Astronomy 135: Archaeoastronomy

Summer 2017

Instructor: Dr. Michael Faison
Office: Steinbach 315, 52 Hillhouse Ave.
E-mail: michael.faison@yale.edu

Introduction

Archaeoastronomy is the study of "old astronomy," often taken to mean astronomy before the use of telescopes. Archaeoastronomy is concerned with such issues as how people over time have interpreted celestial events, or how celestial events may have affected our overall worldview (cosmology). For example, the alignment of a building with the line of sight of the rising sun on a particular day might tell us something about the purpose of the building or the cultural significance of that particular day in a prehistoric culture.

The primary theme of this course will be *the interaction between naked-eye astronomy and human culture.*

This course will be presented in three main parts…

Part I: The Cycles of the Sky

We will cover all of the basic celestial cycles that have been used and interpreted in culture, such as the daily rotation of the earth, the seasonal motion of the Sun, the cycles of the moon, and the cycles of the planets. We'll discuss how to tell time or keep a calendar using these cycles, how to predict eclipses, and how to navigate using the Sun and the stars.

Part II: From the Babylonians to Galileo

We will follow the thread of the development of Western Cosmology from ancient Sumerian and Assyrian observations from the tops of ziggurats to the telescopic observations of Galileo that provided strong support for the new heliocentric model of the Universe.

Part III: Non-Western Astronomy and Cosmology

We will look at historical astronomy, astrology, and cosmology in several cultures that were isolated from Western science, including China and Southeast Asia, the Maya, the Incan Empire, and the Pre-Columbian American Southwest.

We will spend very little time discussing modern *astrophysics,* i.e., the application of terrestrial experimental physics to observed celestial phenomena. For example, for most of the course we will assume that the earth is stationary at the center of the Universe. We will discuss some ways that that archaeoastronomy has contributed to modern science– for example, in the dating of ancient supernovae or in understanding the historical orbits of comets.

Required Texts

Archaeoastronomy: Introduction to the Science of Stars and Stones, Magli, ISBN: 3319228811
http://amzn.to/2nozHDg
Stairways to the Stars: Skywatching in Three Great Ancient Cultures, A. Aveni, ISBN: 0471329762
http://amzn.to/2noER25

You will also need to download two free software packages onto a computer that you will have access to throughout the semester (both of these are available for Mac and Windows operating systems). The first is *Stellarium* (www.stellarium.org), which is a desktop planetarium program that will allow you to view the sky from any location at any time. The second is *Google Earth* (earth.google.com), which allows you to view 3D satellite images of the earth.

Recommended Texts

These books are not required, but may be helpful for understanding concepts in the course:
Exploring Ancient Skies: A Survey of Ancient and Cultural Astronomy, Kelley and Milone
Astronomy Before the Telescope, C. Walker
Power of the Stars, Penprase
The History and Practice of Ancient Astronomy, Evans
People and the Sky, Aveni

Problem Sets

There will be reading assignments and problem sets due each week. Before class you should do the readings, think about the discussion questions on the problem sets, and be prepared to discuss them in the online discussion sections.

You are strongly encouraged to discuss the weekly assignments with fellow students, with our Teaching Assistant, and with me, but the answers and solutions that you submit must represent your own understanding of the material. A practical interpretation of this rule is that it is OK to discuss problems and their solutions with instructors and with other students, but you should never copy the written work of anyone else. Apparent copying on any course assessment

(including the online assignments, in-class exams, observing exercises, or papers) will be considered a violation of the academic integrity policy and will be submitted to the College Executive Committee for possible disciplinary action.

Observation Exercise
There will be an observing exercise during the course that will require you to make your own naked eye observations of the sky. This exercise will require some reporting of results which will be graded and counted as a homework assignment. Observing the real sky requires some planning and diligence, since you can't be sure that the sky will be clear on any given night or day. Consequently, you should strive to complete the observing exercises as early as possible.

Exams
We will have one exam, scheduled on Friday, June 23. This will likely be an oral exam given online.

Final Paper
The final project for the course will be a 6-8 page library research paper. The theme of the paper will be the interaction between naked-eye astronomy and human culture, but the specific topic is up to you. You might choose to investigate a particular use of astronomy in a historical or modern context, or you might want to delve into the astronomy of a particular culture that we not have time to discuss in class. We will discuss many potential paper topics during the course, and I recommend that you start your research as early as possible. The final papers will be due by 11:59 pm on **Monday, July 4.**

Grading
All of the work for each student will be assigned a numerical score. To determine the final course grade, students' scores on all coursework will be combined with the following weights:

All problem sets (5) and the observing exercise (1)	50%
mid-term exam	25%
Final Paper	25%

Topics:
Specific topics for each online discussion session will be covered in the lecture videos and reading assignments given on the weekly problem sets, but this is an overview of the topics and concepts covered each week.

May 29: Introduction, overview of cultural astronomy
May 30: Angles in the sky, daily cycles
May 31: Daily cycles, rotation of the earth
June 1: Seasonal cycles, orbit of the earth
June 2: Sundials and timekeeping

June 5: Celestial navigation
June 6: Cycles of the moon, moon phases
June 7: Eclipses
June 8: Calendars
June 9: Planetary motion, other transient phenomena (comets, meteors)

June 12: Stonehenge and other astronomical megaliths
June 13: Ancient Mesopotamian astronomy (Sumerian, Assyrian, Babylonian)
June 14: Ancient Egyptian Astronomy
June 15: Ancient Greek Astronomy up to Ptolemy
June 16: Western Astrology

June 19: Astronomy of the Islamic Empire (Persia, Andalusia, Turkish), the Astrolabe
June 20: Starlore
June 21: Medieval and Early Modern Europe
June 22: The Copernican Revolution, Kepler, Galileo and the telescope
June 23: Exam

June 26: Astronomy of India and China
June 27: Pre-columbian Mesoamerica, Mayan astronomy
June 28: Incan astronomy
June 29: Ancient pueblo people of the American Southwest
June 30: Modern Cosmology in a cultural context, Conclusions

July 3: Final papers due