

ILS 271: PreCopernican astronomy and cosmology
in cross-cultural perspective (Spring 1999)

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MWF at 11 in Social Science 6125

This course confers Physical Science (P) credit and is writing-intensive. Prerequisite: one ILS science course (201/202/251), equivalent history of science courses, or consent of instructor (Office hours W 2:30-3:30 Social Science 7135; mhshank@facstaff.wisc.edu; 262-3972).

Structure: two lectures, plus one section devoted to a discussion, a practicum, a "lab," or calculation exercise. Writing-intensive. Limited enrollment.

Requirements/Evaluation:

- participation in discussion (10%)
- observation projects report, ca. 5 pages (10%)
- two-to-four-page writing assignments (20%)
- other lab/calculation (5%)
- take-home midterm essay, plus rewrite (15% + 10%)
- final: take-home essay (20%), in-class Ids and short essays (10%)

TAKING DETAILED NOTES on the readings will help you look for and remember main points, as well as clarify what you do and do not understand.

Extra-credit work (optional) may include a critical review of a substantial and relevant (check with me first!) book (15%) or an independent project (percentage of grade by contract); e.g., additional observation project, construction of an instrument, research paper, etc.

Books (on order at University Bookstore)

- Otto Neugebauer, *The Exact Sciences in Antiquity*, 2nd edition (New York: Dover, 1969).
- John D. North, *The Norton History of Astronomy and Cosmology* (Norton, 1995).
- Readings (marked by an asterisk below) available in Soc. Science 7130.

Useful resources:

- The Dictionary of Scientific Biography* (for individuals, but see especially the topical articles in the last volume).
- The Journal for the History of Astronomy*

World Wide Web sites of relevance to the course:

- <http://ccwf.cc.utexas.edu/~hope/aneastro.html#Links> (ancient Near-eastern astronomy, with many links to other ancient sites)
- <http://www.sron.ruu.nl/~jheise/akkadian/index.html> (for Mesopotamia generally, incl. cuneiform writing & Akkadian)
- <http://www.perseus.tufts.edu> (on Greece; scientific materials are slowly being added).
- For Mac users: check out the planetarium program Starry Night (from Siennasoft; <http://www.siennasoft.com/sienna>)

Written work

I expect scrupulous academic honesty in written work. Treat your evidence and your opponents fairly. Use quotation marks to distinguish the words of others from your own; give credit to the sources of your ideas. If you are unsure about proper citation practice, look at Wayne Booth *et al.*, *The Craft of Research* (Chicago, 1995) and the *Chicago Manual of Style*. If questions remain, contact me (in person, by phone, or by email).

Major due dates

- 1/29: two-page review/analysis of Goody and Watt.

2/5: four-page analysis & comparison/contrast of Pingree with either Vernant or Bernal; or of Bernal with Palter
 2/22: target date for observation project
 2/26: epicycle exercise due
 3/15: midterm essay--8 pages (due in class on Monday).
 3/19: two-page review/analysis of Gough
 3/29: revision of midterm essay
 4/16: two-page review/analysis of Sabra, "Appropriation..." (not the "Andalusian" one!)
 5/10: in-class part of final (M, 2:45 p.m.); essay due no later than Friday 14 May at 5 p.m. (my office).

Week 1: Introduction Myth and Science: Problems and Debates

W 1/20 Introduction: Current debates about the centrality of Greece
 F 1/22 **Discussion:** Historiography, the "Greek Miracle," and the debate about multiculturalism

Readings:

North, ch. 1 (pp. 1-6). [6]
 Neugebauer, ch. 1, ch. 3 [28+18=46].
 Ian Watt and Jack Goody, "The Consequences of Literacy," in Jack Goody, ed., *Literacy in Traditional Societies* (Cambridge: Cambridge University Press, 1968), pp. 27-68 [42].
 *Jean-Pierre Vernant, "The Formation of Positivist Thought in Archaic Greece," in *Myth and Thought Among the Greeks* (London: Routledge and Kegan Paul, 1983), pp. 343-374 [32].
 *David Pingree, "Hellenophilia and the History of Science," *Isis* 83 (1992) 554-563. [10]

Week 2: Ancient Near-Eastern Cosmogonies

M 1/25: Mesopotamia
 W 1/27: Egypt
 F 1/29: **Discussion:** Watt and Goody article; **two-page analysis due.**

Readings:

North, ch. 2 and first part of 3 (pp. 7-34). [28]
 Neugebauer, ch. 4 [26]
 *The Epic of Creation [Enuma Elish], in D. W. Thomas, ed., *Documents from Old Testament Times*, 3-16. [14]
 *The Hymn to Aten, in D. W. Thomas, ed., *Documents from Old Testament Times*, pp. 142-150. [9]
 *Genesis 1-2. [2]
 *J. M. Plumley, "The Cosmology of Ancient Egypt," in Blacker and Loewe, eds., *Ancient Cosmologies*, pp. 17-41. [25]
 *W. G. Lambert, "The Cosmology of Sumer and Babylon," in Blacker and Loewe, eds., *Ancient Cosmologies*, pp. 42-65. [24]
 *Martin Bernal, "Animadversions on the Origins of Ancient Science," *Isis* 83 (1992), pp. 596-607. [12]

