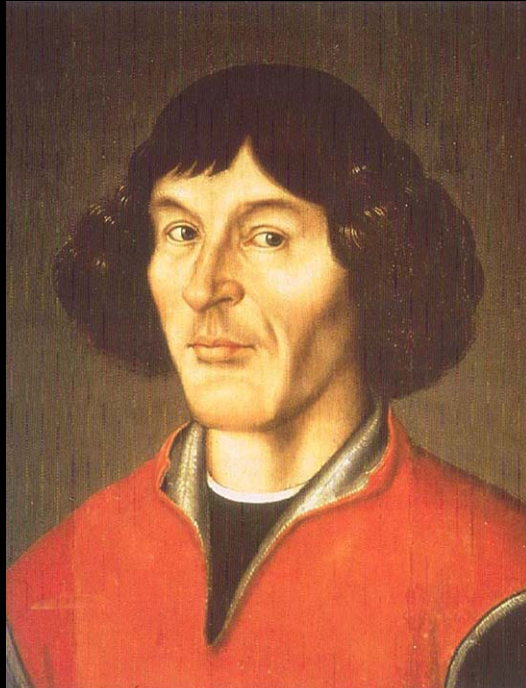


The Copernican Revolution:

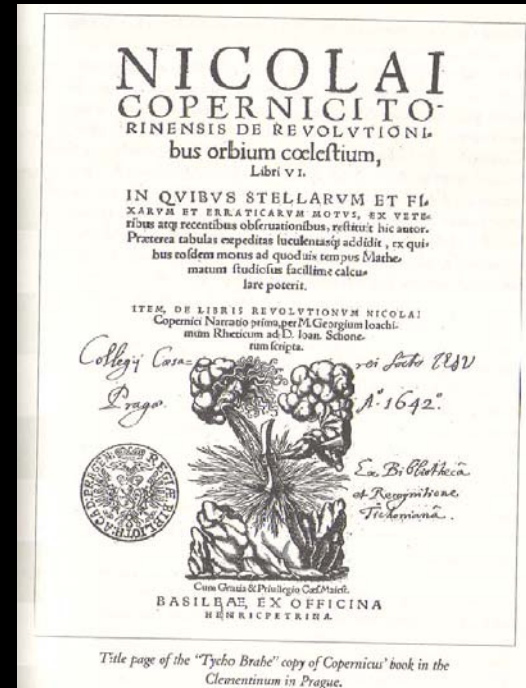
Myth vs. Reality

Harry Ringermacher, Ph.D

"On the Revolutions of the Heavenly Spheres"



