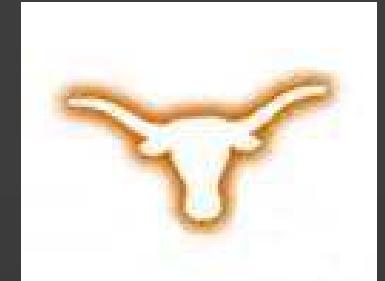




# Astronomy 350L

(Fall 2006)



## The History and Philosophy of Astronomy

(Lecture 1: Introduction)

Instructor: Volker Bromm  
TA: Jarrett Johnson

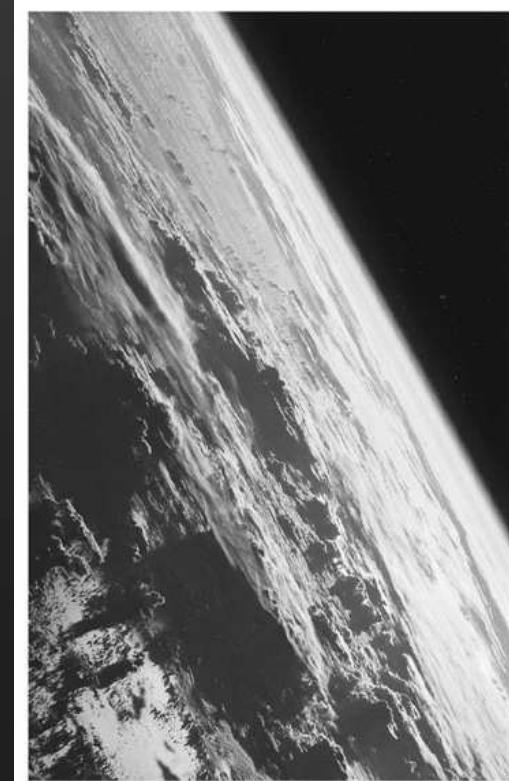
The University of Texas at Austin

# Our Cosmic Environment: A Quick Tour

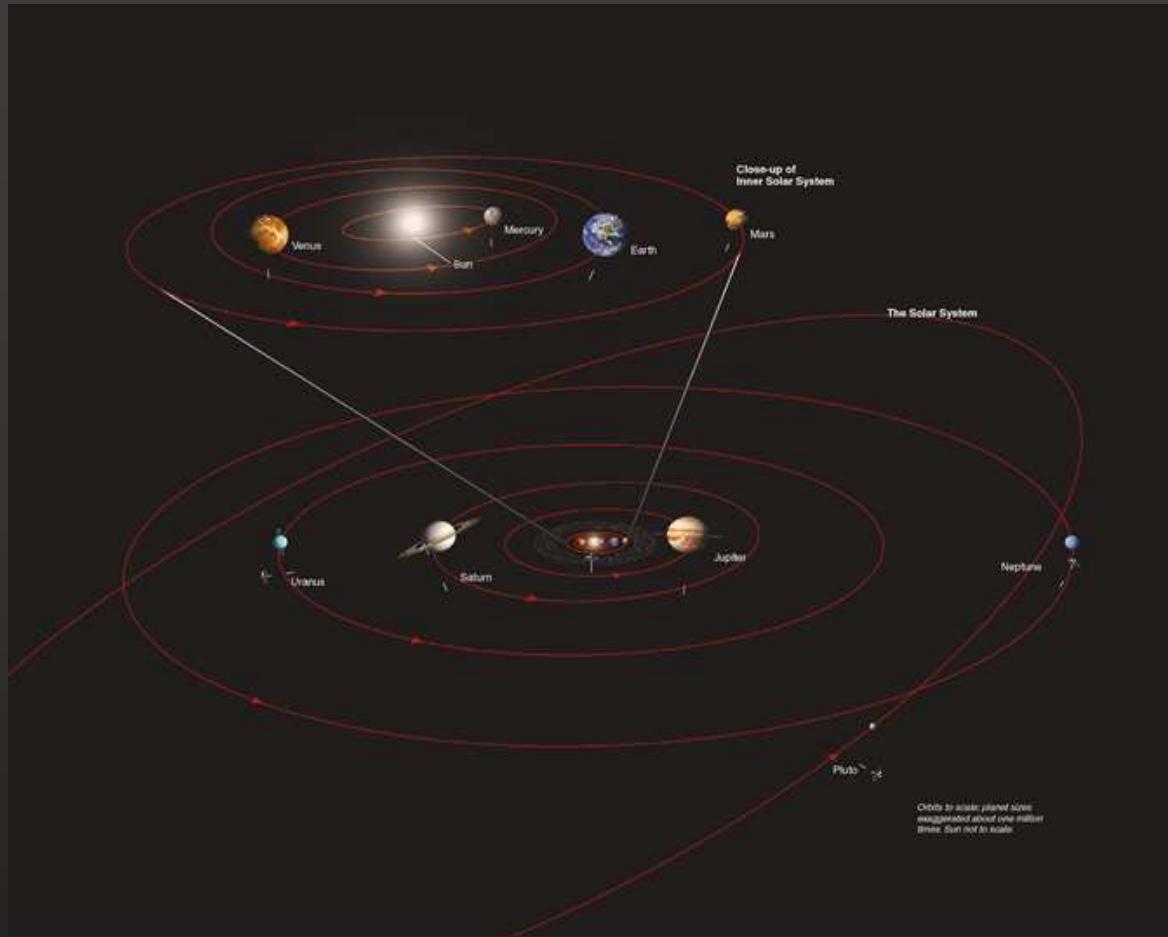


Earth:

