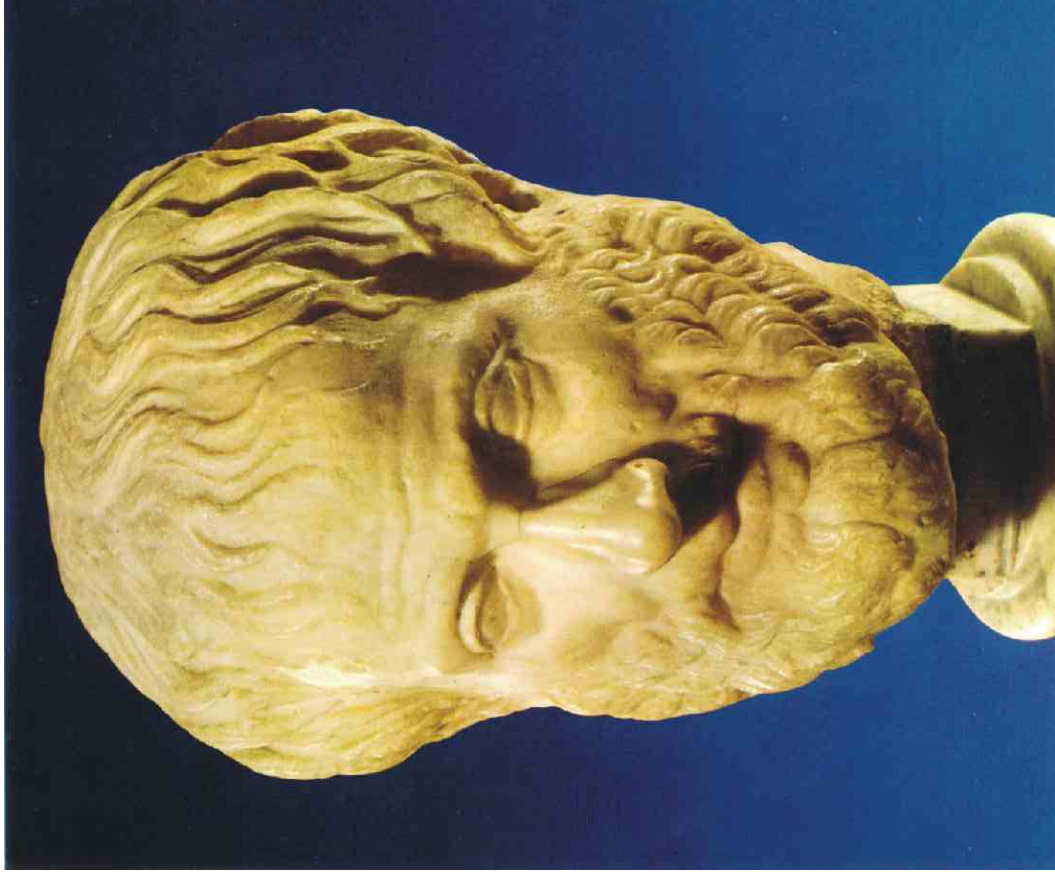


“All men by nature
desire knowledge”