Nicolaus Copernicus
1473-1543

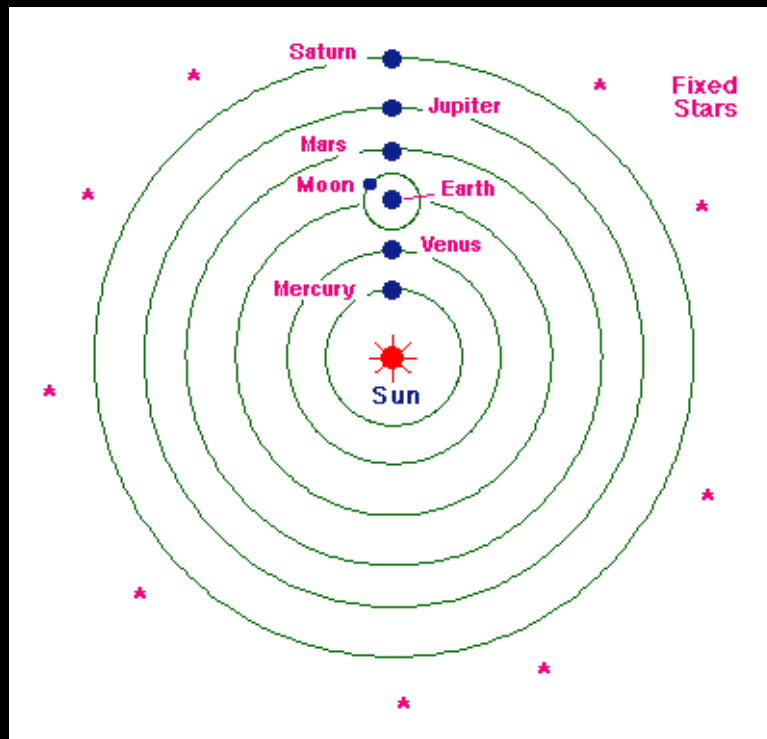


Title page of the "Tycho Brahe" copy of Copernicus' book in the Clementinum in Prague.