- 10,000 km
- 4.5 billion years
- Humans: 1 million yrs



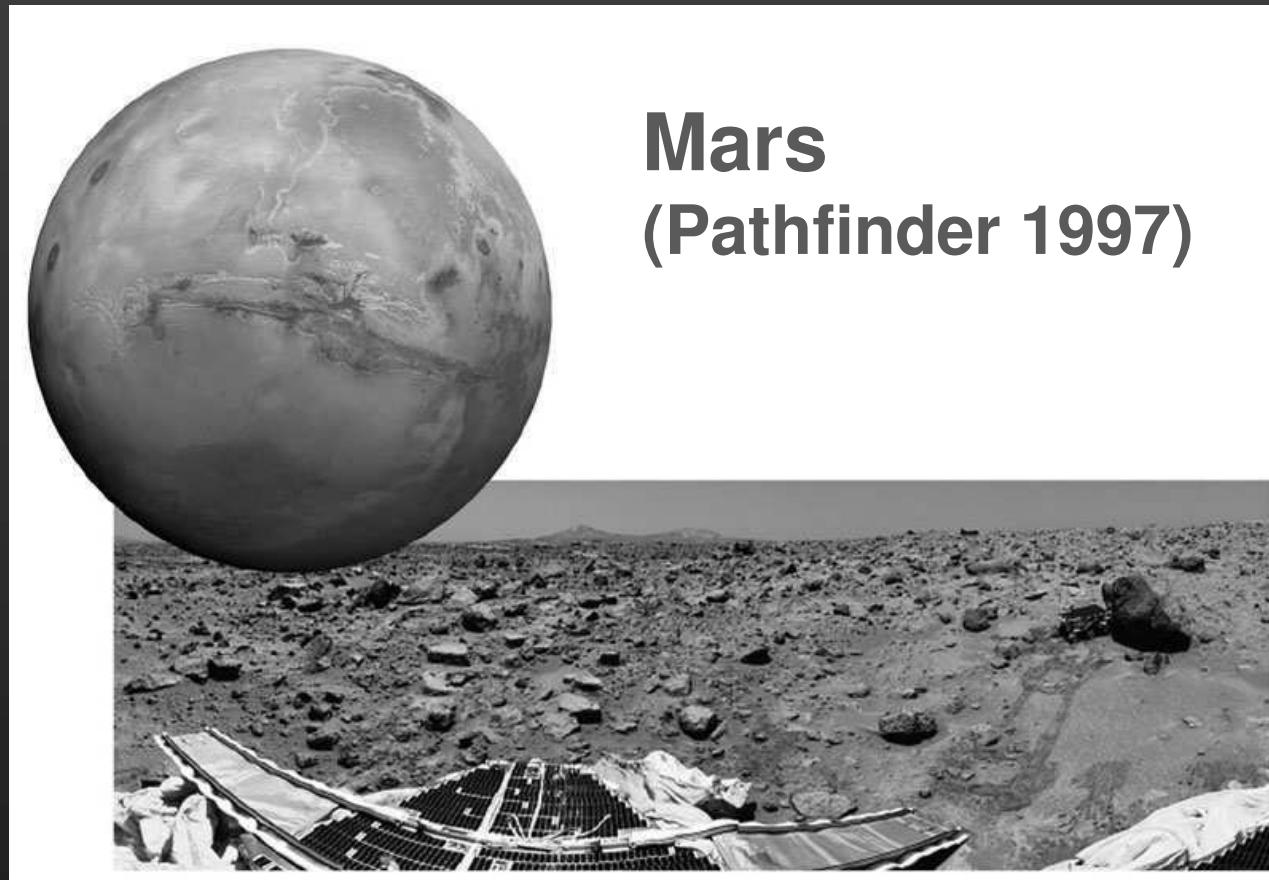
# Architecture of the Solar System



## Solar System:

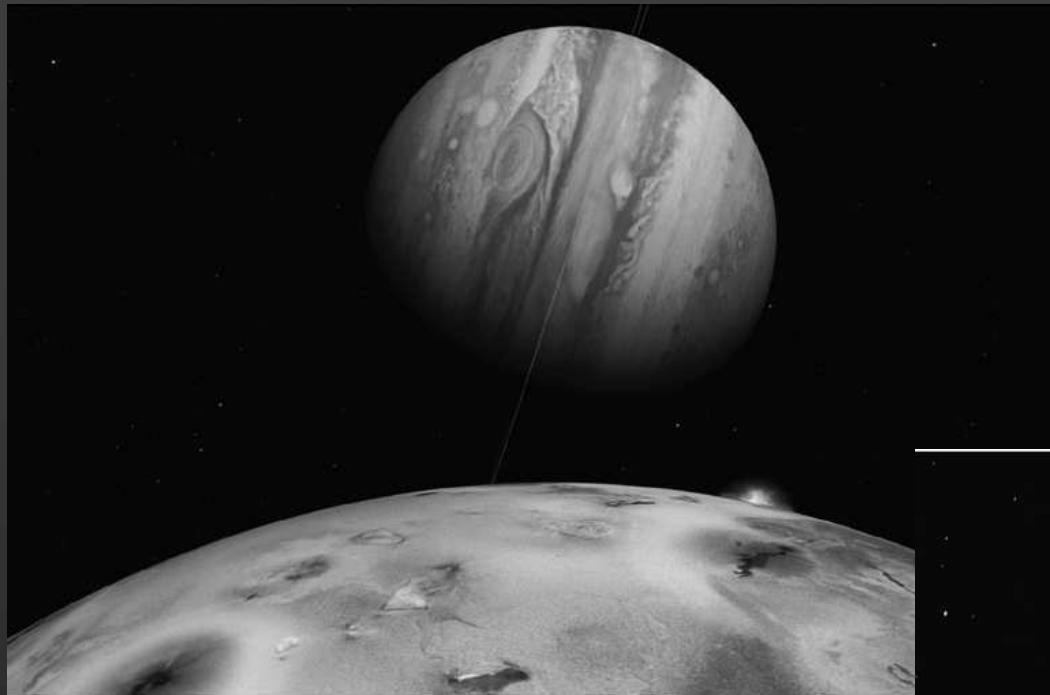
- few 100 million km
- 5 billion years

# Exploring the Planets I



**Mars**  
**(Pathfinder 1997)**

# Exploring the Planets II

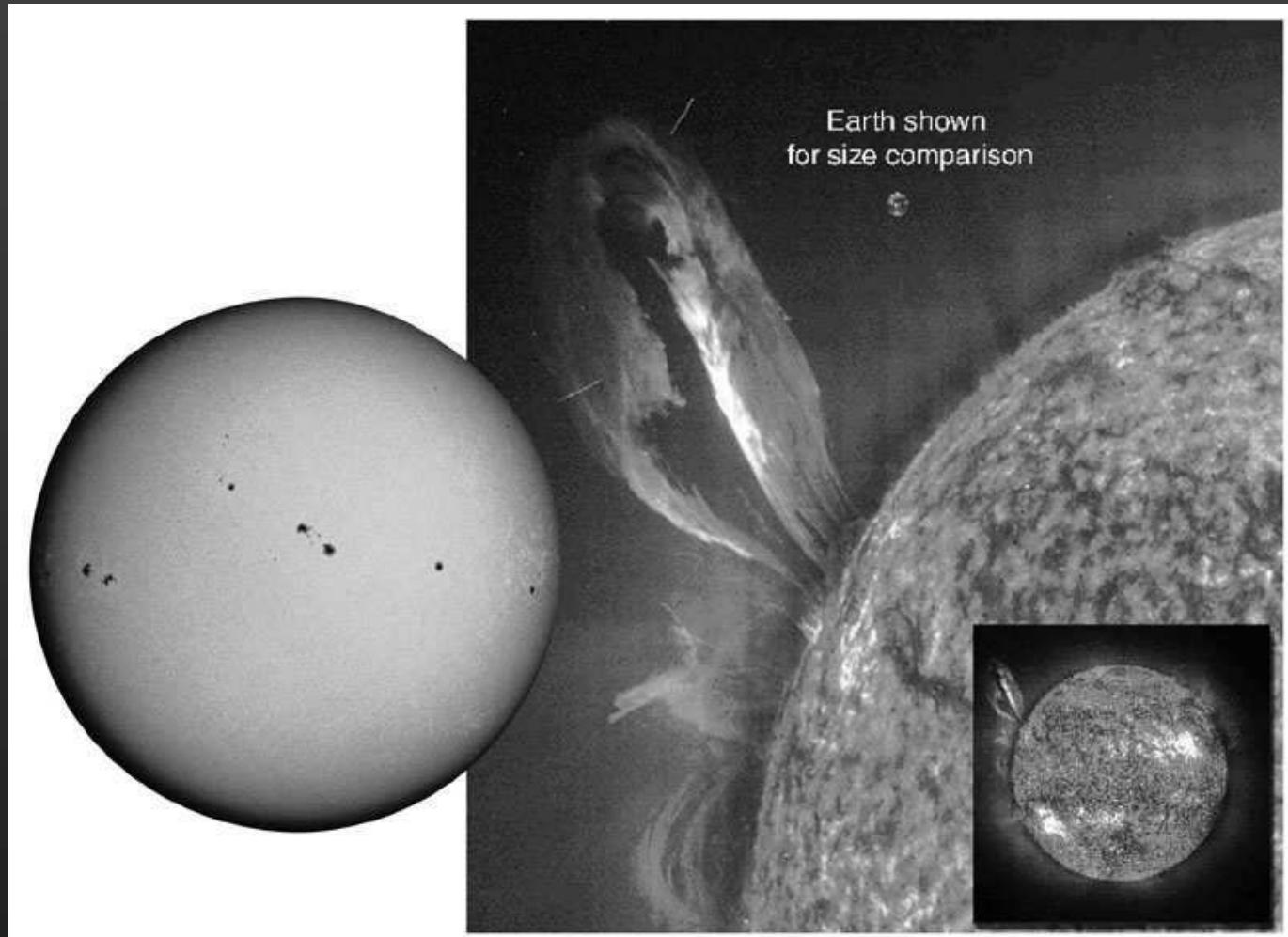


Jupiter + Io



