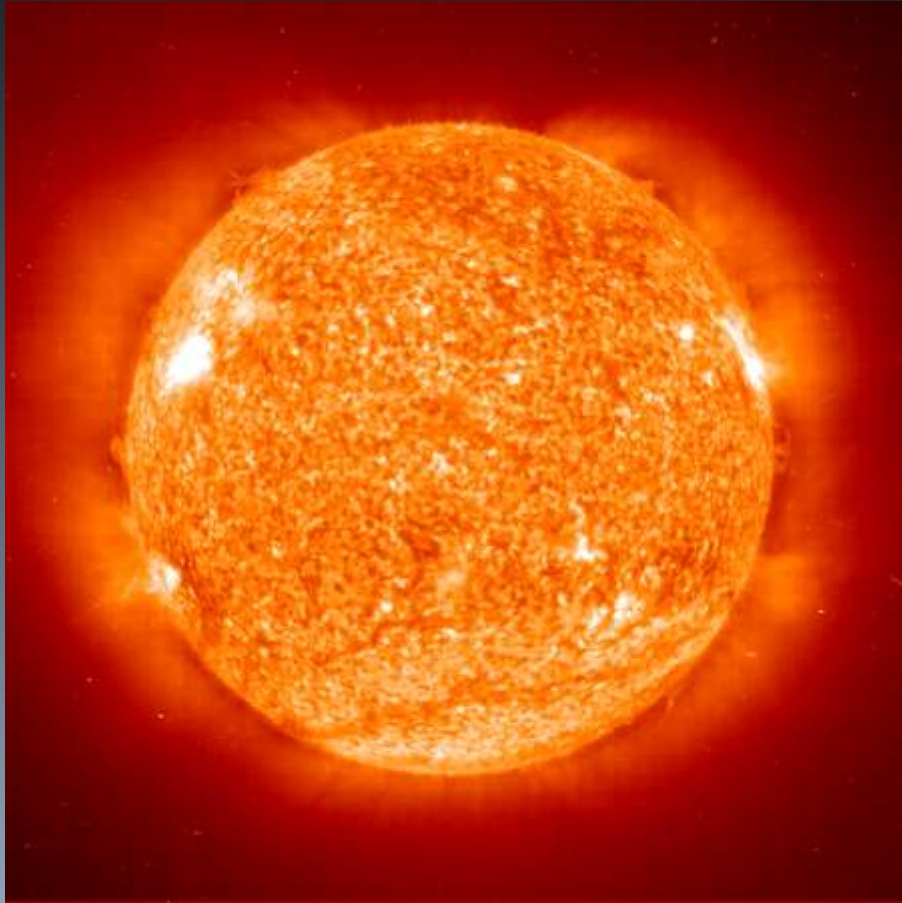


# Solar System

- Solar System consists of our star, Planets, the Sun, and everything bound to it by Gravity
- Beyond our own Solar System, we have discovered thousands of Planetary systems orbiting other stars in the Milky way.



# Sun



- Sun is the heart of our solar system.
- It is a yellow dwarf star, a hot ball of glowing gases.
- It's gravity holds the solar system together, keeping everything from the biggest planets to the smallest particles of debris in its orbit.
- The connection and interactions between the Sun and earth drive the seasons, ocean currents, weather, climate, radiation belts and aurorae.





# THE SUN: VITAL STATISTICS

Mass ( $1 M_{\odot}$ ):  $1.989 \times 10^{30} \text{ kg} = 3.33 \times 10^5$  Earth masses

Visual radius ( $1 R_{\odot}$ ):  $6.960 \times 10^5 \text{ km} = 109$  Earth radii

Luminosity ( $1 L_{\odot}$ ):  $3.827 \times 10^{26} \text{ W}$

Mean angular diameter: 32 arcmin

Rotation periods:  
Equatorial: 25 days  
Polar: 35 days

Mean density:  $1408 \text{ kg/m}^3$

Distances from Earth:  
Mean ( $1 \text{ AU}$ ):  $1.496 \times 10^8 \text{ km}$   
Maximum:  $1.520 \times 10^8 \text{ km}$   
Minimum:  $1.470 \times 10^8 \text{ km}$

Mean light travel time to Earth: 8.32 min

Mean temperatures:  
Surface: 5800 K  
Center:  $1.55 \times 10^7 \text{ K}$



# The SUN: VITAL STATISTICS

Composition (by mass): 74% hydrogen, 25% helium, 1% other elements

Composition (by number of atoms): 92.1% hydrogen, 7.8% helium, 0.1% other elements