De Revolutionibus
Orbium Coelestium

The Copernican Universe

Page from De Revolutionibus



Translation

The Copernican Universe

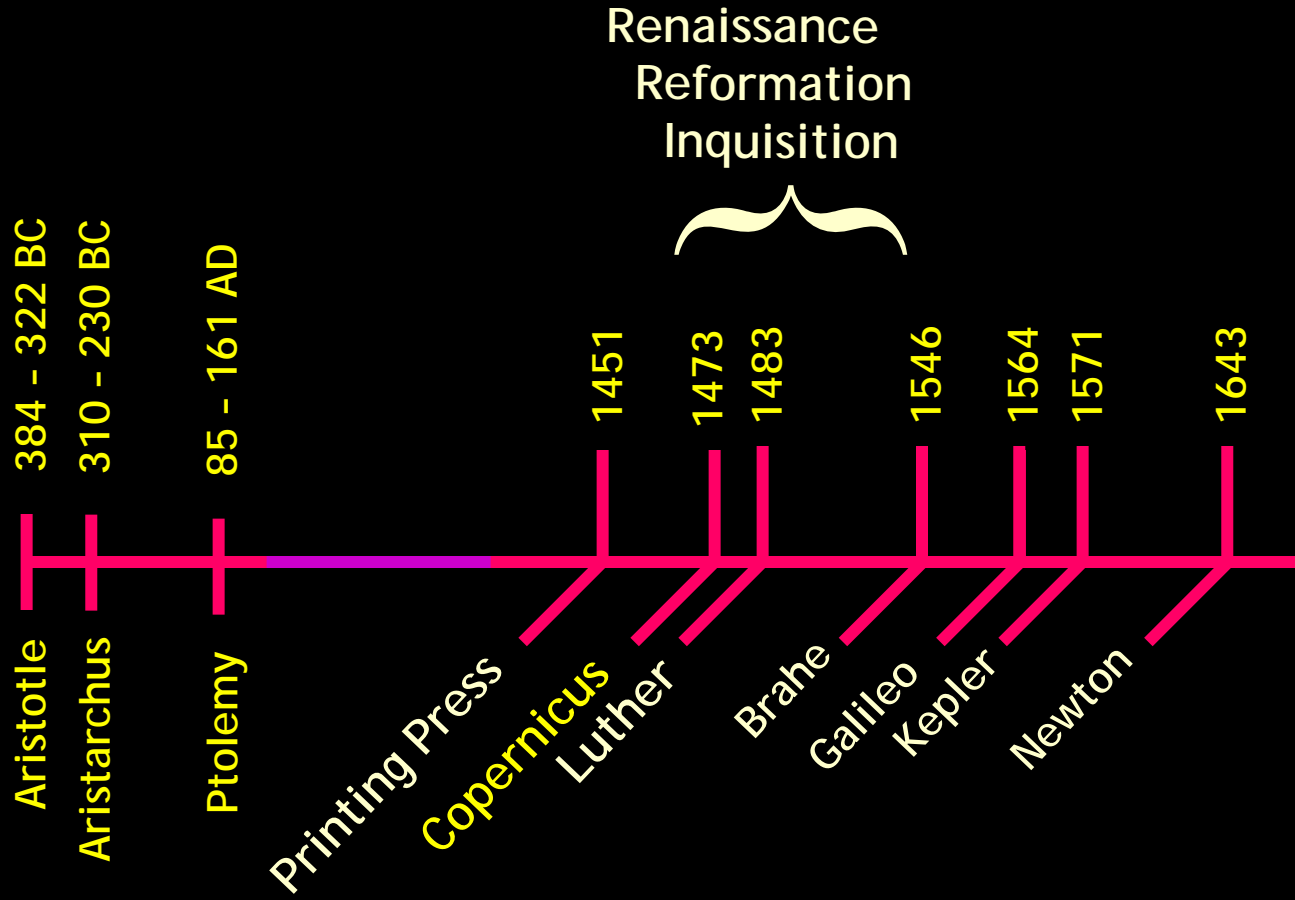
Taken from Dudley Observatory Copy



Overview

- Copernicus Bio
- Myths and Facts
- Copernicus - scientist
- Geocentrism and Epicycles
- Heliocentrism - paradigm change

Copernicus - Timeline



Copernicus - Bio

- Born: Nicolaus Koppernig, Torún, Poland 1473
- Father: well-to-do copper merchant. Upon death taken in by uncle Watzenrode - became a bishop
- Schools: St. John's (grammar sch), Cathedral Academy (prep sch), U. of Cracow
- U. of Cracow : Here he meets Prof. Brudzewski; hears of Columbus; becomes "Copernicus" 1495
- Canon, Cathedral of Frauenburg - 2 servants, 3 horses, free residence, steady income

Life is Good 😊

Copernicus - Polymath

- Canon of the Roman Catholic Church - (services, taxes, census, parish events, etc.)
- Astronomer (his primary love)
- Physician to Bishops and Royalty - "common sense" vs. spiders, frogs, leeches, astrology
- Economist - causes of inflation, 1526 wrote *Monetae cudendae ratio* later to become "Gresham's Law" - minting bad money drives out good
- Soldier - diplomat (repelled attack of Teutonic Knights on his castle Olsztyn 1519-1521)

Myths ?

- The Roman Catholic Church opposed his work because earth was dethroned as center of universe, a blow to human pride.
- Giordano Bruno, regarded as the first Copernican Martyr, was burned at the stake because he preached the Copernican ideas.
- He was the first to posit the heliocentric concept.
- His work eliminated Ptolemaic “epicycles” .

Church opposed Heliocentrism ?

FACT

- It was the scientific community that initially objected.

Why?

- Heliocentrism created more problems than it solved !
 - Earth in motion but what moves it ?
 - Why doesn't everything fly off ?
 - If Earth not center why do things fall down ?
 - If something is thrown up, why does it land in same place when earth moves ?

Church opposed Heliocentrism ?

FACTS

- Publication of De Revolutionibus was encouraged by his Bishop. Why? Partly because Copernicus was his successful Doctor also !
- The Church taught De Revolutionibus in Catholic Universities for 60 years after death of Copernicus.
- De Revolutionibus was banned by the church for nearly 200 years starting around 1650 when the “revisionist view” started.

Earth Dethroned ?

Consider:

- Religious scholars believed center was worst. Muck collected there.
- Cardinal Bellarmine (critic of Galileo): “ ..the Earth is very far from heaven and sits motionless at the center of the world” .
- Hell is placed at earth's core
- Heaven was up ! By placing earth higher, Copernicus is promoting it.

Earth Dethroned ?

- Revisionist thinking started around 1650 and was solidified by 1800.
- Goethe: “ No sooner was the Earth recognized as being round...than it was obliged to relinquish the colossal privilege of being the center of the world” .
- Carl Sagan said of Copernicanism: first of a series of “great demotions... delivered to human pride” .

Giordano Bruno

FACT

- He was burned at the stake because of his heretical views (e.g. pantheism...God=Nature). Copernicanism charges were secondary.



Giordano Bruno
1548 - 1600

Myth?

Because of the church's adherence to religious dogma, scientific progress was held back for a millennium.

- Edict against Galileo not lifted until 1992.