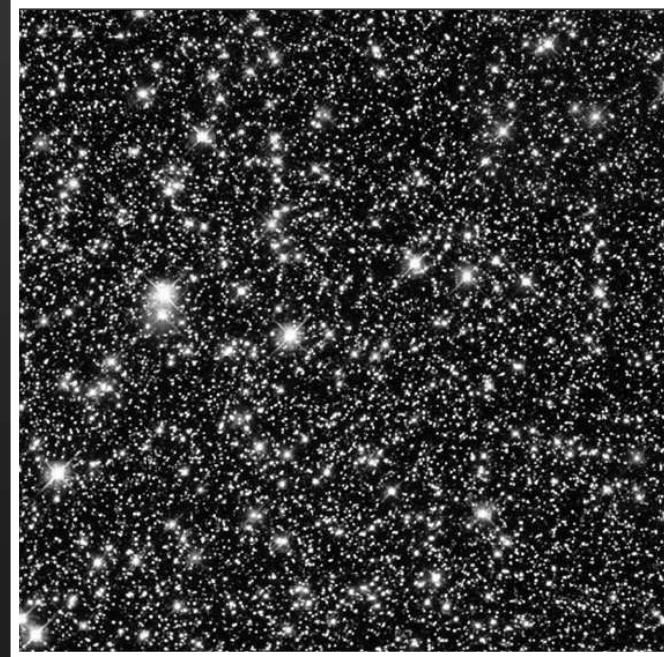
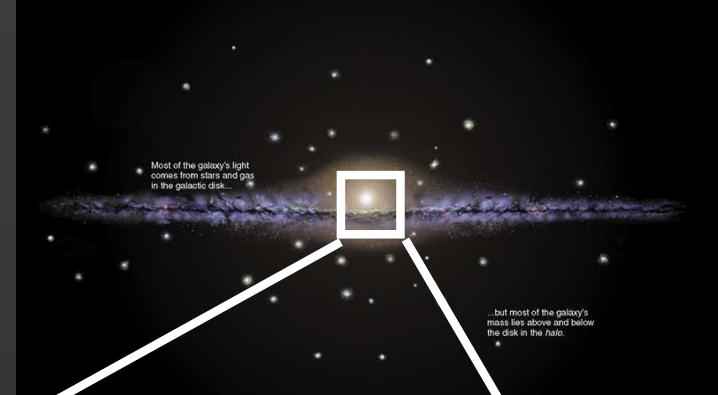
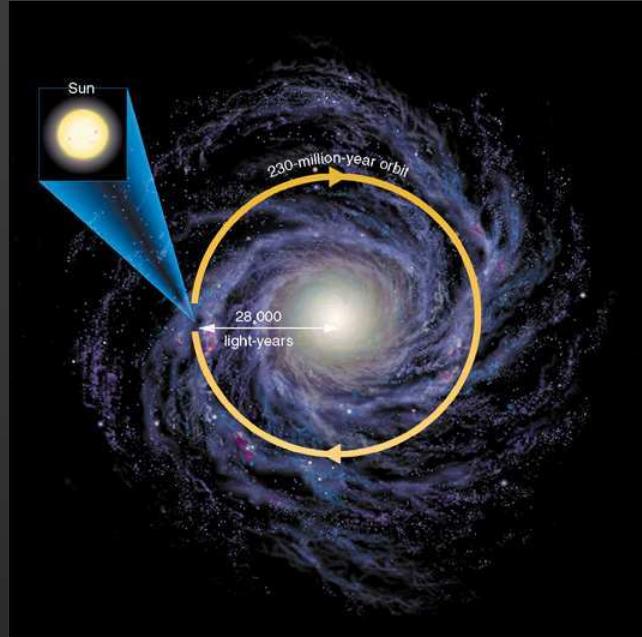
Saturn

# Our Dynamic Sun



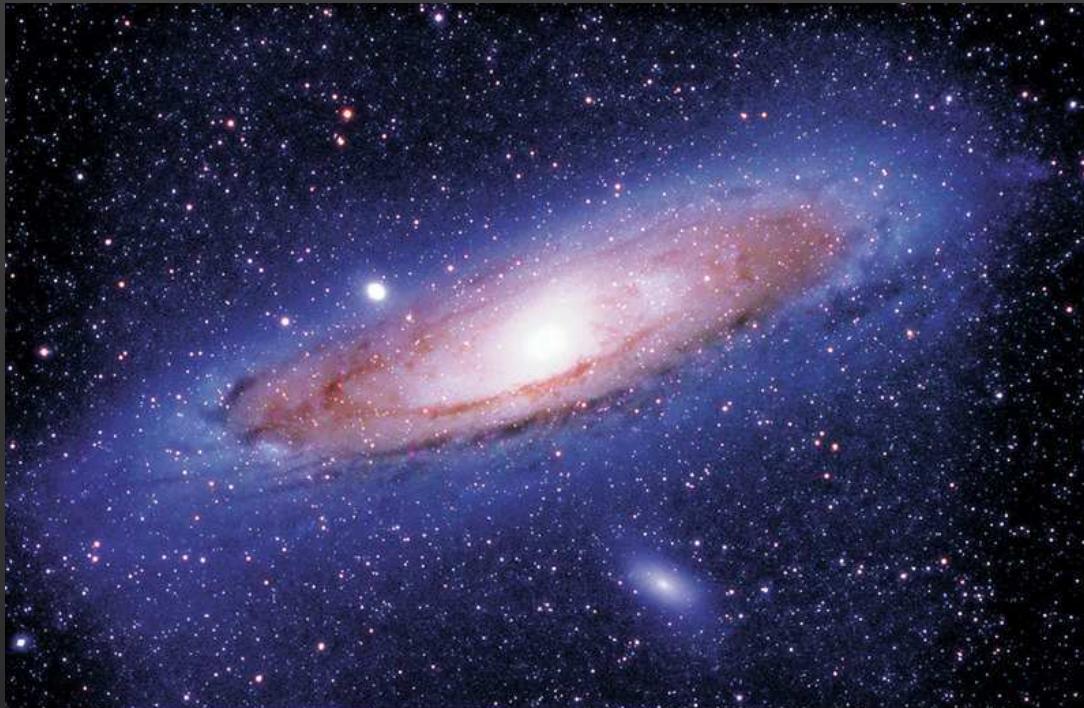
Sun is a *typical* Star!

# Architecture of the Milky Way: Our Galaxy



Our Galaxy: 100 billion stars

# Multitude of Galaxies



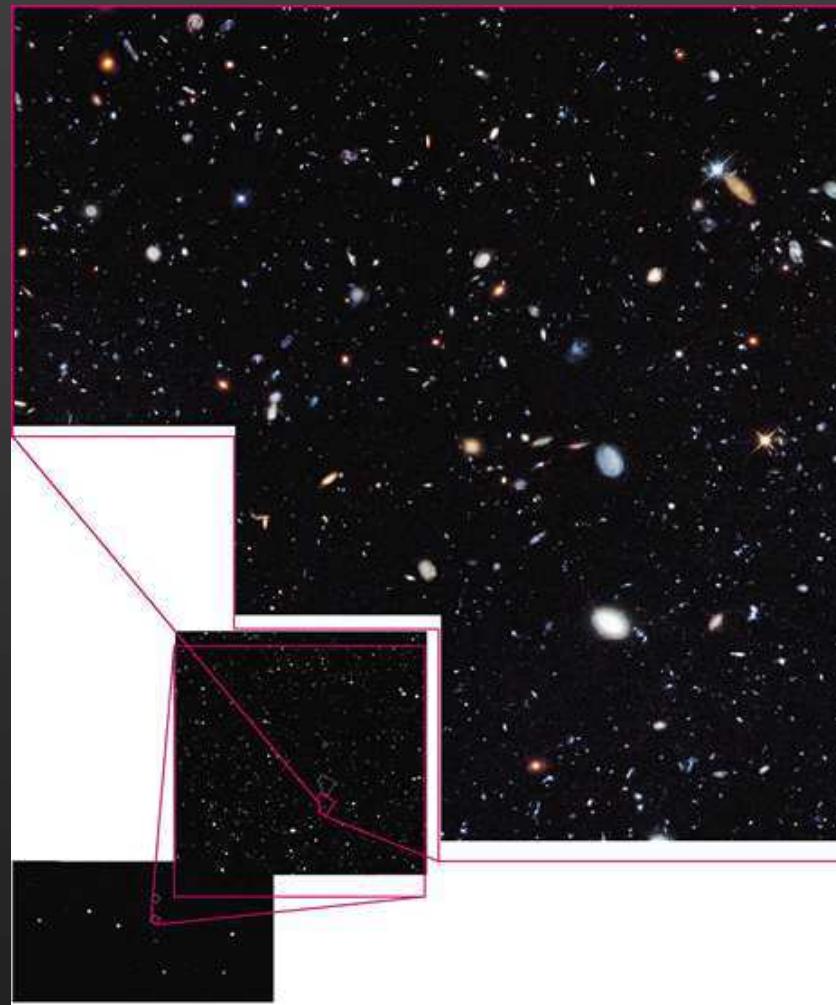
Andromeda (M31)



