

## A Brief History of Astronomy

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### Early Man

- It was believed that the heavens held power over earthly existence
  - Different star patterns appeared in the sky when it was time to plant and harvest
  - Lunar cycles appeared to control fertility
  - Stonehenge (constructed between 3100-2000 BCE) is designed to align with the summer solstice

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### Babylonians (~1600 BCE)

- Earliest written records are of astronomical observations
  - Position of planets
  - Times of eclipses

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### Chinese (~1059 BCE)

- Kept careful records of events in the skies, particularly the appearance of “guest stars”
  - Comets, novae, and other transients
- Most important record is of a guest star that was bright enough to be seen during the day in the constellation that we call Taurus in 1054 BCE
  - This is the supernova explosion that resulted in the Crab Nebula

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### Pythagoras of Samos (~580-500 BCE)

- Planets were attached to crystalline spheres, one for each planet, that produced the “Music of the Spheres”
- The spheres were centered on Earth and the earth was moving
- Recognized that the “morning star” and “evening star” is Venus

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### Thales ~480 BCE

- Used Babylonian records to predict eclipses

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Aristotle  
384 - 322BCE

- Earth was situated at the center of the universe
- Adopted Pythagoras' model of concentric spheres for the planets but deduced that the Earth must be immobile

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Heraclides  
~330 BCE

- Developed a geocentric model of the solar system in which the planets, sun and moon orbited the earth in perfect circles

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Aristarchus of Samos  
~310-230 BCE

- Concluded that the solar system must be heliocentric according to his geometrical estimates of the relative sizes and distances of the earth, moon, and sun

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### Eratosthenes of Cyrene

276 – 197 BCE

- Developed a map of the world and estimated the circumference of the Earth
- He calculated a value of 40 320 km
  - The current accepted value is 40 030 km

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### Hipparchus

~100 BCE

- Produced first star catalog and recorded the names of constellations

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### Claudius Ptolemy

~85-165 CE

- Developed a mathematical model of the motions of the solar system based on the geocentric model and circular orbits
- Complex model included epicycles to account for retrograde motion

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**Nikolas Kopernig (Copernicus)**  
**1473-1543**

- Developed a heliocentric model of the solar system with circular orbits
- Established the proper order of the planets outward from the sun

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**Tyge (Tycho) Brahe**  
**1546 - 1601**

- Made meticulous observations with instruments that he designed
- Observed a supernova in 1572 and a comet in 1577 and was able to show that they were beyond the moon
- Developed his own model with the earth in the center, but the planets orbiting the sun

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**Johannes Kepler**  
**1571-1630**

- Used Brahe's observations to make highly precise calculations of planetary orbits
- Developed three rules for the orbits of planets
  - Orbits of the planets are ellipses with the Sun at one focus
  - The planets sweep out equal areas during equal times of the orbit

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– The square of the orbital period is proportional to the cube of the planet’s distance from the sun

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**Galileo Galilei**  
**1564-1642**

- Made a number of discoveries in astronomy using telescopes of his own design
  - Sunspots on the sun
  - Craters and mountains on the moon
  - Moons of Jupiter (Io, Europa, Callisto, and Ganymede)
  - Rings of Saturn
  - Phases of Venus

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**Isaac Newton**  
**1642 - 1727**

- Developed the science of mechanics
- Mathematically described motion
- Invented calculus to perform the mathematics necessary to do the calculations necessary for describing motion
- Provided a mathematical basis for Kepler’s rules of planetary motion

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### Some Other Discoveries

- 1781, William Herschel discovered Uranus
- 1846, Hohan Galle discovered Neptune
- 1910, Harlow Shapley estimated the size of the milky way
- 1924, Edwin Hubble established that the Andromeda nebula and other “spiral nebulae” are star systems like the Milky Way
- 1929, Hubble & Milton Humason discovered that the universe is expanding

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- 1930, Clyde Tombaugh discovered Pluto
- 1931, Karl Jansky observed that the nucleus of the Milky Way and other celestial objects are strong sources of radio waves
- 1938, Hans Bethe determined that the Sun’s energy comes from thermonuclear fusion reactions
- 1948, George Gamov developed the Big Bang Theory of the origin of the universe

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- 1950s, chemical composition of stars
- 1960s, quasars, x-rays, infrared astronomy
- 1965, Arno Penzias and Robert Wilson from Bell Laboratories discovered the cosmic microwave background radiation remnant of the Big Bang
- 1968, Jocelyn Bell & Anthony Hewish discovered pulsars

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