Science advanced despite the church. Later because of its sheer economic power on society...

What Goes Around Comes Around !

Geocentrism



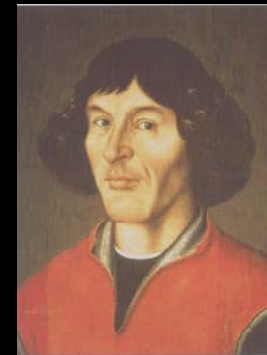
Aristotle 384BC
Plato, Socrates



Ptolemy 85AD

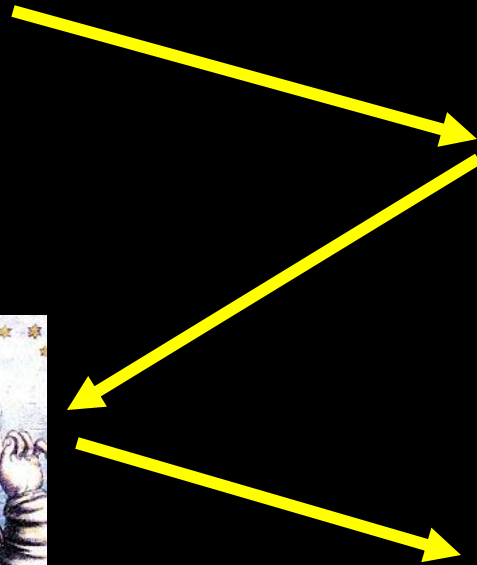


Aristarchus 200BC

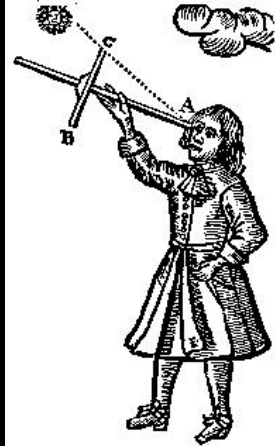


Copernicus 1473

Heliocentrism



Copernicus' Instruments

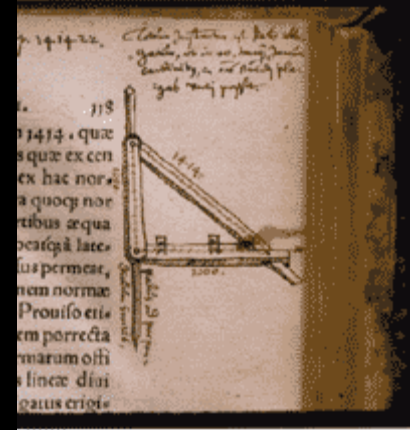


Jacob's Staff



Sundial
(Gnomon)

+ clock?



Triquetrum

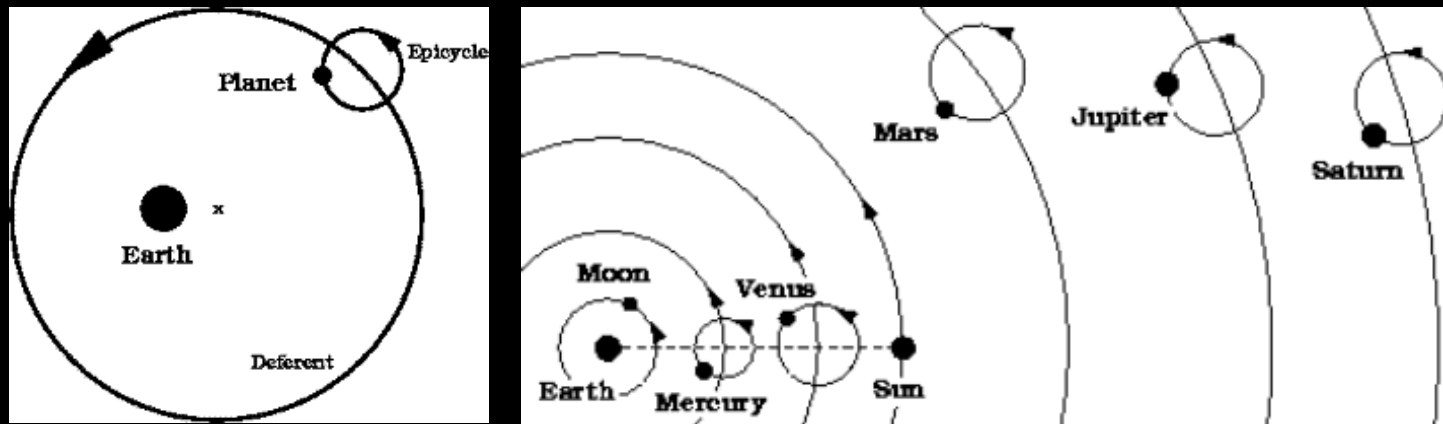
How do I know ?



