

## ASTRONOMERS THROUGH THE AGES

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### EARLY ASTRONOMERS- THALES OF MILETUS (624 – 546 BCE)

- Studied solstices, equinoxes, and the seasons
- He thought stars were balls of earth on fire
- Proposed water was origin of all things
- Inspired later thinkers such as Aristotle

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### EARLY ASTRONOMERS- EUDOXUS OF CNIDUS (390 – 337 BCE)

- A scientific approach grounded in both observation and geometry
- Substantially advanced proportion theory
- Described constellations and star risings
- Wrote one of the earliest systematic descriptions of the known world
- Created the first geometric model of the heavens

Eudoxus's model of planetary motion.

Animation depicting Eudoxus's model of retrograde planetary motion.

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### EARLY ASTRONOMERS- ARISTARCHUS OF SAMOS (310 – 230 BCE)

- Proposed;
  - Earth rotated once on its axis per day
  - Earth orbited the sun once per year
  - Sun is a star, just much closer to us than the others
- Estimated;
  - Sun is much larger than the Earth
  - Sun is much farther away than the moon
  - Earth's shadow during a lunar eclipse about twice moon's diameter

Aristarchus's third-century BC calculations on the relative sizes of (from left) the Sun, Earth, and Moon, from a tenth-century AD Greek copy

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### GRECO-ROMAN ASTRONOMY – THEON OF SMYRNA (70 – 135 CE)

- Observed Mercury and Venus
- Wrote key textbook for understanding Greek astronomy
- Linked astronomy with musical harmony
- Clarified the structure of the heavens for non-experts

**THE HARMONIC COSMOS**

- FIXED STARS (outermost sphere; perfect consonance)
- SATURN (sphere 7) Deep, slow tone – lowest pitch
- JUPITER (sphere 6)
- MARS (sphere 5)
- SUN (sphere 4) Central harmonic pivot of the planets
- VENUS (sphere 3)
- MERCURY (sphere 2)
- MOON (sphere 1) Highest pitch – fastest motion
- EARTH (centre)

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### GRECO-ROMAN ASTRONOMY – CLEOMEDES

- Complements the work of Theon of Smyrna
- Gave clear physical explanations of celestial phenomena
- Preserved stoic cosmology and natural philosophy
- Documented Posidonius' method for calculating Earth's circumference

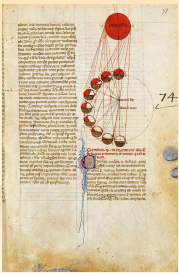
**THE STOIC COSMOS – A RATIONAL UNIVERSE**

- (Outer Fire) Celestial Sphere
- Perfect, circular motions governed by reason
- (Middle Region) Sun • Moon • Planets • Stars
- Bodies made of divine, intelligent fire
- (Inner Region) Earth at the centre
- A living part of the cosmic organism
- Everything connected • Everything purposeful
- The cosmos is a single, ordered whole

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### ISLAMIC GOLDEN AGE – AL-BATTANI (D. 929 CE)

- Established his own observatory at Raqqa where he conducted;
  - Solar observations
  - Lunar observations
  - Planetary observations
  - Star cataloguing
  - Eclipse observations
- Produced highly accurate trigonometric tables

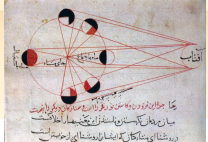


A folio from a Latin translation of Kitāb az-Zij as-Sābi' (c. 900)


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### ISLAMIC GOLDEN AGE – AL-BIRUNI (973-1050)


- He created diagrams of lunar phases, refined astronomical tables, and analysed celestial refraction.
- Measured Earth's radius with astonishing accuracy
- Challenged geo-centrism
- He produced multiple major texts on astronomy



Al-Biruni's chart of the lunar phases



Al-Biruni, Soviet commemorative stamp, 1973




Al-Biruni, Afghan commemorative stamp, 1973


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### ISLAMIC GOLDEN AGE - NASIR AL-DIN AL-TUSI (1201-1274)

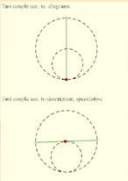
- Built the Maragheh Observatory
- Produced the Ilkhanic Tables
- Created "Tusi Couple"



The Astronomical Observatory of Nasir al-Din Tusi.