Whirlpool (M51)

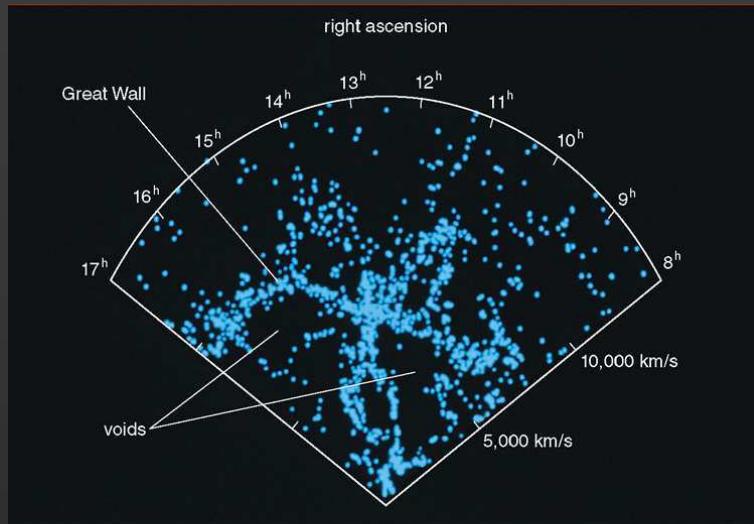
Milky Way is a *typical* Galaxy!

# Universe at the Grandest Scale I

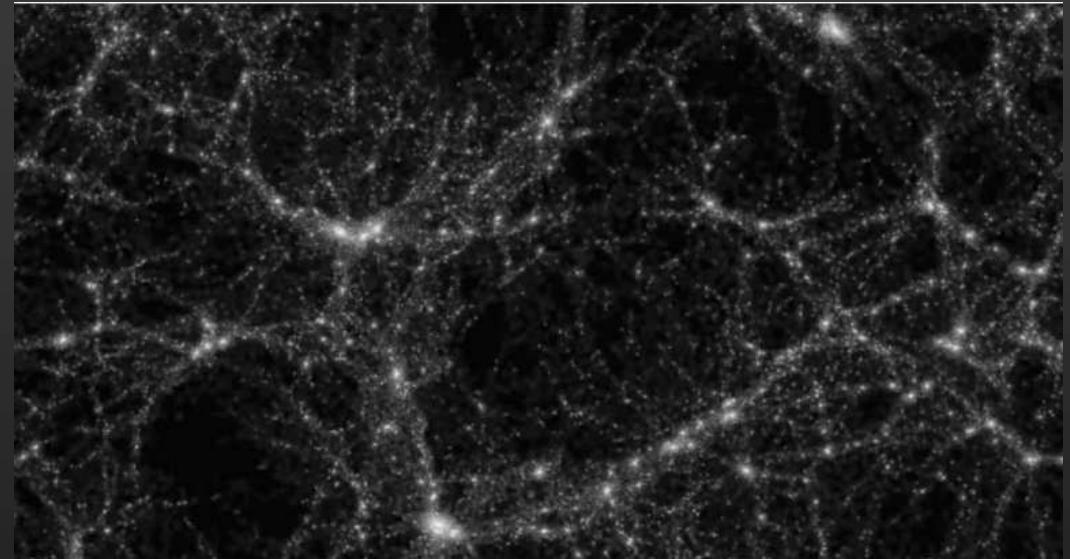


The Hubble Deep Field: few 1000 galaxies

# Universe at the Grandest Scale II



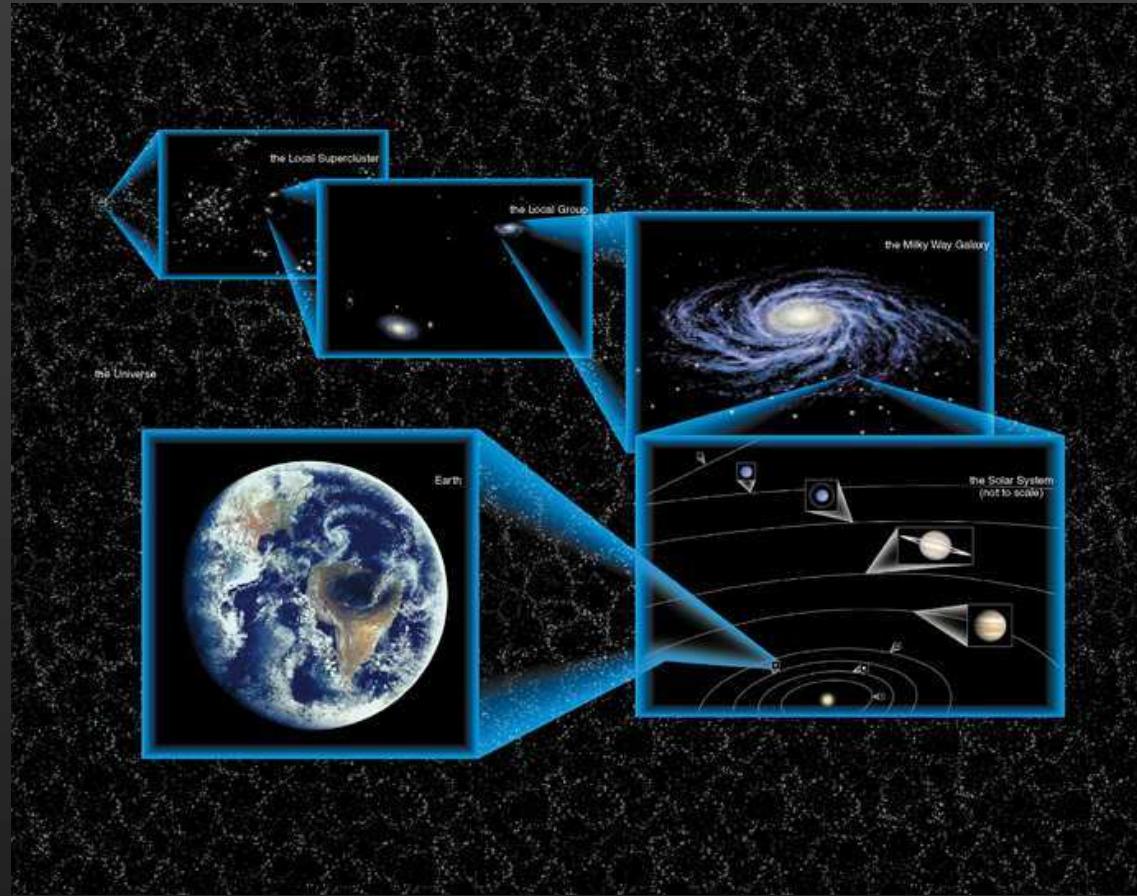
Luminous Matter  
(Galaxies)



