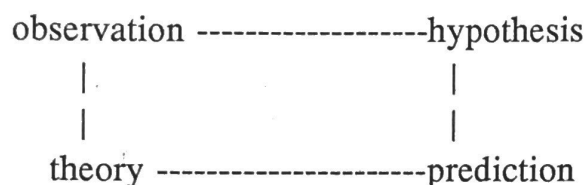


## LECTURE NOTES ON ASTRONOMY

- Astronomy is the science of the universe. It takes as its field of study the motion, composition, and evolution of heavenly bodies.

- Why is it a science?

It uses the scientific method for its investigations.



- Astronomy is different from other sciences (like Physics, Chemistry, etc.) in that it is purely observational. The source of information for astronomers is the electromagnetic radiation that passes through the earth's atmosphere. Ground based astronomy is limited to visible light and radio waves.

- Why study astronomy?

In ancient times

- a) Calendar
- b) Navigation
- c) Time-keeping

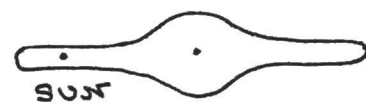
In modern times

- a) test physical theories
- b) understand our place in the universe

**ASTRONOMY IS BEAUTIFUL!!**

## TOUR OF THE UNIVERSE

- Solar System
  - Sun
  - Planets - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto
  
- Binary Stars
  
- Star Clusters
  - a) Associations (< 100 stars)
  - b) Open or Galactic Clusters (100 - 1000 stars)
  - c) Globular Clusters ( $10^5$  to  $10^6$  stars)
  
- Milky Way Galaxy
  - $\sim 10^{11}$  stars
  - gas
  - dust
  
- Local Group ( $\sim 30$  galaxies)
  
- Clusters of Galaxies ( $\sim 1000$  galaxies) [e.g. Virgo Cluster]
  
- Superclusters of Galaxies [e.g. Local Supercluster]



## SCALE OF THE UNIVERSE

- Measure distances in light travel time.
- Speed of light  $c = 186,100 \text{ mi / s}$  or  $3 \times 10^5 \text{ km/s}$   
1 light year =  $9.46 \times 10^{12} \text{ km}$
- Earth to moon 1.25 lt. sec
- Earth to sun 8 lt. min
- Sun to Pluto 5.5 lt. hour
- Sun to Nearest star 4.4 lt. yr
- Sun to Center of Milky Way 30,000 lt. yr
- Extent of the Milky Way 100,000 lt. yr
- Distance to Andromeda Galaxy (M31) 2.25 million lt. yr
- Distance to Virgo Cluster 50 million lt. yr.
- Edge of observable universe 15 billion lt. yr

## COSMIC CALENDAR

Jan 1	Big Bang
May 1	Origin of the Milky Way Galaxy
Sept 9	Origin of the Solar System
Sept. 25	Origin of life on Earth
Dec 16	First worms
Dec 19	" fish
Dec 21	" insects
Dec 23	" reptiles
Dec 26	" mammals
Dec 27	" birds
Dec 29	" primates
Dec 31, 10:30 p.m.	First humans
Dec 31,	
11:59:50	First dynasties in Sumer and Egypt
11:59:51	Invention of the alphabet; Akkadian Empire
11:59:52	Hammurabic legal code in Babylon
11:59:53	Bronze metallurgy; Trojan War
11:59:54	Iron metallurgy; Founding of Carthage
11:59:55	Asokan India; Periclean Athens
11:59:56	Euclidean Geometry, Birth of Christ
11:59:57	Fall of Rome; Muslim conquests
11:59:58	Mayan civilization; Crusades
11:59:59	Renaissance in Europe; Discovery of America