Jan Matejko - "Conversation with God, 1872"

What Are the so-called "Epicycles"

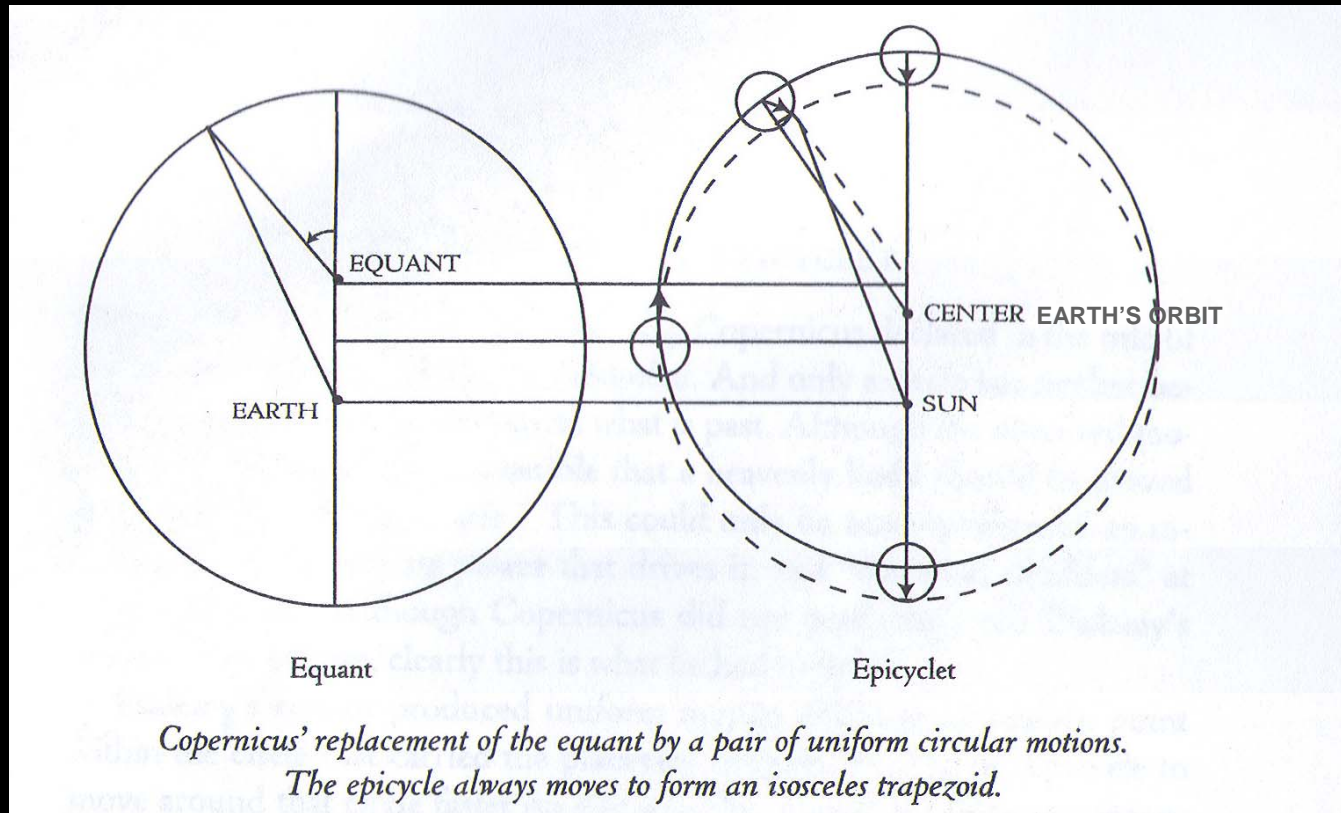
- Epicycles are small circular "sub-orbits" added, by Ptolemy, onto the main orbit of a planet to explain the apparent "retrograde motion" at certain times.