Dark Matter

# From Home to Immensity:

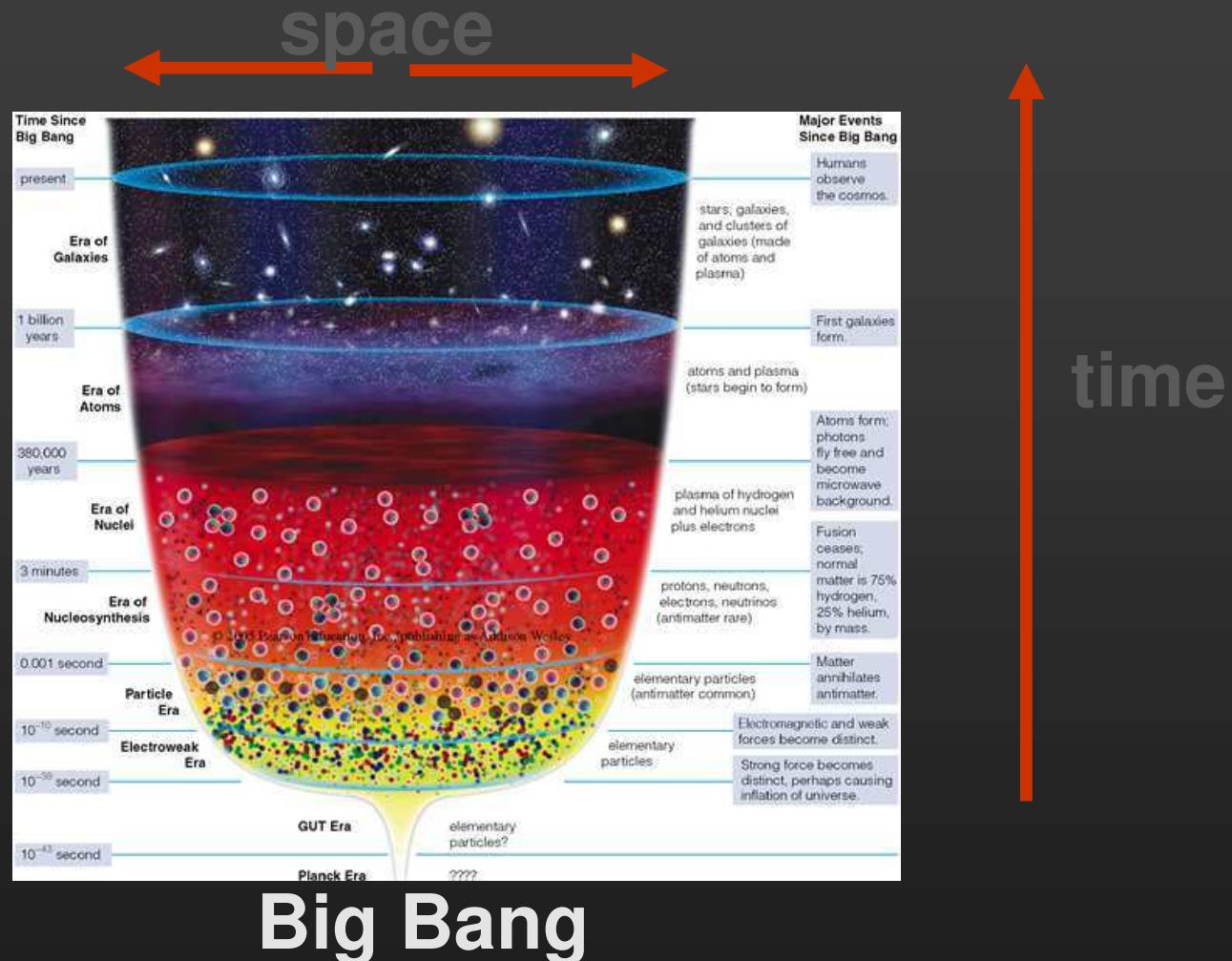
## Journey through Space



An infinite universe, no center, no edge!

# From the Big Bang to Eternity:

## Journey through Cosmic Time



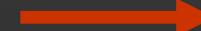
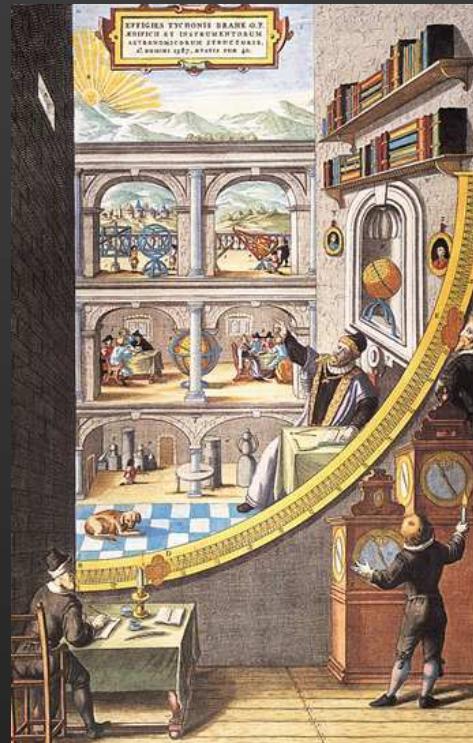
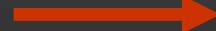
A universe of finite age, but with eternity ahead!

# Cosmic Calendar: Human History in Perspective



# A Brief History of Astronomy:

## From Pre-history to the Modern Age



Two millennia of discovery!