Aristotle, 384 – 322 BCE

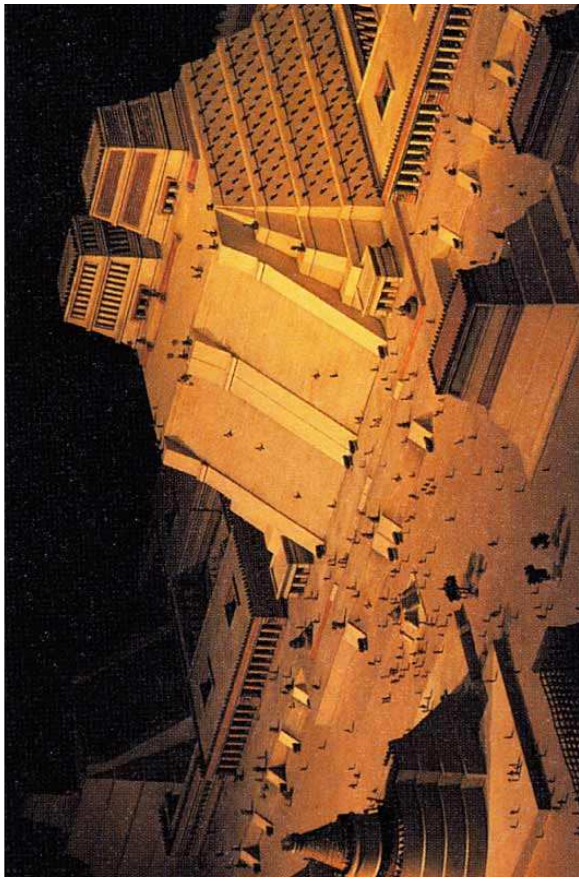
What We Will Learn Today

- How did ancient astronomy (likely) begin?
- Why did early humans pursue astronomy?
- What astronomical beliefs were held for centuries?

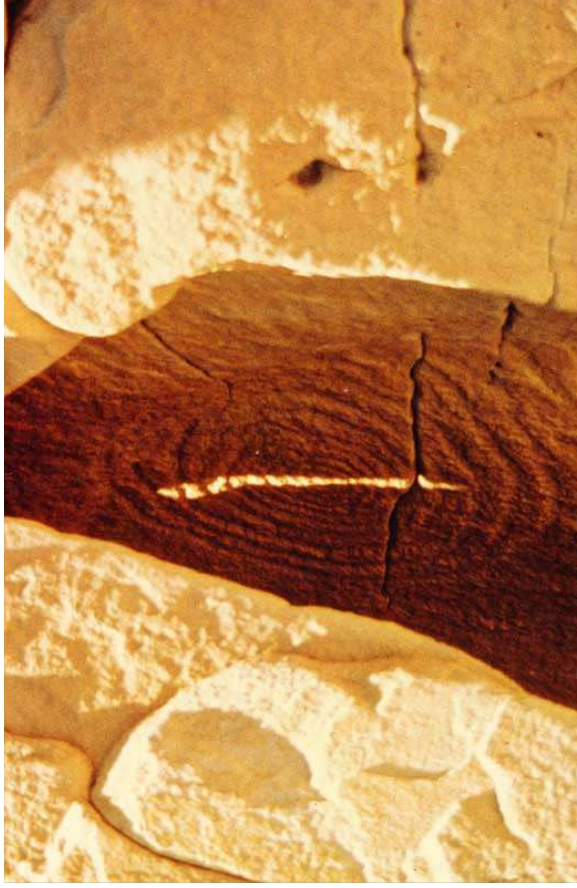
Speculations re. Ancient Astronomy



Stonehenge 3100 – 1550 BCE, England



Templo Mayor, Aztec, Mexico City



The Sun Dagger, Anasazi, New Mexico



Big Horn Medicine Wheel, Wyoming

Inevitable Ancient Astronomy

- People were very aware of the sky!
 - Very dark skies
 - No light pollution on Earth
 - How many of you have seen the Milky Way?
 - People spent more time outdoors
 - Not much other source of entertainment
 - Skies were magnificent and evoked a sense of wonder!



Benefits of Ancient Astronomy

- Telling time
 - Sun at meridian implies noon
 - What do *am* and *pm* stand for?
 - First quarter moon about to set implies approaching midnight
 - Constellations rising / setting also used to tell time
 - Shadow of obelisks used to tell time during the day
- Telling seasons
 - Equinoxes, solstices used to predict seasons
 - Very useful for planning farming activities
- Celestial navigation
 - Exploration of Earth required knowing the stars!