Week 3: Babylonian mathematics, cosmology, and astronomy

M 2/1 Egyptian and Babylonian mathematics
 W 2/3 Babylonian astronomy and astrology
 F 2/5 **Discussion:** Pingree, Vernant, Bernal, Palter, and primary sources--**four-page analysis due**

Readings:

North, ch. 3, end (pp. 34-58). [25]
 Neugebauer, ch. 2, 5. [24+50]
 *Francesca Rochberg, "Mesopotamian Cosmology," in Noriss Hetherington, ed., *Cosmology*, pp. 37-52.
 *Robert Palter, "Black Athena, Afrocentrism, and the History of Science," in Mary R. Lefkowitz and Guy MacLean Rogers, eds., *Black Athena Revisited* (Chapel Hill: Univ of North Carolina Press, 1996), pp. 209-227, 255-260.

Week 4: Early Greek Cosmology and Astronomy

M 2/8 Greek myth

W 2/10 Presocratics to Plato

F 2/12 Planetarium visit; preparation for naked eye observation exercise.

Before the planetarium session, read the *Timaeus* excerpts below. The planetarium is located on the top level of Sterling Hall (on Charter St., between Van Vleck and Chamberlin Halls). Take the elevator to the top floor and walk up two flights of stairs (straight ahead when you exit the elevator).

Readings:

North, ch. 4 beginning (pp. 59-67). [9]

*D. R. Dicks, "Homer and Hesiod," ch. 2 in his *Early Greek Astronomy ...* (Cornell, 1970), pp. 27-38. [12]

*J. P. Vernant, "Geometry and Spherical Astronomy in the First Greek Cosmology," in his *Myth and Thought Among the Greeks*, pp. 176-189. [14]

*Plato, *Timaeus* excerpts [23]

*Bernard Goldstein and Alan Bowen, "A New View of Early Greek Astronomy," *Isis* 74 (1983) pp. 330-340. [11]

Week 5: From Eudoxus to Hipparchus

M 2/15 Homocentric astronomy: Eudoxus, Calippus, and Aristotle

W 2/17 Apollonius and Hipparchus; eccentrics and epicycles

F 2/19 **Discussion/** epicycle exercise handed out

Readings:

North, ch. 4 middle (pp. 67-104). [38]

*Alexander Jones, "The Adaptation of Babylonian Models in Greek Numerical Astronomy," *Isis* 82 (1991) pp. 441-453. [13]

*Aristotle, excerpts from *On the Heavens* (*De caelo*) and *Physics*, from Cohen and Drabkin, eds., *A Source Book in Greek Science* (Harvard).

BEGIN reading for next week!

Week 6: Ptolemy I: Ptolemy's *Almagest*

M 2/22 Context and scope of the *Almagest*; **target date for observation exercise**

W 2/24 Mathematics and solar model; planet

F 2/26 Lab: Calculation of Ptolemy's solar table (*Almagest* bk 3).

Readings:

North, end of ch. 4 (pp. 104-131). [28]

*Ptolemy, *Almagest*, excerpts from Book I.

Neugebauer, ch. 6 and Appendix 1, pp. 145-207. [63]

For detailed information, see Olaf Pedersen, *A Survey of the Almagest* (Odense University Press, 1974).

Week 7: Ptolemy II: Cosmology and Astrology

M 3/1 Cosmology: The *Planetary Hypotheses*

W 3/3 Astrology: The *Tetrabiblos*

F 3/5 Midterm exam (if in-class essay)

Readings:

*G. E. R. Lloyd, "Greek Cosmologies," in Blacker and Loewe, eds., *Ancient Cosmologies*, pp. 198-224. [28]

*Ptolemy, *Tetrabiblos* excerpts (Robbins translation, Loeb edition)

Spring Break 3/6-3/14

Week 8: Ancient India

M 3/15 Early Indian Cosmologies--MIDTERM DUE (if take-home)

W 3/17 Hellenistic Influences

F 3/19 **Discussion** of Gough; **two-page analysis due**

Readings:

North, ch. 7 (pp. 162-176). [15]

- *R. F. Gombrich, "Ancient Indian Cosmology," in Blacker and Loewe, eds., *Ancient Cosmologies*, pp. 110-142. [33]
- *Kathleen Gough, "Implications of Literacy in Traditional China and India," in Jack Goody, ed., *Literacy in Traditional Societies* (Cambridge: Cambridge University Press, 1968), pp. 69-84. [16]
- *B. V. Subbarayappa, "Indian Astronomy: An Historical Perspective,"

Week 9: Ancient China

- M 3/22 Early Chinese Cosmology
- W 3/24 Chinese Astronomy
- F 3/26 **Discussion** of Needham and Cullen's criticisms of Needham.

