

Astronomy 350L (Spring 2005)



The History and Philosophy of Astronomy

(Lecture 6: Copernicus I)

Instructor: Volker Bromm TA: Amanda Bauer

The University of Texas at Austin

Astronomy during the Renaissance (c. 1450 – 1600)





• Rebirth of cultural activity in Europe!

Intellectual Climate: Reformation (1517 onwards)





• Restore lost original (pure) state of Church!

Intellectual Climate: Humanism





Pico della Mirandola

Erasmus of Rotterdam

• Anti-Aristotelian strain, desire for classics!

Intellectual Climate: Neoplatonism





mathematical harmony

Marsilio Ficino

• Sun worship

• Search for underlying (mathematical) structure of reality!

Intellectual Climate: Voyages of Discovery



oiumpus (1451-1506)

Spanish and Portuguese exploration

• New spirit of discovery!

Intellectual Climate: Fall of Constantinople 1453





• Escape of Greek scholars and texts to Italy!

Intellectual Climate: Invention of Printing Press





Johannes Gutenberg

Rapid dissemination of knowledge!

Nicolaus Copernicus



- 1473 1543
- De Revolutionibus Orbium Coelestium
 (1543, On the Revolution of the Heavenly Spheres)
- What was he:
 - first modern astronomer?
 - last ancient astronomer?

Nicolaus Copernicus: Geography of his Life



Copernicus: Studies in Italy



Bologna



Padua

• Bologna and Padua: astronomy, mathematics, medicine, law

• Eventually: Doctorate in church law (Ferrara)

Copernicus: Canon at Frombork Cathedral



• Q: What is a canon?

Copernicus: War in Varmia (1519-1521)



• Poland vs Teutonic Knights, Copernicus involved in defence

Copernicus: De Revolutionibus (1543)



- heliocentric model
- Q: What motivated him?
- Q: Structure of book?
- Q: In which way was it revolutionary?

De Revolutionibus: Basic Motivation



(Pope Paul III)

- Q: What motivated him?
- A: in preface
- Against Ptolemaic "monster"!
- Ptolemaic system ugly, arbitrary, and inaccurate

Basic Motivation: Need for better calendar



(Pope Gregory XIII)

De Revolutionibus: Basic Structure

Book 1: Popular justification for Earth's motion

 Book 2-6: Mathematical details to account for celestial (planetary) motions

Book 1: not original, not really convincing

 Book 2-6: highly specialized ("Mathematics is for mathematicians")

De Revolutionibus: Basic Principles (Book 1)

NICOLAI COPERNICI

ner, in quo terram cum orbe lunari tanquam epicyclo contineri diximus. Quinto loco V enus nono menfe reducitur. Sextum d enicp locum Mercurius tenet, octusginta dierum fpacio circu currens. In medio uero omnium reficiet Sol. Quis enim in hoc



pulcherimo templo lampadem hanc in aliouel meliori loco po neret, quim unde totum fimul polsit illuminare; Siquidem non inepte quidam lucernam mundi, alij mentem, alij rectorem uocant. Trimegiftus uilibilem Deum, Sophotlis Electra intuenté omnia, lea profecto tanquam in folio regali Sol relidens circum agentem gubernas Altrorum familiam. Tellus quoqi minime fraudatur lunari minifterio, fed ut Ariftoteles de animalibus ait, maximă Luna cu terra cognationê habet, Concipit interea à Soletterra, & impregnatur annuo partu, Inucnimus igitur fub

Sun-centered

- Earth is planet (3rd from Sun)
- Earth's motions:
 - daily rotation
 - annual revolution around Sun

 Celestial motions uniform and circular

• finite universe

De Revolutionibus: Basic Principles (Book 1)



 daily rotation of celestial (fixed star) sphere



 yearly motion of Sun along ecliptic (zodiac)

De Revolutionibus: Aesthetic Appeal Ptolemy <u>Copernicus</u>





- Conceptually simpler explanation for retrograde motion (7 spheres vs 12)
- Retrograde motion of planets natural outcome of Earth's motion!

De Revolutionibus: Final Result (Books 2-6)

Ptolemy

Copernicus





As messy as Ptolemy, not more accurate:
 a failure really (according to original claim)

Copernicus (part 1)

- Transitional figure in history of astronomy!
- Still deeply routed in ancient (Arsitotelian-Ptolemaic) tradition
- But also: A typical Renaissance figure
 daring to do things differently
 - Neoplatonic influence (from his time in Italy)
- De Revolutionibus: Not a revolutionary book, but a revolution-making one!