Moon Helps Predict Earth Weather

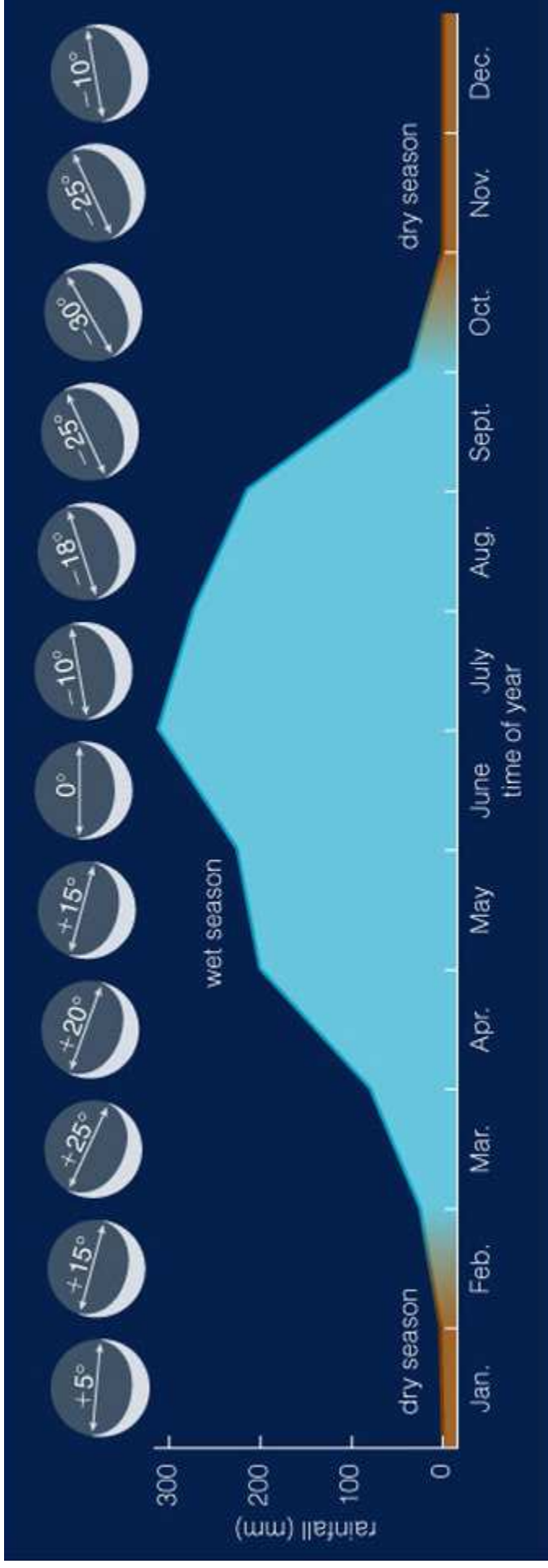


Fig 3.1

- Central Africa
 - Orientation of crescent Moon relative to horizon used to predict rainfall season
 - Only two seasons at the Equator – dry and rainy: Why?
- Lunar calendar carved into animal bone
 - 6500 BCE!

Ancient Greek Astronomy

- Knew of stars, plus:
 - Mercury, Venus, Mars, Jupiter, Saturn (Naked-eye planets)
 - Sun, Moon
 - Seven objects, seven days of the week!
- Observations of planets
 - Wandered (defined the word planet)
 - Changed brightness
 - Changed apparent speed
 - Changed direction (retrograde motion)
- Model created to fit observations
 - Geocentric Model

The Geocentric Model

- Earth is at center of the Universe
- Moon, Mercury, Venus, Sun, Mars, Jupiter, Saturn have individual rings
- Stars inhabit the outermost sphere
- Orbits are perfect circles, traversed at constant speed
 - Heavenly perfection
- Supporting evidence
 - Could not measure parallax for stars

