

ASTRONOMY 9: HISTORY OF COSMOLOGY
Handout #7

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Astrology and Ancient Astronomy

I. Astrology vs. Astronomy

- Do not confuse these, or you will offend your friendly neighborhood (modern) astronomer!!
- Astronomy: science of the heavens
- Cosmology: study of the universe as a whole (incorporates a wide range of physics and astronomy)
- Astrology: unfounded superstition

II. Why discuss astrology in a history of science course?

- Until about 1700, little distinction between astrology/astronomy (e.g., Kepler)!
- Nearly half of Americans today still believe astrology has some “scientific” validity!
- Important to understand why, and how to challenge
- Astrology is as implausible as “jetology” (see Fraknoi article in reader)

III. History of astrology (Cowling)

- Chaldean (Mesopotamian) astrology
 - Little concern with individual personal forecasting
 - Forecasts for empires, wars, etc.
- Ptolemy (2nd century AD, Egypt, Greek Empire)
 - Systematizes Sun-sign astrology in *Tetrabiblos*
 - Similar to modern form of astrology
- Greek skeptics (e.g., Carneades)
 - Why can twins with same horoscope suffer different fates?
 - Not all men who fall in the same battle have the same horoscope.
 - Personal characteristics more tied to, e.g., ethnicity than time of birth
- Christianity
 - St. Augustine (5th century AD)
 - * Astrology leaves no room for God’s will
 - * Must be associated with devil
 - Degree of repression of astrology varies
- Question of free will vs. determinism
 - The stars “tilt but do not compel”?
- Some modern arguments against astrology (see also articles in reader)
 - Why is time of birth more important than conception?
 - Why isn’t the astrologer rich(er)?
 - The signs (constellations) are illusory: stars at different distances, patterns change completely over millions of years
 - Precession of the equinoxes (26,000 yr period)
 - * Signs have moved out by one whole place!
 - * Astrologers still use old dating system
 - * Sun is now in Ophiuchus for several days each year; why isn’t it a sign?
 - New planets: Uranus, Neptune, Pluto
 - Bizarre nature of the implied “force”
 - * If depends on distance (like gravity or EM), cell phones and books should have far greater influence
 - * If independent of distance, what about quasars, neutron stars, etc?

- Astrology falsely assigns central importance to humanity, Earth’s place in the cosmos
 - * Product of an Earth-centered cosmic system
 - * Celestial physics thought very different from earthly
 - * “Wanderers” (visible planets, sun, moon) thought to have divine power, influence over man
- Today we know planets are just big balls of rock and gas!
- No more influence on your personality than the positions of all the world’s jets (“jetology”)

IV. Basic motions in the sky visible to naked eye

- Daily (diurnal) rotation of “sphere” of the heavens
 - Really rotation of Earth about its axis
 - Axis is inclined by 23.5° to orbital plane
- Sun, Moon, planets (“wanderers”) confined to a strip around the sky (ecliptic, constellations of the zodiac)
- Approximately annual motions of Wanderers along the ecliptic
 - Really orbital motion of Earth around Sun, plus planetary orbital motions
- Complicated behavior: planets sometimes stop and reverse course for a while (retrograde motion)
- At noon, Sun is furthest north on summer solstice, furthest south on winter solstice, crosses celestial equator at spring/fall equinoxes
- Monthly motion of Moon, 29.5-day cycle of phases
 - Eclipses are rare (not every month) because Moon’s orbit is tilted by 5° compared to plane of Earth’s orbit
- Precession of the equinoxes
 - 26,000-year circular motion of Earth’s axis
 - North Pole currently points near Polaris, but not always!
 - Motion like a spinning top
- Stars seem fixed on timescale of civilization, but really move

V. Ancient Astronomy

- Very old! Lascaux cave paintings, about 17,000 BC!
- Celestial events are predictable (if you wait long enough to see the pattern, and/or understand why they occur)
- Alone among “exact” sciences for thousands of years
- Astronomical order tied to social and religious needs
 - Time-keeping and calendars
 - Agriculture: when to plant or harvest crops
 - Religion: gods control heavenly events
- Egypt
 - Pyramids are monumental feats of engineering
 - Celestial alignments accurate to a few arc minutes (1/60th of degree)!
 - Used diurnal motions as a clock
- Babylonia
 - Developed sexagesimal (60) counting system
 - * Still used for time (hours, min, sec) and angles (degrees, arc-minutes, arc-seconds)!
 - Tables of planetary motion
 - Prediction of eclipses and heliacal risings (first appearance after invisible due to being near the sun)
 - Predictions made by looking for patterns in the times of events
 - No understanding of *why* events occurred, no pictures of orbits, no geometry!
- China
 - Well-preserved historical records dating back 3000 years
 - Oldest records of comets, eclipses, sunspots, etc.

- Recorded supernovae in 1006 and 1054 (mostly ignored in Europe though as bright as full moon!)
- Astronomy tied to political bureaucracy and functioning of government
- Decline in importance of astronomy after about 1200 AD
- Mayans (S. America)
 - Complicated, highly accurate calendar system
 - Precise tables for motions of Moon and Venus
 - Prediction of solar eclipses
- Celts
 - Stonehenge: impressive stone monument, approx. 2000 BC
 - Purpose and function unknown; probably religious, probably *not* an astronomical calculator
 - At least one astronomical alignment: sunrise at summer solstice