A stamp issued in the republic of Azerbaijan in 2009 honouring Tusi





An animated model of a Tusi couple

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### THE TELESCOPIC REVOLUTION – CHRISTOPH SCHEINER (1573 – 1650)


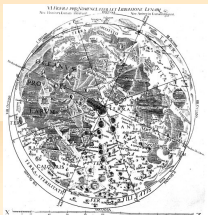
- Jesuit priest and rival to Galileo
- Devised the helioscope for safe projection of the Sun's image
- Built first refracting telescope of its kind
- First to publish telescopic sunspot observations
- Helped determine the Sun's rotation period and the tilt of its rotational axis
- Wrote Rosa Ursina, one of the great works of early solar astronomy.

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### THE TELESCOPIC REVOLUTION – GIOVANNI BATTISTA RICCIOLI (1598 – 1671)

- Known for his "Almagestum Novum" (1651)
- Produced the first detailed lunar map
- Discovered the first double star
- Experimented with Falling Bodies and Pendulums






Map of the Moon from the New Almagest

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### THE AGE OF THE CELESTIAL MECHANICS - WILLIAM PEARSON (1767-1847)


- Co-founder of the Royal Astronomical Society
- A highly skilled observer and instrument-maker
- Author of "An Introduction to Practical Astronomy"
- A champion of accessible astronomy

Orrery designed by William Pearson now in the Science Museum

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### THE AGE OF CELESTIAL MECHANICS – MARY SOMMERVILLE (1780 – 1872)



- One of the first two women ever elected Honorary Members of the Royal Astronomical Society
- 1842 discussed a hypothetical planet perturbing Uranus
- The first person ever described as a “scientist”
- Her obituary called her the “queen of science”


Page 157 from *Mechanism of the Heavens*, Somerville discusses the law of universal gravity and Kepler's laws of planetary motion.

Cover page of “On the Connexion of the Physical Sciences”





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### THE MODERN AGE – ROGER LANGDON (1825 – 1894)



- Self-educated amateur astronomer
- Built multiple telescopes
- Constructed a garden observatory
- Published a paper “The Markings of Venus”
- Developed a method for photographing the Moon and the transit of Venus
- Made a plaster model of the visible Moon




Credit: Graham Parnell, Silvertown Local History Society

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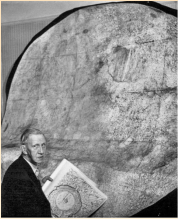
### JOHANNES VON GUMPACH (1814 – 1875)



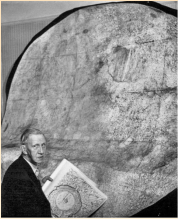
- Early life:
  - Born in Germany
  - Moved to London
  - Arrested for embezzlement
- Turned up in Germany as a self declared Baron
- Moved to Jersey & began career as an astronomer however he believed...
  - “Newton’s gravity was nonsense”
  - “The Earth was really lemon shaped”
  - “Comets were baby worlds”
- Appointed professor of Mathematics and Astronomy in Peking but...
  - Taught neither mathematics nor astronomy
  - Still drew his salary of £600 per year
  - Offered a year’s salary and a free passage home on his resignation
  - Didn’t go, sued for defamation of character

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### THE MODERN AGE – HUGH PERCY WILKINS (1896 – 1960)



- Member of the BAA, Fellow of the RAS
- Famous for his moon maps;
  - The 100-inch Map (1940s)
  - The 300-inch Map (1951)
- Mentor to and later collaborator with Patrick Moore
- Wrote widely to popularise astronomy
- Became a media favourite and drifted towards sensational excess
- Criticised publicly in BAA journal and resigned shortly afterwards
- His fall from grace partially assisted Patrick Moore’s rise to fame



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