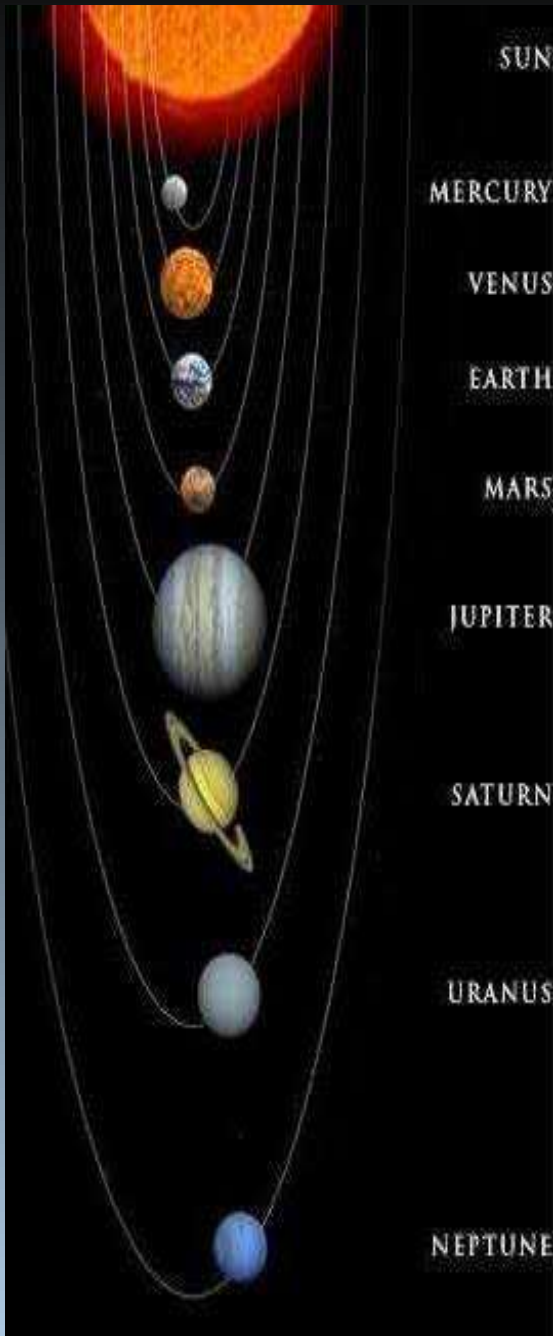
Distance from center of Galaxy: 26,000 ly = 8000 pc

Orbital period around center of Galaxy: 220 million years

Orbital speed around center of Galaxy: 220 km/s







# Planets of our Solar System

There are Eight Known Planets in our Solar System.

These Planets are Classified as:

(i) Inner Planets or Terrestrial Planets

Mercury, Venus, Earth and Mars

(ii) Outer Planets or Giant Planets

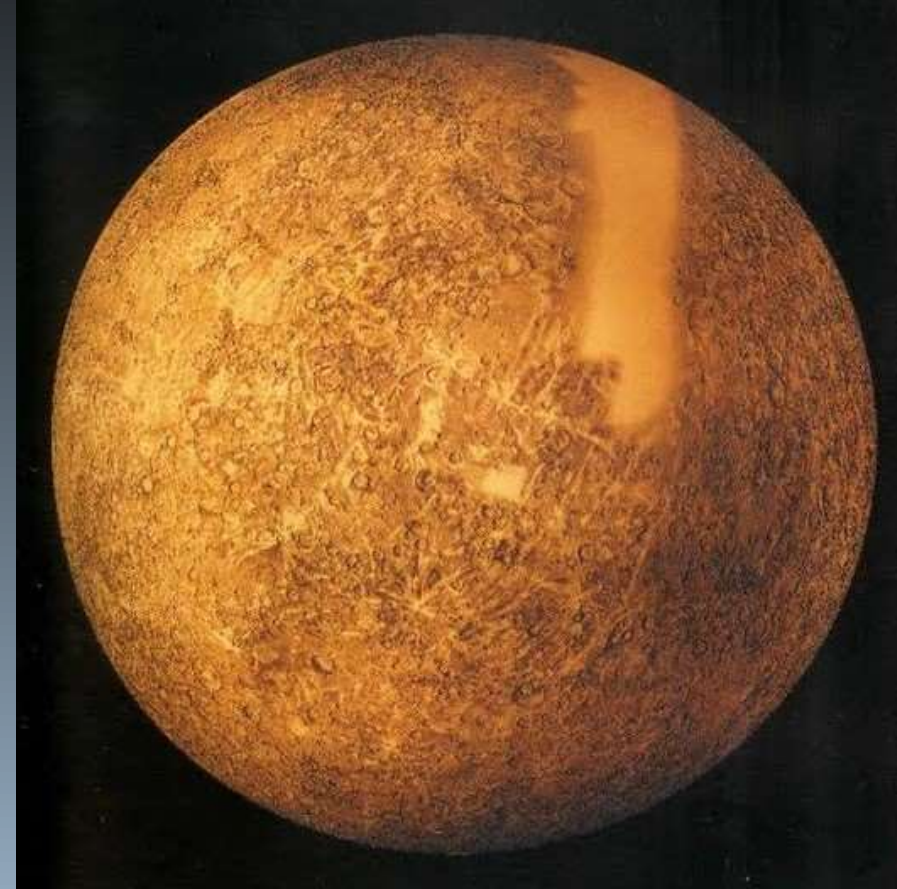
Jupiter and Saturn (Gas Giants)