# Every culture looks up to the heavens:



Mayan



China

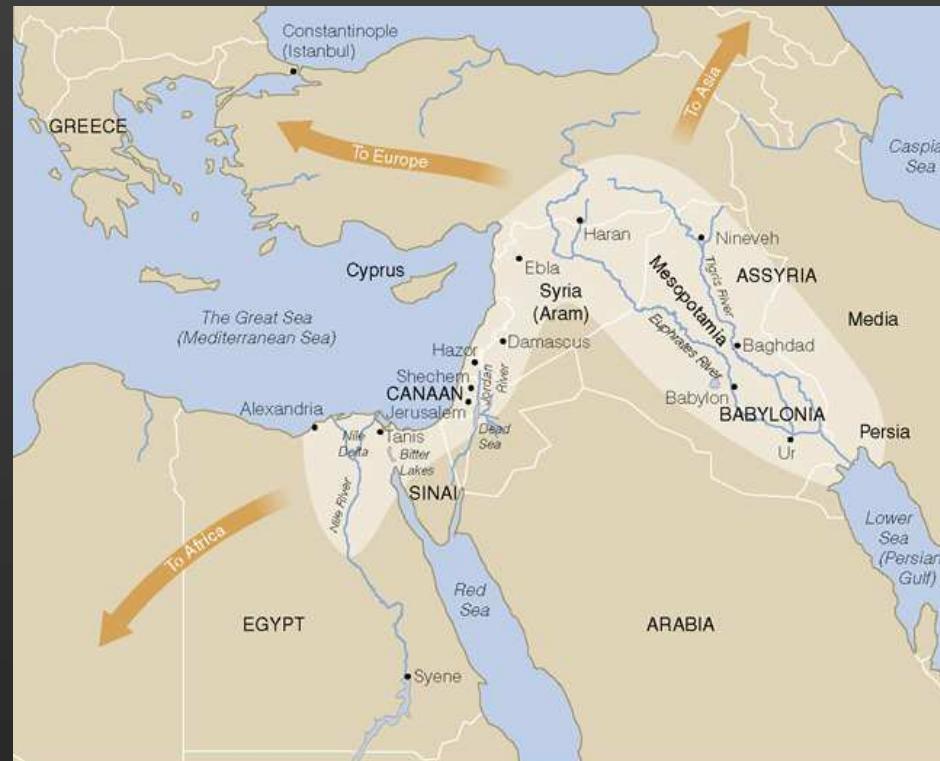


Polynesia

# The Stone Age (~100,000 - 2,000 BC)



# Dawn of Civilization



Babylon, Egypt: Technology, astrology, calendars

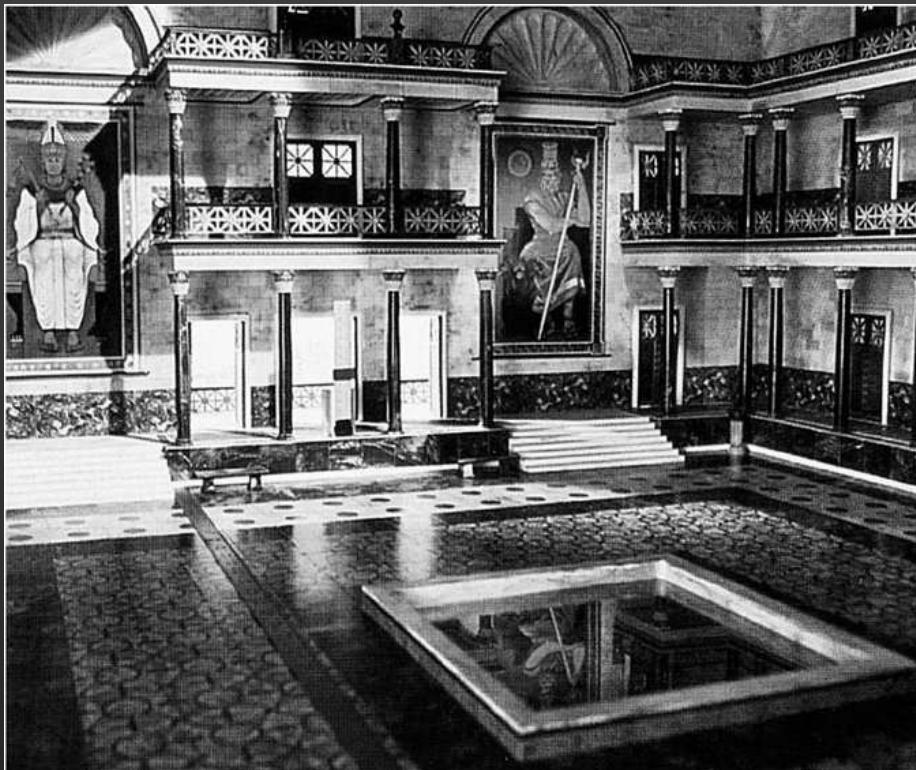
→ no science yet! → Greece (600 BC)

# Antiquity (1,000 BC - 500 AD)



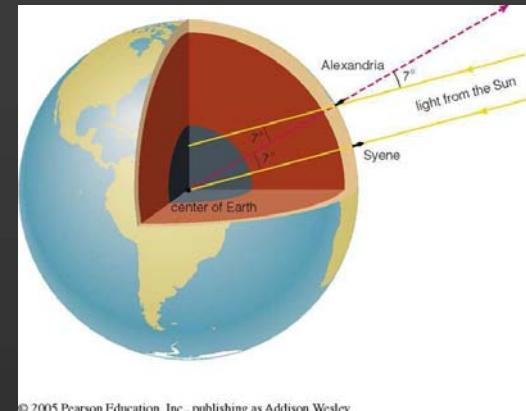
Raphael (~1510): School of Athens

# Antiquity (1,000 BC - 500 AD)



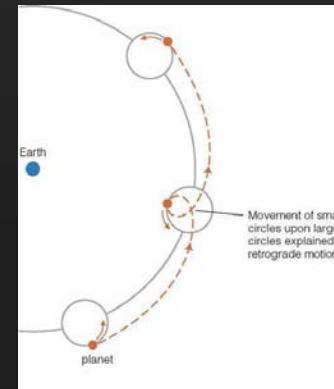
## Great Library of Alexandria

### Eratosthenes (2<sup>nd</sup> BC)



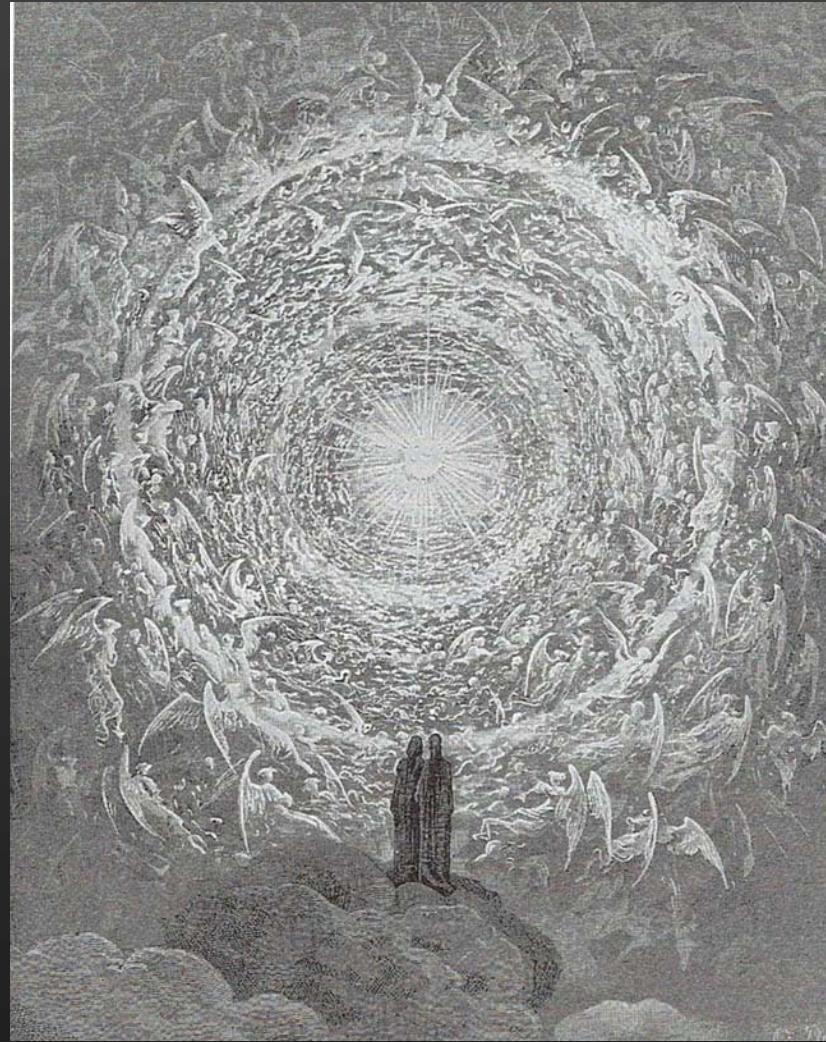
- Earth is Sphere
- Measure size

### Ptolemy (150 AD)



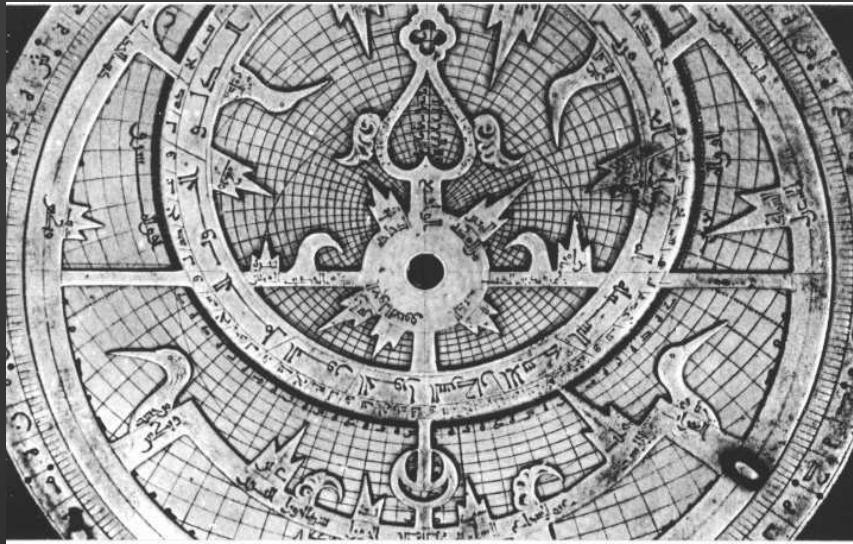
- Intricate model for planetary motion
- Geocentric system

# Middle Ages (500 - 1492 AD)



Dante's Paradise (The Empyrean)