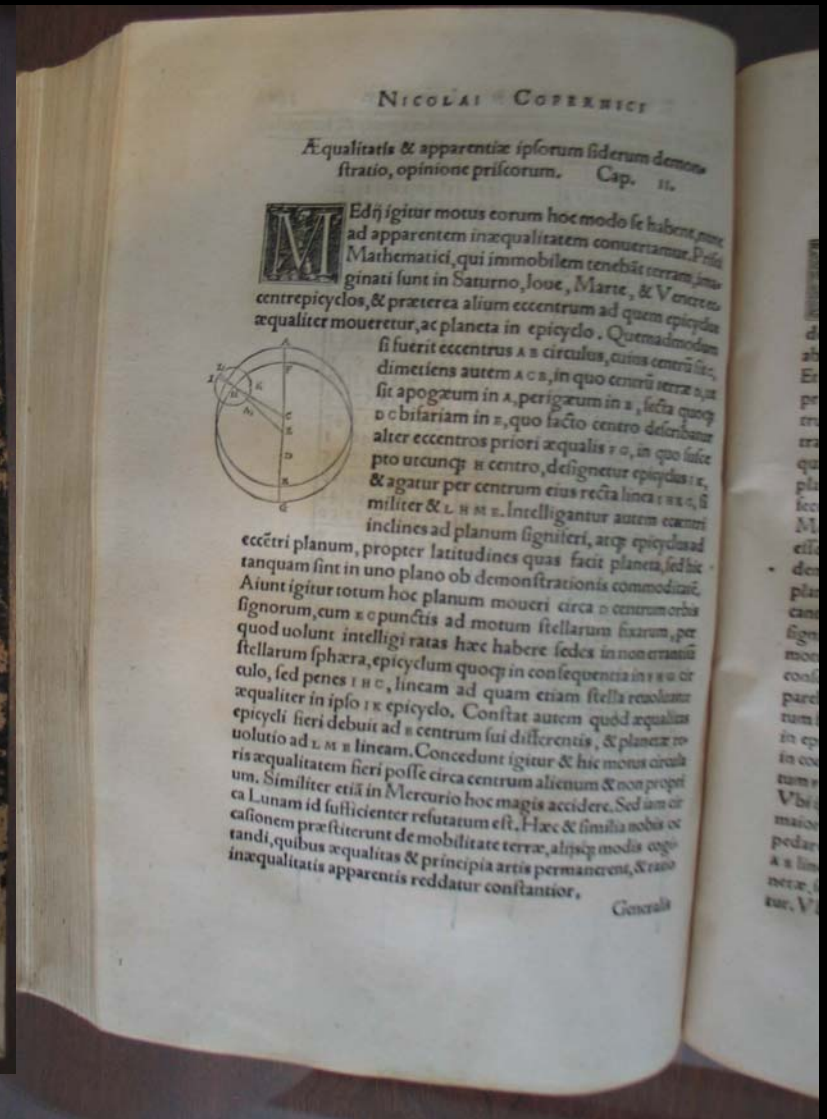
All the planets have retrograde motion

Copernicus' "Epicyclets"

Copernicus still required epicyclets to account for seasonal distance changes of earth from sun