Uranus and Neptune (Ice Giants)



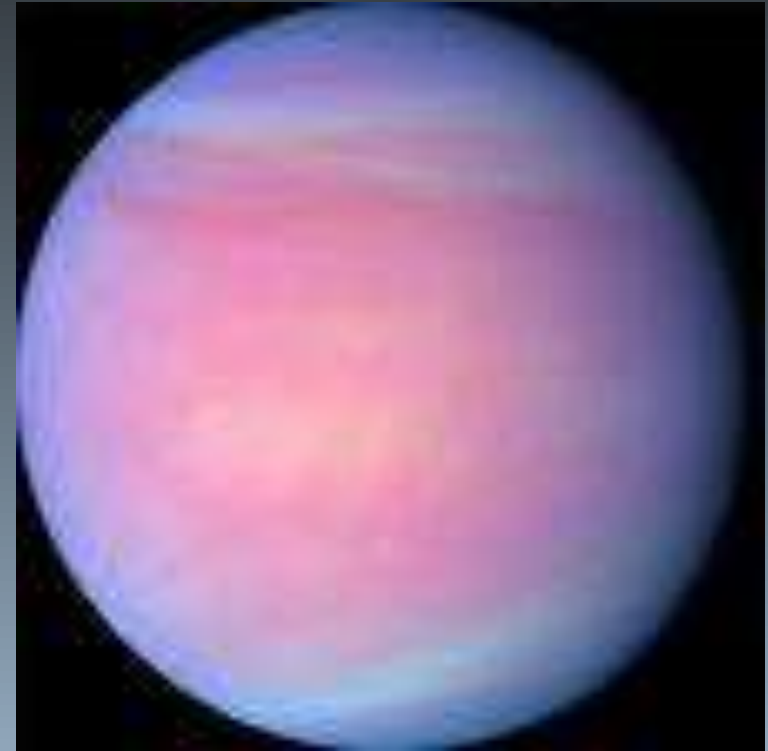
# Mercury: The Swift Planet

- It is called the “Swift Planet” because of its Swiftness around the Sun.
- it is the Smallest and innermost planet in the Solar System.
- Its orbit around the Sun takes 87.97 Days, the shortest of all planets in the Solar System.
- Most good views of Mercury occur at midday, when the planet sits high in the sky.



# Venus: The Morning Star or Evening Star

- Venus is called the 'Morning or Evening Star' because it appears like a Star in the Night Sky.
- It is the second planet from the Sun.
- Daytime observations of Venus are also easier than those of Mercury because Venus shines brighter
- Venus orbits the Sun every 224.7 Earth Days.



# Mars: The Red Planet

- Mars is called the “Red Planet” because of its color which is due to the presence of iron oxide on its surface.
- It is the fourth planet from the Sun and second Smallest Planet in the Solar System after Mercury.
- Mars and Earth are closest once every 26 months.



