



## Introduction

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Astronomical nomenclature is still strongly influenced by this tradition

⇒ appreciation of history of astronomy is required for understanding even today's astronomy (many terms used are based on this history).

## Babylon



**Babylonian astronomy:** Earliest astronomy with influence on us:  $\sim 360$  d year

$\implies$  **sexagesimal system** [360:60:60], 24h day,  $12 \times 30$  d year, . . .

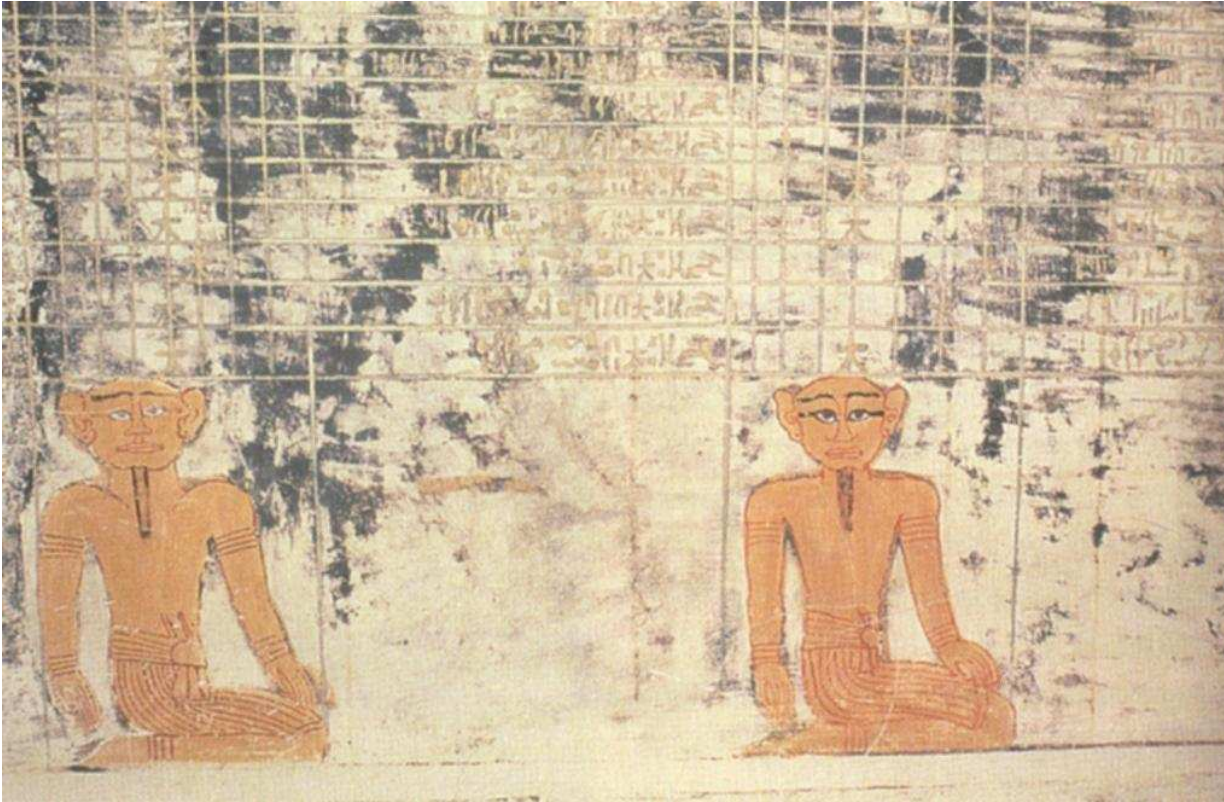
**Enuma Elish** myth ( $\sim 1100$ BC): Universe is place of battle between Earth and Sky, born from world parents.

Note similar myth in the Genesis. . .

*Image:* Mul.Apin cuneiform tablet (British Museum, BM 86378, 8 cm high), describes rising and setting of constellations through the babylonian calendar. Summarizes astronomical knowledge as of before  $\sim 690$  BC.



## Egypt



Egyptian coffin lid showing two assistant astronomers, 2000 . . . 1500 BC; hieroglyphs list stars (“decans”) whose rise defines the start of each hour of the night.

