Course Plan

Objective

To come away with an understanding of

- how astronomy developed,
- what contemporary astronomy studies,
- and what’s in the winter sky.
Course Plan

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<td>1. History of Astronomy – Ancient Astronomy</td>
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<td>2. History of Astronomy – Scientific Era</td>
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Course Plan

Discussion Schedule

1. History of Astronomy – Ancient Astronomy
2. History of Astronomy – Scientific Era
3. The Night Sky – Sky Orientation & Constellations
4. The Night Sky – Earth, Moon, Sun, and other Phenomena
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5. Contemporary Astronomy – Cosmology
6. Contemporary Astronomy – Current Experiments
**Course Plan**

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What would you like to have covered?
Today’s Plan

**History of Astronomy — Ancient Astronomy**

- A historical perspective
- What is science?
- Purpose of initial astronomy
- Astronomy in different cultures
Disclaimer

I am a physicist, not a historian

We will discuss history, science, and mythology.

But telling stories is mythologizing, too
### Archimedes (ca. 287-212 BCE)

- Renowned inventor, scientist, and mathematician
- Came close to inventing calculus
- Proved $A_{\text{circle}} = \pi r^2$, determined $\pi$ to $\sim 1 : 1000$
- Famously engineered defensive machines that thwarted the Romans
- Studied and explained levers; created block-and-tackle pulley systems
Parables $\neq$ History

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### Did he really...
- ...run naked through Syracuse after discovering his eponymous buoyancy principle?
- ...pull a ship with his little finger, using pulleys to multiply the force?
Timeline

Mediterranean

- Invention of Writing: 3200 BCE
- Bronze Age Begins: 3000 BCE
- 2800 BCE
- 2400 BCE
- 2000 BCE
- 1600 BCE
- Iron Age Begins: 1200 BCE
- 800 BCE
- 400 BCE

Mesopotamia

- Minoan Civilization Begins
- Giza Pyramids Constructed
- 3000 BCE
- Temple of Karnak
- 1600 BCE
- Deir el-Bahari
- Minoan Eruption
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- **Armana Period**: 800 BCE
- **Battle of Issus (Alexander vs Darius)**: 400 BCE

**Mesopotamia**
- **Uruk Period Ends**: 3000 BCE
- **Sumerian Civilization Begins**: 3000 BCE
- **Gilgamesh(?)**: 2800 BCE
- **Akkadian Empire Begins**: 2400 BCE
- **Neo-Sumerian Empire Begins**: 2000 BCE
- **Code of Ur-Nammu**: 1600 BCE
- **Babylonian Empire Begins**: 1200 BCE
- **Code of Hammurabi**: 800 BCE
- **Assyrian Empire Begins**: 400 BCE
- **Library of Ashurbanipal**: 400 BCE
- **Medes-Persian Revolution**: 400 BCE
- **Neo-Babylonian Empire**: 400 BCE
- **Persia defeats Babylon**: 400 BCE
What is Astronomy?

Astronomy is the study of “...the origins, physics, and evolution of planets, stars, galaxies, and the universe as a whole.” –Department of Astronomy, OSU
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- tests are *reproducible*
- hypothesis make *falsifiable predictions*
- limited by experimental accuracy
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Early Astronomy

Purely observational – focused on cataloguing

**Applied for**

- Marking the seasons
- Aligning lunisolar calendars
- Telling time at night
- Navigation
- Setting Religious events
  - astrology: divination/prognostication
  - religious/philosophical cosmologies

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Venus Tablet, ca. 1500 BCE
K.160, The British Museum

Etruscan Liver Chart, ca 400-300 BCE
Wikipedia Commons (Museo Civico)

Antikythera Mechanism, ca 150-100 BCE
National Archeological Museum of Athens
Egypt

Star Clock/Decan Chart
Image Credits: Wikimedia Commons

ca 1200 BCE  ca 1473 BCE

Decans:
- specific 36 star groups
- ~ 36 groups in a year
- 1 group every 10 days

Lunisolar Calendar (Luxor)
Image Credit: hudsonvalleygeologist, blogspot

- Solar Calendar:
  - 36, 10-day weeks
- Lunar Calendar:
  - 12 months, new moon
  - Synchronized: heliacal rising of Sirius
  - 5 day intercallary month
    - month of rest
    - spiritually dangerous
Mesoamerica (Maya)

Uxmal
- Codices show Venus synodic cycle
- Governors Palace: Venus built aligned not with Uxmal but with Venus’s Northern extreme

Chitzen Itza
- Caracol: built observatory with line-of-sights for 20+ events
- Temple of Kukulkan
  - Corners align with sunrise/set for solar culmination at zenith
  - Kukulkan slithers at the equinox
Anasazi

Chaco Canyon (ca 900 - 1150 CE)

Alignments

Great Houses:
- Pueblo Bonito & Chetro Ketl on the East-West geodesic
- Pueblo Alto & Tsin Kletsin North-South aligned
- Penasco Blanco & Una Vida lunar azimuthal maximum
- Pueblo Pintado & Kin Bineola lunar azimuthal minimum

Piedra del Sol
- Observation point: Sun ‘balances’ two weeks before the summer solstice
- eclipse of 1097 with corona?
China

**Taosi Observatory** ca 2200-2100 BCE

- 21-m wall forming an arc
- columns set into the wall foundation
- pit aligned with pillar gaps
- 2 gaps aligned with solstices

*Image Credit: He Nu, UNESCO/IAU*

**Astronomy**

- *bi* (gnomon) for measurements
- experimental mixed with philosophical Taoism, Confucianism, & Buddhism
- 6 flat Earth schools (3 major)
- zenith culmination ⇒ Earth-Sun distance

*Image Credit: Marilyn Shea, UMF*