# Jupiter: The Giant Planet



- It is the fifth Planet from the Sun and the Largest Planet in our Solar System.
- It is 1300 times bigger than our Earth.
- Jupiter's atmosphere divides into dark areas, called belts, and lighter ones, called zones.
- Jupiter is one of the brightest objects visible to the naked Eye in the Night Sky.
- Jupiter has 53 named moons and another 26 awaiting official names



# Saturn: The Ringed Planet

- It is called “Ringed Planet” because of its rings made up of Ice Particles.
- It is the Sixth Planet from the Sun and Second largest planet in the Solar System, after Jupiter.
- It is a gas giant with average radius 9 times that of earth.
- It has only one-eighth the average density of Earth; however with its larger volume, it is over 95 times more massive.



# Uranus: The Ice Giant



- It is the Seventh Planet from the Sun.
- it has Third-Largest Planetary radius and Fourth-Largest Planetary mass in the Solar System.
- It is Coldest Planet in our Solar System.
- Through a small telescope, greenish Uranus appears as a slightly elliptical disk because of its rapid rotation.



# Neptune: The Big Blue Planet

- It is called “ Big Blue Planet” because it looks like Blue as Earth.
- It is 17 times larger than Earth.
- Neptune is the Eighth and Farthest known Planet from the Sun in the Solar System.
- In the Solar System, it is the fourth-largest planet by diameter, the third most massive planet and the densest giant planet.
- Neptune is 17 times the mass of Earth, slightly more massive than its near twin Uranus





# Moon



- Moon is the only natural Satellite orbiting the earth
- It is the 5<sup>th</sup> largest Satellite in Solar System
- Moon surface is covered with dead Volcanos, impact craters and lava flows, some visible to the unaided stargazer.
- The crust of the moon is made up of rocky surface covered with regolith.

**Distance from Earth: 384,400 km**

**Gravity : 1.62 m/s<sup>2</sup>**

**Radius : 1737.1 km**

**Surface area : 3.793 x 10<sup>7</sup> km<sup>2</sup>**

**Orbital period : 27 days**



# Moon

## Quick Moon Facts:

- Only Celestial body that has been visited by Humans



**First Humans to visit the moon:  
Neil Armstrong & Edwin Aldrin**

- Min Temperature:  $-387^{\circ}$  Fahrenheit
- Max Temperature:  $253^{\circ}$  Fahrenheit
- Distance from Earth: About 239,000 miles