(Aveni, 1993, p. 42)

~2000 BC: 365 d calendar ( $12 \times 30$  d plus 5 d extra), fixed to Nile flood (heliacal rising of Sirius), star clocks.

*heliacal rising*: first appearance of star in eastern sky at dawn, after it has been hidden by the Sun.





## Greek/Roman, I



Atlas Farnese, 2c A.D., Museo Archeologico Nazionale, Napoli

**Early Greek astronomy:** folk tale astronomy (**Hesiod** (730?–? BC), *Works and Days*). Constellations.

**Thales** (624–547 BC): Earth is flat, surrounded by water.

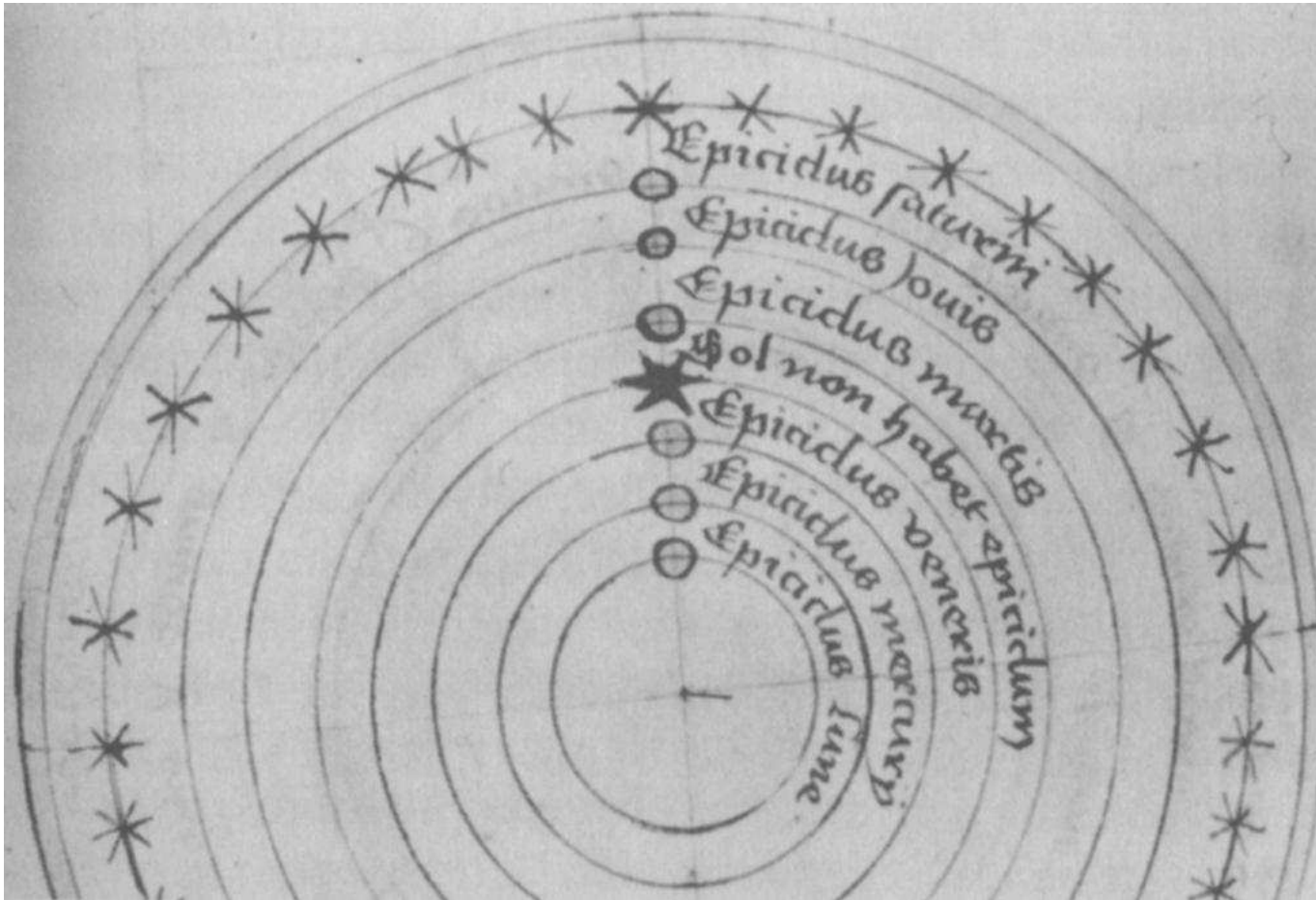
**Anaxagoras** (500–428 BC): Earth is flat, floats in nothingness, stars are far away, fixed on sphere rotating around us. Eclipses: due to Earth's shadow.