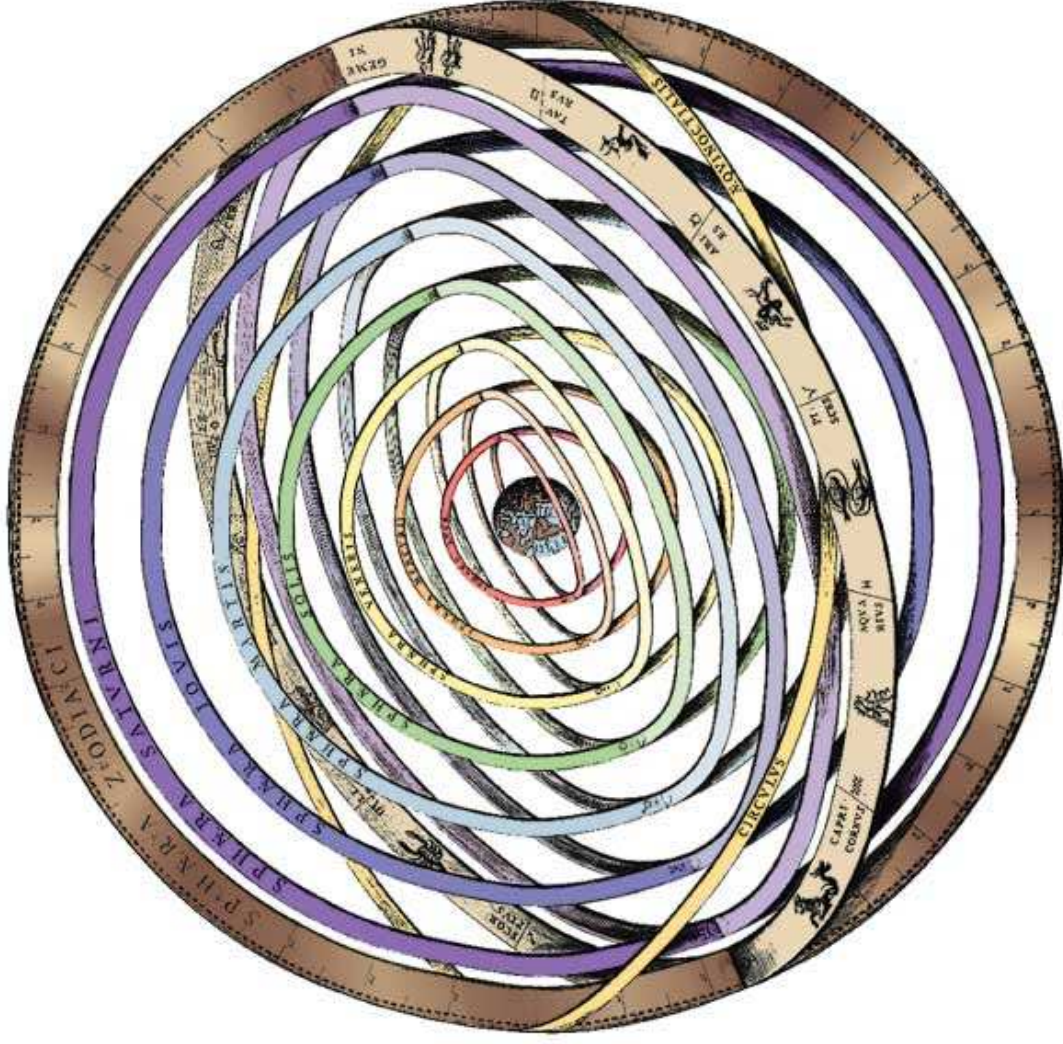
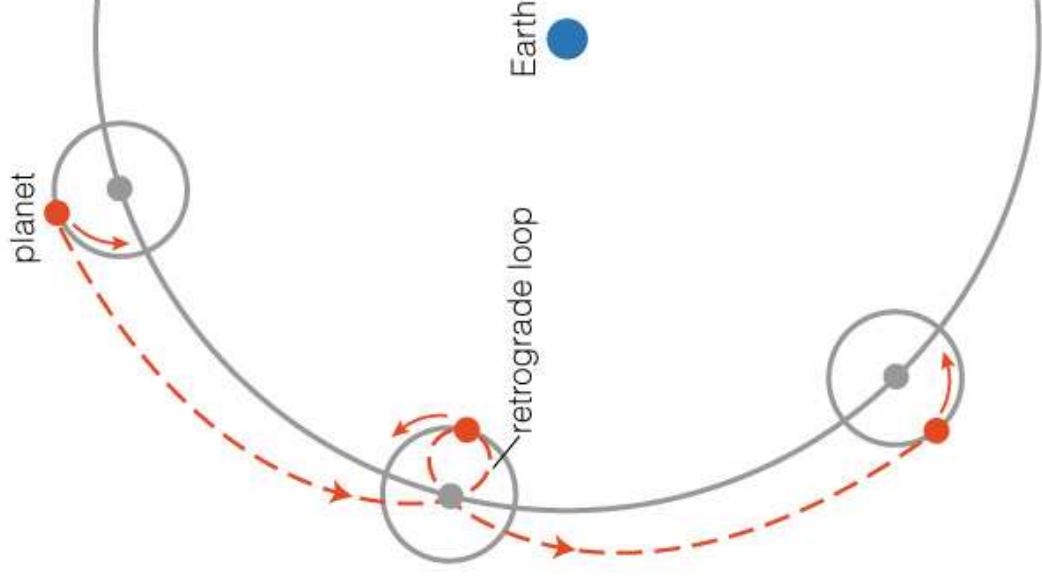