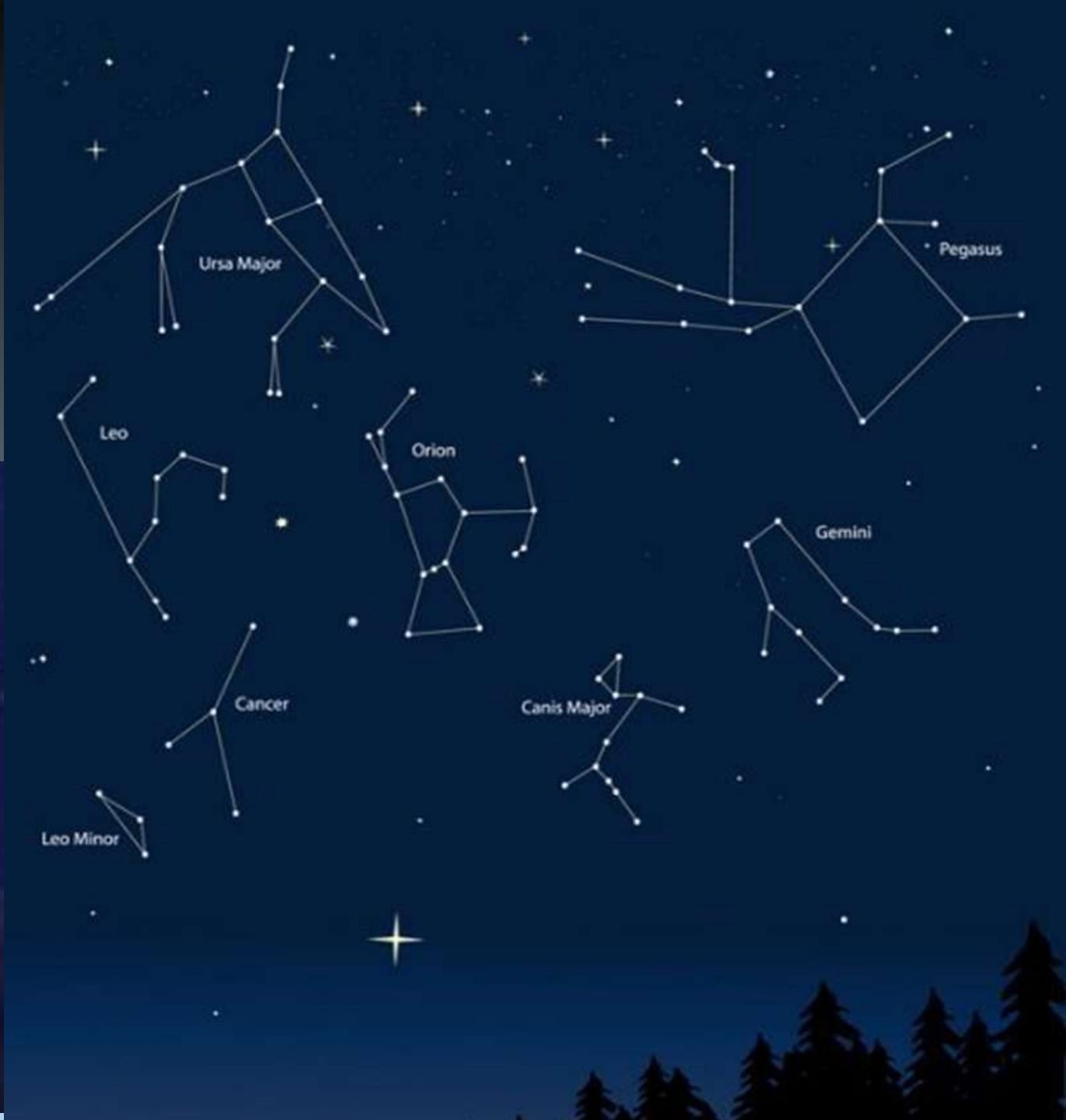
# Constellations



- A Constellation is a group of stars that appears to form a pattern or picture like Orion the Great Hunter, Leo The Lion, or Tarus the Bull, etc.
- Constellations are easily recognizable patterns that help the people orient themselves using the Night Sky.
- There are 88 “Official” Constellations recognized by the International Astronomical Union (IAU), .
- Out of these 36 are found predominantly in the northern sky, while 52 are located in the southern sky.
- Most of the constellation names we know came from the ancient Middle Eastern, Greek and Roman Cultures.



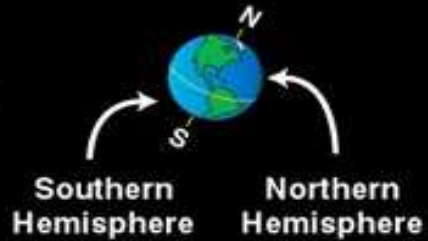
# Some important Constellations



# Some Starry facts

- All stars observed at the equator rise in the east and set in the west.
- If observed through the year, the constellations shift gradually to the west. This is caused by Earth's orbit around our Sun.
- The brightest star in the sky is Sirius, also known as the “Dog Star” or, more officially, Alpha Canis Majoris
- North Star or Pole Star - Polaris , designated  $\alpha$  Ursae Minoris , is the brightest star in the constellation of Ursa Minor. It is very close to the north celestial pole, making it the current northern pole star.
- There is a "South Star" called Sigma Octanis located in the constellation Octans, but it is so dim that virtually nobody calls it the south star.
- Stars twinkle at night sky because when starlight enters our atmosphere it is affected by winds and by areas with different temperatures and densities. This causes the light from the star to twinkle when seen from the ground.

Earth has seasons because its axis is tilted. Earth rotates on its axis as it orbits the Sun, but the axis always points in the same direction.