# Middle Ages/Islam (7<sup>th</sup> cent. - 1,600)



طلاقی ره و رکه الماسون اساوی ره رکه مادر را  
 بجهه خدا همان تاب و خطه را سطین علی خط و آفظنه را داد  
 علی خط قطب اینجا زمینه عنده و دکلک فی سایر اراده ضایع ندان بنظره  
 تبره و دامنه این طرف خطاه غیر ملائمه شد و ملائمه شد مان اراده باعثه الماس  
 مطبقی نلکن سپس و مبنی این یکن مرد من الداره الصفره مدار  
 دکل الدار به پهنه و من الداره الکمبه داره ضفت  
 خطاه اینقدر خط الداره الصفره همان جهان است  
 المداره موضعه و اراده الکمک خانه  
 المداره موضعه و اراده الکمک خانه  
 المداره موضعه و اراده الکمک خانه  
 تاب عن صعبها و حسنا که رکه محظی بالدوڑه  
 معرفه  
 تاب حکم الکمک سبیلا و قبیله الکمک طبله و صدریت داره مسله  
 حصل حکم الصفره علی الکمک و سطینه همان کلک قطب الداره الصفره  
 ضفت خط الداره الکمک سارکلکه را اینجا ایسا و حسنه تاب حکم و ضفت  
 علی خط ستم سطینه علی خط ایسا دره همین طرف ایسا دره علی خط  
 ایساط، واذ اغیره مداره ملتند نانیم و داره مکان الغترة  
 المداره موضعه و مجهه بالدید کلک دنیا و القمر و مذریت  
 که ایڑی عصمه بر حافظه رفعه مای تو در من الشیخ و مبنی این

# Preserve and develop classical heritage!

# Renaissance (1450 – 1600 AD)



(Leonardo da Vinci, La Gioconda)

Rebirth of activity in arts and sciences!

# Renaissance (1,450 – 1,600 AD)



Copernicus  
(1473-1543)

**Copernican Revolution:** (De Revolutionibus, 1543)

Earth-centered → Sun-centered universe

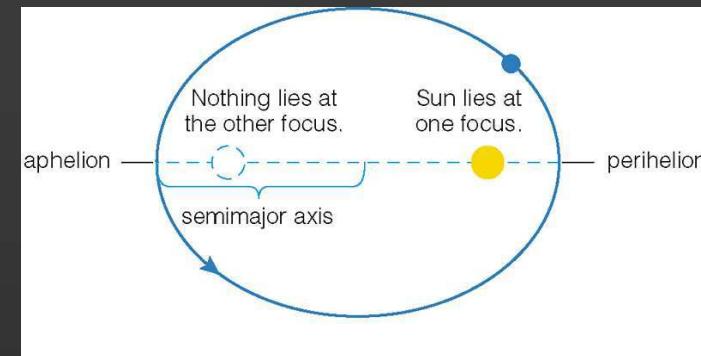
# The Baroque Period (1600 – 1750 AD)



(Rubens, Battle of the Amazons)

The Scientific Revolution!

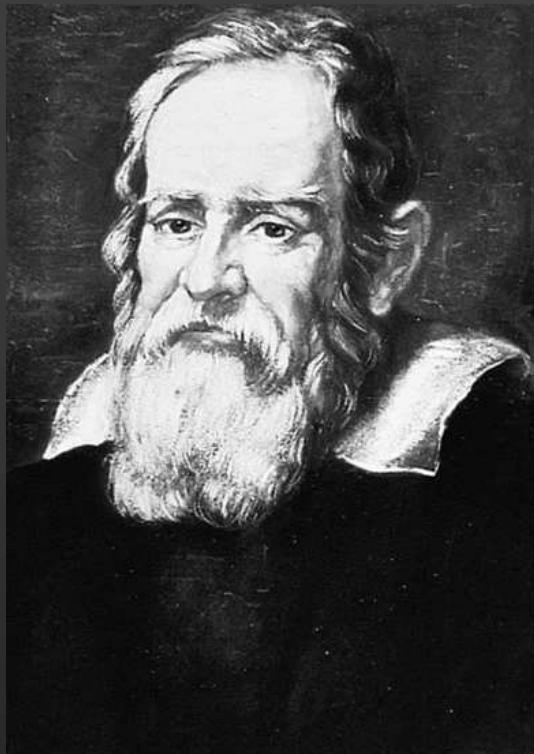
# The Baroque Period (1600 – 1750 AD)



- Planets move in elliptical orbits around Sun

Kepler (1571-1630)

# The Baroque Period (1600 – 1750 AD)

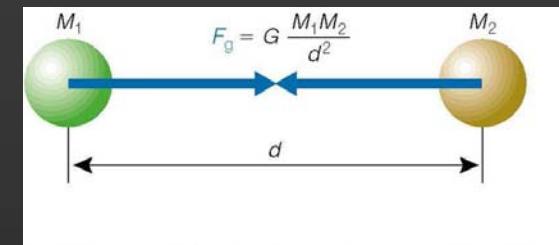


Galileo (1564-1642)

Observations January 1610			
2. S. 1610:	March 12	O **	
3. mon		** O *	
2. x 6n:		O *** *	
3. mon		O * *	
3. Ho. 5.		* O *	
4. mon.		* O **	
6. mon		** O *	
8. mon	March 13.	*** * O	
10. mon		* * * O *	
11.		* * O *	
12. H. 4 nigh:		* O *	
13. mon		* ** O *	

Telescopic Discoveries

# The Baroque Period (1600 – 1750 AD)



## Law of Universal Gravity

Newton (1642-1727)

# The Enlightenment (1750 – 1830 AD)



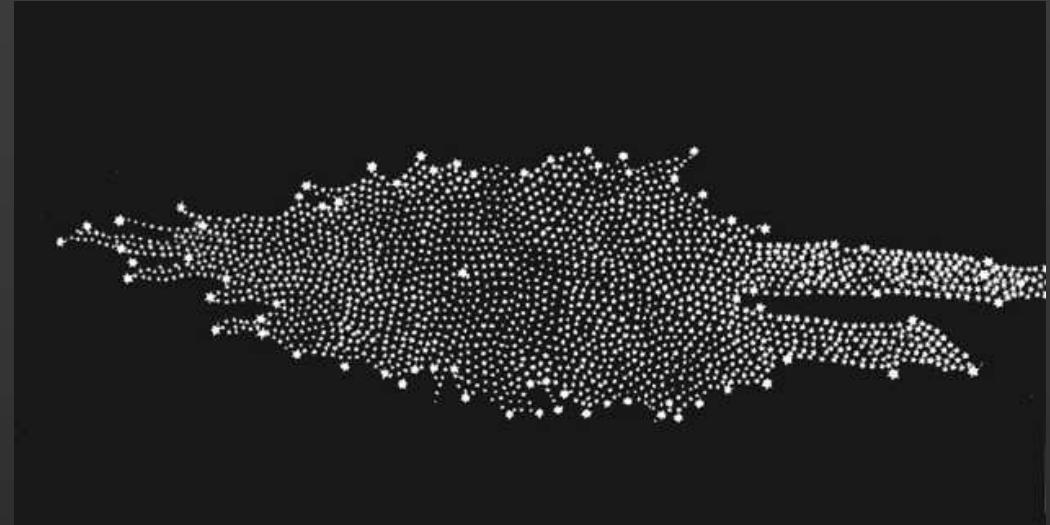
(Portrait of Denis Diderot  
→ Encyclopédie)

Science comes of Age!

# The Enlightenment (1750 – 1830 AD)



Sir William Herschel  
(1738-1822)



Shape of Milky Way Galaxy

→ Discoverer of Uranus, 1781

# The Victorian Age (1830 – 1900 AD)



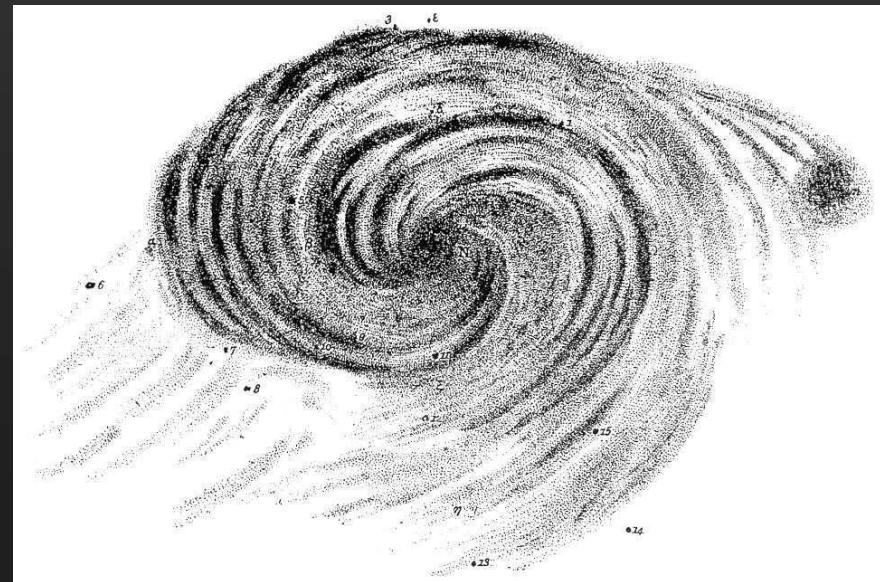
(Crystal Palace, London, Great Exhibition of 1851)

Dynamic interplay between science and technology!