**Eudoxus** (408–355 BC): Geocentric, planets affixed to concentric crystalline spheres. **First real model for planetary motions!**

**Aristarchus** (310–230 BC): Determination of relative distance to Moon and Sun (factor 20).



## Greek/Roman, II



**Aristotle** (384–322

BC, *de caelo*):

Refinement of

Eudoxus model:

add spheres to

ensure smooth

motion

⇒ Universe filled

with crystalline

spheres (*nature*

*abhors vacuum*).

⇒ Central philosophy until ~1450AD!

**Hipparchus** (?? – ~127 BC): Refinement of geocentric Aristotelian model into tool to make predictions.



## Greek/Roman, III



(Aveni, 1993, p. 58)

**Ptolemaeus** (~140AD): *Syntaxis* (aka *Almagest*): Refinement of Aristotelian theory into model useable for computations  
 $\Rightarrow$  **Ptolemaic System.**





## Renaissance, I



**Nicolaus Copernicus** (1473–1543):  
Earth centred Ptolemaic system is too complicated, a Sun-centred system is more elegant.



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(Gingerich, 1993, p. 165)

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**Copernican principle: The Earth is not at the center of the universe.**





## Renaissance, IV



**Tycho Brahe** (1546–1601): Visual planetary positions of highest precision reveal flaws in Ptolemaic positions.

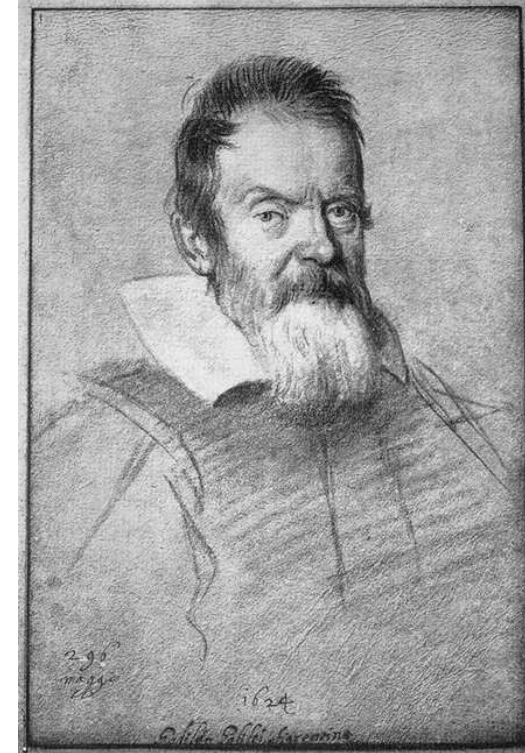




## Renaissance, V



**Johannes Kepler** (1571–1630):  
Planets orbit on **ellipses** around  
Sun, not on **circles**, laws of motion.



**Galileo Galilei** (1564–1642): Moons of  
Jupiter, moving around Jupiter  
(Kepler  $\implies$  similar to heliocentric  
model!)



## Newton



(Newton, 1730)

**Isaac Newton** (1642–1727): Newton's laws, physical cause for shape of orbits is gravitation

(*De Philosophiae Naturalis Principia Mathematica*, 1687).

⇒ Begin of modern physics based astronomy.

Aveni, A. F., 1993, *Ancient Astronomers*, (Washington, D.C.: Smithsonian Books)

Gingerich, O., 1993, *The Eye of Heaven – Ptolemy, Copernicus, Kepler*, (New York: American Institute of Physics)

Newton, I., 1730, *Opticks*, Vol. 4th, (London: William Innys), reprint: Dover Publications, 1952



## *The Planets: Overview*