# What Causes Seasons ?

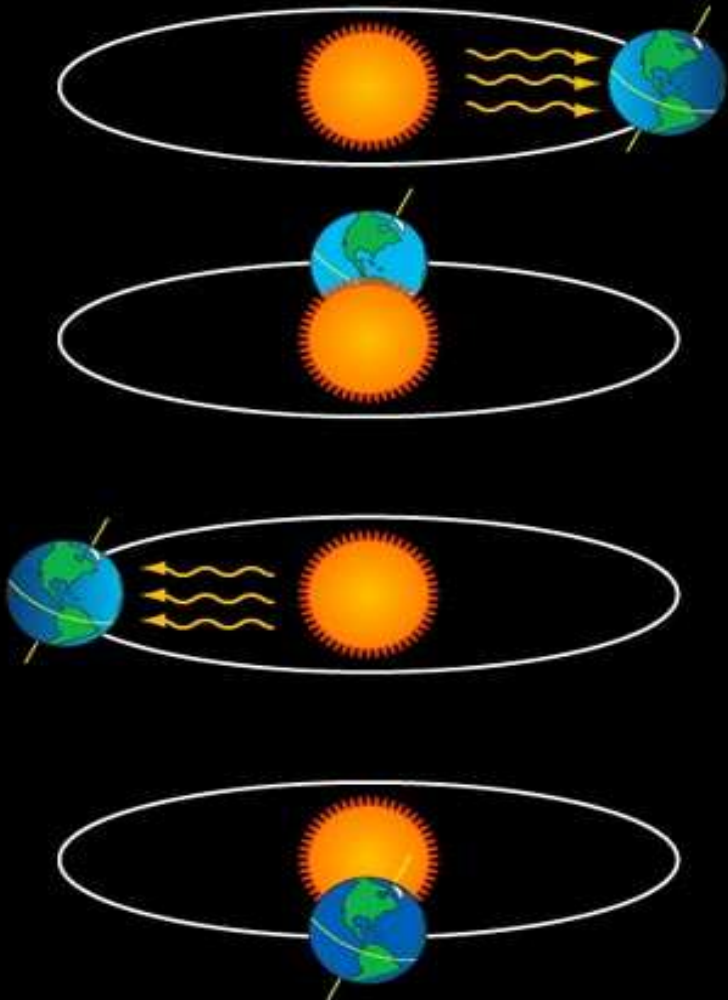
Earth's tilted axis causes the seasons. Throughout the year, different parts of Earth receive the Sun's most direct rays. So, when the North Pole tilts toward the Sun, it's summer in the Northern Hemisphere. And when the South Pole tilts toward the Sun, it's summer in the Southern Hemisphere. And when the North Pole tilts away from the Sun, it's winter in the Northern Hemisphere. And when the South Pole tilts away from the Sun, it's winter in the Southern Hemisphere.

**December:**  
Summer south of the equator, winter north of the equator. The Sun shines directly on the Southern Hemisphere and indirectly on the Northern Hemisphere

**March:**  
Fall south of the equator, spring north of the equator. The Sun shines equally on the Southern and Northern Hemispheres

**June:**  
Winter south of the equator, summer north of the equator. The Sun shines directly on the Northern Hemisphere and indirectly on the Southern Hemisphere

**September:**  
Spring south of the equator, fall north of the equator. The Sun shines equally on the Southern and Northern Hemispheres



# How Do Star Positions Change ?

As the Earth rotates, the moon and stars appear to move across the sky just the way the sun does during the day. The Earth also revolves around the sun, causing different parts of the galaxy to appear during different points in the Earth's orbit.

The following factors change star positions over time:

1. axial precession and nutation – slow tilts of Earth's axis with rates of 50 arc seconds and 2 arc seconds respectively, per year;
2. the aberration and parallax – effects of Earth's orbit around the Sun; and
3. the proper motion of the individual stars.



Earth



# Astronomical Telescope

- Astronomical Telescope is an optical instrument which is used to see the magnified image of distant heavenly bodies like stars, planets, satellite, galaxies, etc.





# Telescope filters



- Like a photographic filter, telescope filters enhance details and improve contrast.
- They do this by cutting out unwanted colors or wavelengths of light.
- Professional astronomers may use filters for technical observation, such as classifying Stars