Fig 3.14

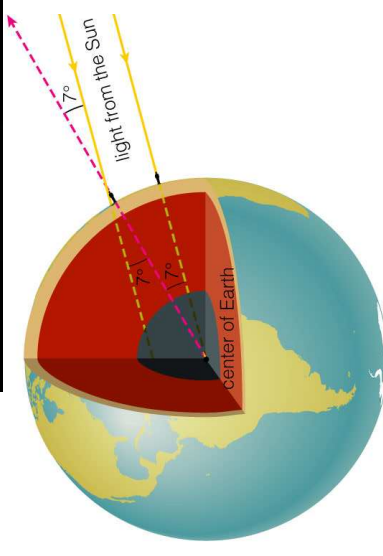
Scientific Method at Work

- How do we explain retrograde motion?
 - Planets can't move at a constant speed
- Solution: Add nested spheres
 - Eudoxus (400 – 347 BCE)
- Could explain all observations
 - To precision of observations
- Aristotle (384 – 322 BCE)
 - Endorsed and explained this model
- Ptolemy (100 – 170 CE)
 - Synthesized the Geocentric model
 - Used circle upon circle to explain retrograde motion: *Epicycles*
- This model stood for ~ 2,000 years!
 - Ptolemaic Model



Shape of the Earth

- Flat Earth: Thales (624 – 546 BCE)
 - “Father” of the scientific method
 - Asked the question “what is in the universe?”
- Cylindrical Earth: Anaximander (610 – 546 BCE)
 - Constellations seen vary by latitude
- Spherical Earth: Pythagoras (560 – 480 BCE)
 - Aristotle later used the shape of Earth’s shadow seen in lunar eclipses to confirm this view
- Measuring the Earth: Eratosthenes (240 BCE)
 - Ingenious method, great result!
 - Circumference = 250,000 stadia = 42,000 km
 - Modern value = 40,000 km



Sun-Centered Model in BCE?

- Aristarchus (310 – 230 BCE)
 - Contemporary of Aristotle
 - Proposed that all planets, including Earth orbit the Sun
 - Built on the work of Heracleides (388 – 315 BCE)
 - Mercury and Venus are always close to the Sun on our sky, so must orbit the Sun
 - Earth rotates on its axis
 - Simple & elegant explanation of retrograde motion (remember Occam's Razor)
- However, this model was rejected for 1,600 years!
 - Until the Copernican Revolution