# The Victorian Age (1830 – 1900 AD)



William Parsons  
(1800 – 1867,  
3<sup>rd</sup> Earl of Rosse)



Spiral Nebulae

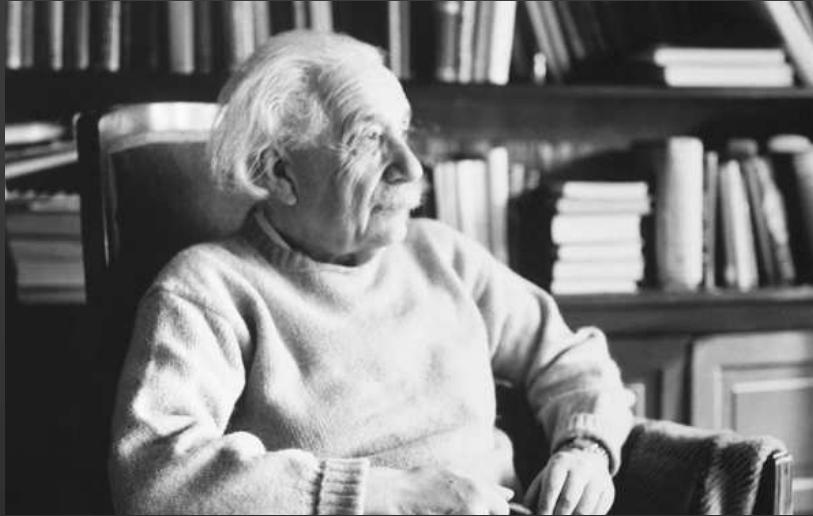
# The 20<sup>th</sup> Century



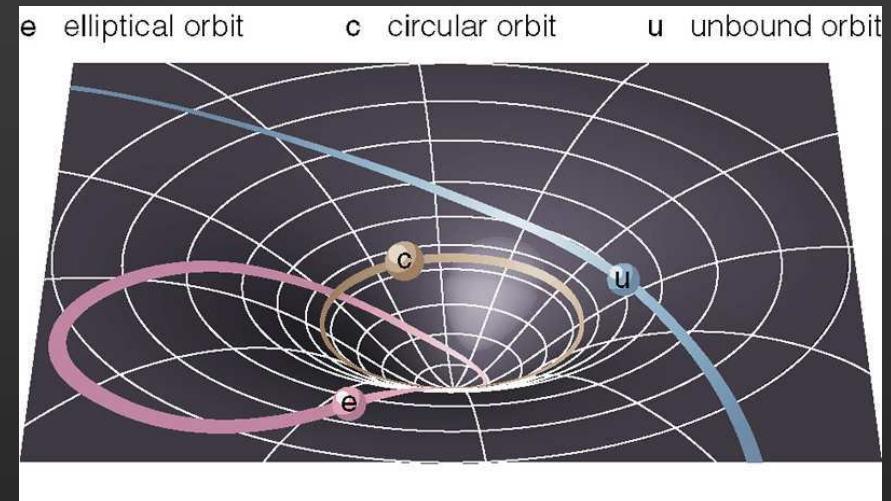
(Picasso, Guernica 1937)

Towards our modern view of the universe!

# The 20<sup>th</sup> Century



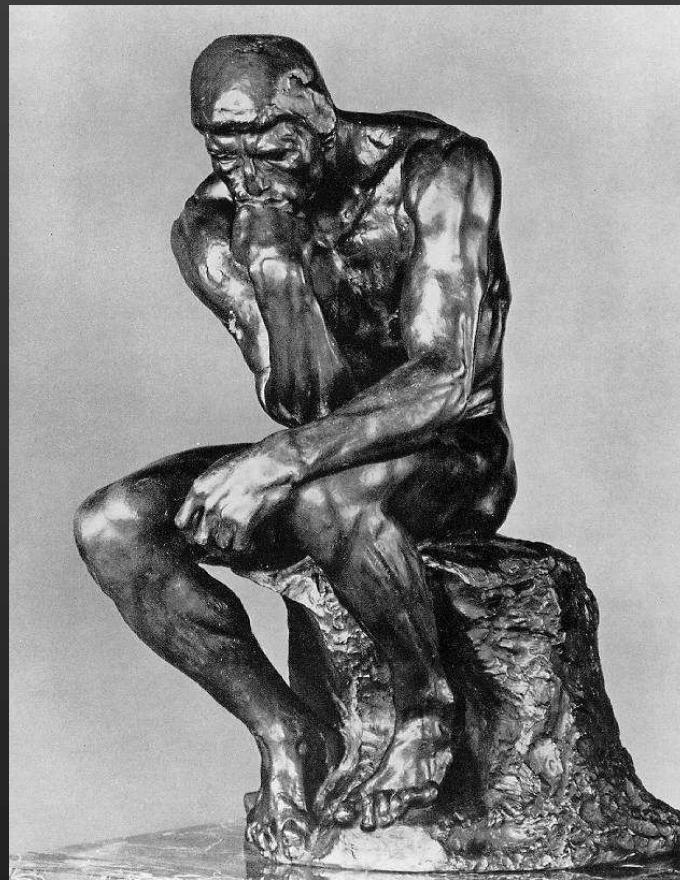
Einstein, 1879 - 1955



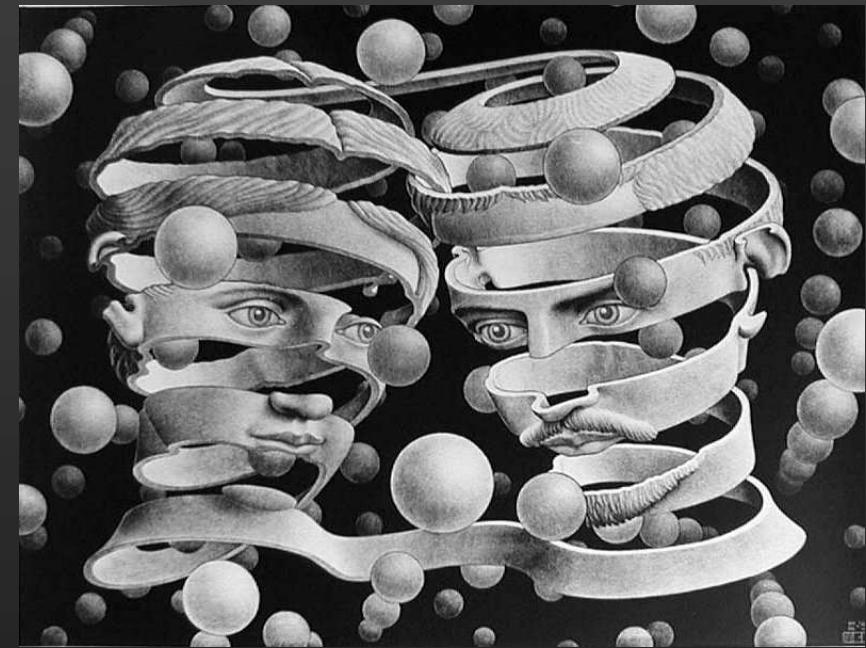
General Theory of Relativity:

Gravity = curved spacetime

# History of Astronomy: The Story of Humanity



Auguste Rodin,  
The Thinker (1880)



M. C. Escher,  
Bond of Union (1956)