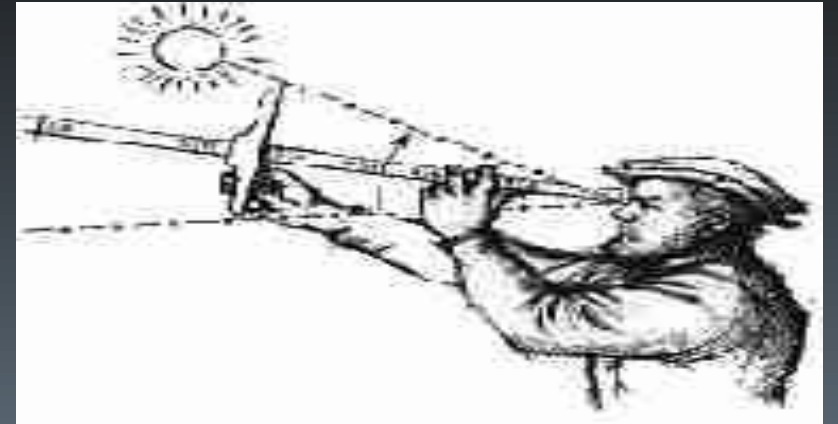


# Most effective filters for viewing common celestial objects

Filters	Moon	Mercury	Venus	Mars	Jupiter	Saturn
#8 Yellow	X					
#12 Yellow				X		
#21 Orange	X	X				
#23A Light Red				X		
#25 Red			X	X		
#38A Dark Blue			X		X	
#47 Violet	X		X			
#56 Light Green				X		
#58 Green				X		
#80A Blue	X				X	X
#82A Light Blue				X		