Readings:

- North, ch. 5 (pp. 132-153). [22]
- *Joseph Needham, "Astronomy in Ancient and Medieval China," in F. R. Hodson, ed., *The Place of Astronomy in the Ancient World*, pp. 67-82. [26]
- *Christopher Cullen, "Joseph Needham on Chinese Astronomy," *Past and Present* #87 (1980), pp. 39-53. [15]

Weeks 10: Mesoamerica

Mayan Astronomy, Cosmology, and Calendrical work

- M 3/29 Mayan Calendar; **revised mid-term essay due**
- W 3/31 Cosmology and Astronomy
- F 4/2: Discussion of Maya mathematics and astronomy

Readings:

- North, ch. 6 (pp. 154-161). [8]
- *Anthony Aveni, "Astronomy in Ancient Mesoamerica," in E. C. Krupp, ed., *In Search of Ancient Astronomies* (New York: Doubleday, 1977), pp. 165-202. [38]
- *J. Eric S. Thompson "Maya Astronomy" in F. R. Hodson, ed., *The Place of Astronomy in the Ancient World*, pp. 83-98.

Week 11: The Islamic Middle Ages I

- M 4/5 Translation movement
- W 4/7 Cosmology in Muslim Spain
- F 4/9 Workshop: how to construct a basic astrolabe; stereographic projection. Read North article (below).

Readings:

- North, review pp. 124-131, read ch. 8 beginning (pp. 177-192); ch. 9 beginning (pp. 203-216). [30]
- *J. D. North, "The Astrolabe," *Scientific American* 230 (Jan. 1974), pp. 96-106.
- *A. I. Sabra, "The Andalusian Revolt against Ptolemaic Astronomy," in E. Mendelsohn, ed., *Transformation and Tradition in the Sciences* (Cambridge UP, 1984), pp. 133-153 [19].

Week 12: The Islamic Middle Ages II

- M 4/12 The observatory in Islam
- W 4/14 The Maragha School/the Tusi couple
- F 4/16 **Discussion** (esp. Sabra and Sayili); **two-page analysis of Sabra, "Appropriation" due**

Readings:

- North, ch. 8 end (pp. 192-202). [11]
- *Aydin Sayili, *The Observatory in Islam*, ch. 10 & Conclusion, 346-400. [54]
- *A.I. Sabra, "The Appropriation and Subsequent Naturalization of Greek Science in Medieval Islam: A Preliminary Statement," *History of Science* 25 (1987), pp. 223-243. [21]

Week 13: Medieval Europe I (12th-13th c.)

- M 4/19 Twelfth-century translations; beginnings of the university; the curriculum
- W 4/21 Bacon's Cosmological options
- F 4/23 Lab: predicting lunar eclipses with Alphonsine Tables; Grant, *Source Book*.

Readings:

North, ch. 9 end and ch. 10 beginning (pp. 217-241). [25]

*Edward Grant, ed., *A Source Book in Mediaeval Science*, pp. 465-487. [23]

*Edward Grant, "Cosmology," in Lindberg, ed., *Science in the Middle Ages*, pp. 265-302. [38]

*Introduction to the Alphonsine Tables

Week 14: Medieval Europe II (14th-15th c.)

M 4/26 Lab (ctd)

W 4/28 Levi ben Gerson and Parisian cosmology

F 4/30 The Viennese tradition: Georg Peurbach (d. 1461) and Johannes Regiomontanus (d. 1476)

Readings:

North, ch. 10 end, pp. 241-278 [45]

*Olaf Pedersen, "Astronomy," in Lindberg, ed., *Science in the Middle Ages*, pp. 303-337. [35]

*Bernard Goldstein, "The Role of Science in the Jewish Community in Fourteenth-Century France," in Madeleine Perner Cosman, ed., *Machaut's World* (New York, 1978), pp. 39-49. [11]

Week 15: Copernicus (1473-1543)

M 5/3 Regiomontanus and Copernicus

W 5/5 Copernicus and Maragha astronomy; Astronomy in manuscript and print

Possible visit to Special Collection (Memorial Library, 9th floor)

Readings:

North, ch. 11 (pp. 279-98). [20]

*Noel Swerdlow and Otto Neugebauer, *Mathematical Astronomy in Copernicus's De Revolutionibus*, Introduction, pp. 3-85, 94-95. [85]

Final Exam: In-class portion on Monday 10 May 1999 at 2:45 p.m.; essay due no later than Friday 14 May at 5 p.m.