# Before Telescopes

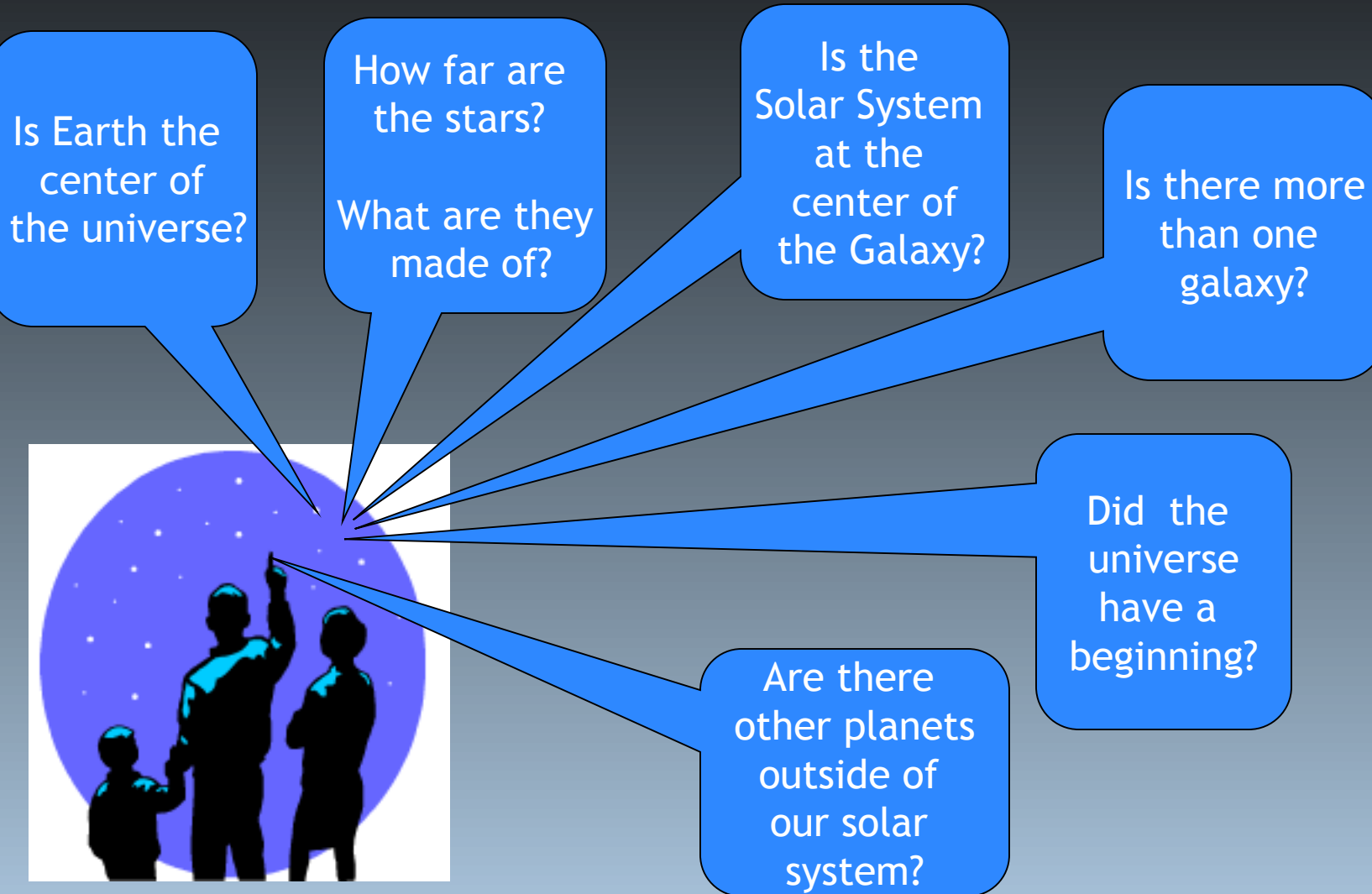


*We only had our eyes . . .*

*and a variety of measuring instruments.*

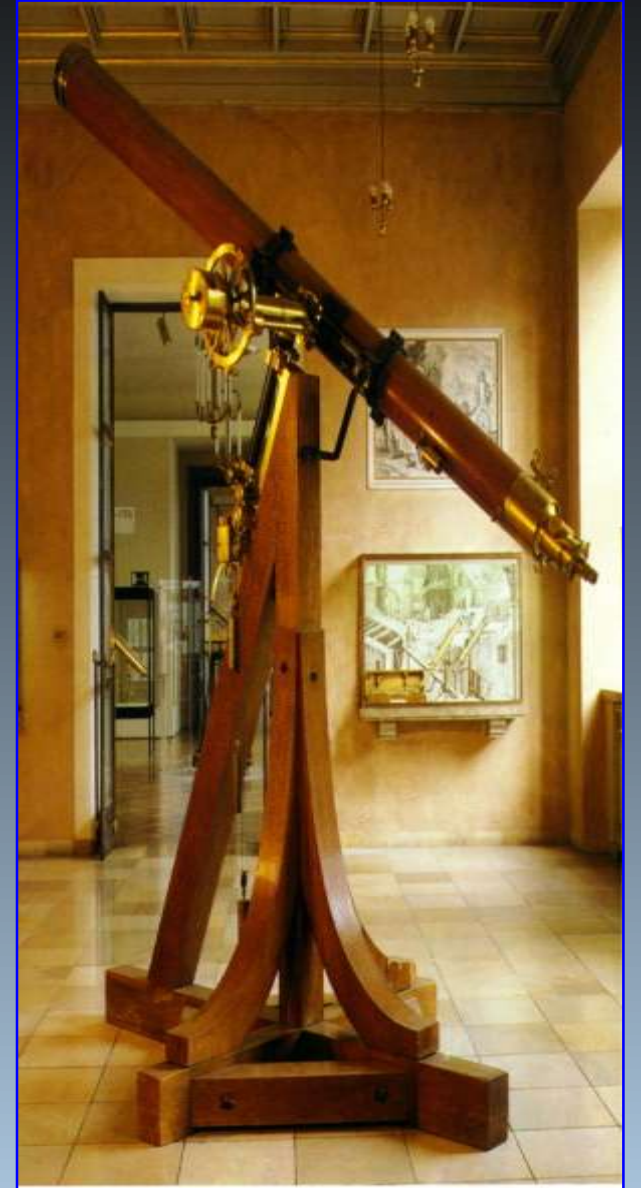


# And we had many questions...



# How Telescopes have changed our understanding of the universe ...

- Telescopes showed mountains and craters on the moon.
- Telescopes have also revealed new planets and asteroids.
- Telescopes helped us to make the first valid measurement of the speed of light.
- Telescopes helped us to understand gravity and other fundamental laws of the physical world.
- Telescopes also helped us to understand the light that radiates from the sun and other stars.



# Telescopes will continue to expand our understanding of our universe.



Hubble Telescope

- Modern telescopes like NASA's Hubble Space Telescope, provide evidence of billions of galaxies, each containing billions of stars like our sun.
- Some new telescopes allow us to study objects in the universe by detecting the heat or radio waves or X-rays they emit.
- Telescopes are now discovering planets around other stars.
- Future telescopes will be useful to answer a fundamental human question: "Are we alone in the universe?" or Earth-like planets will be discovered in the next few years.



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- Sun : <https://solarsystem.nasa.gov>
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- All Planets Information : <https://en.m.wikipedia.org>
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- Telescope Filters : <https://lovethenightsky.com>
- Constellation : <https://www.lpi.usra.edu>
- Telescope Helping in Understanding of Universe : <https://www.nasa.gov>
- Star Position : <https://en.m.wikipedia.org>
- Cause of Seasons : <https://spaceplace.nasa.gov>



# Thanks For Watching...!!!

You can get a good starter astronomy book and a good astronomy binoculars and start watching the night sky

OR

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OR

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(Charges apply)