Copernicus' "Epicyclets" - Dudley Copy



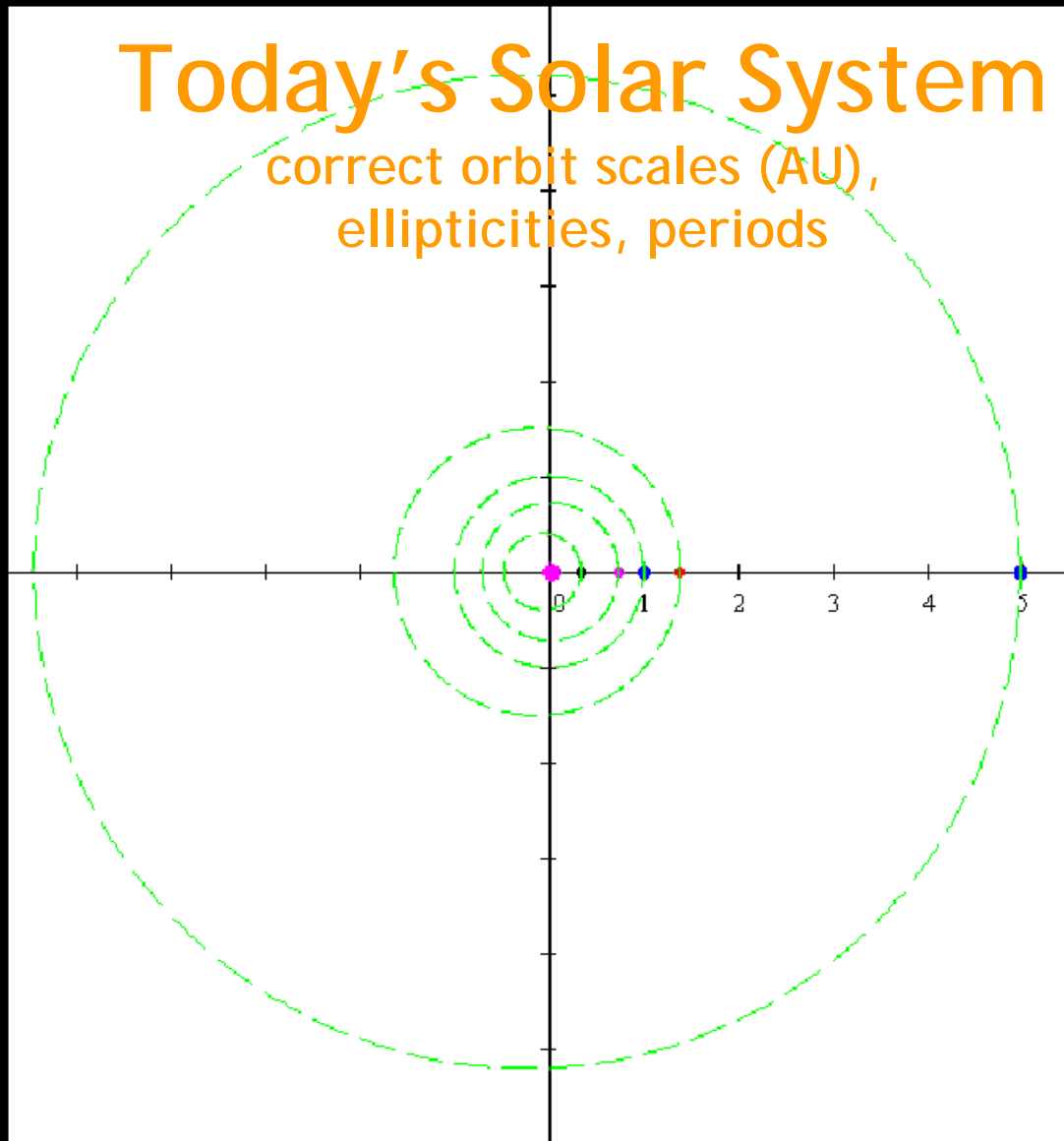
What Causes “Epicycles”

We will see and understand:

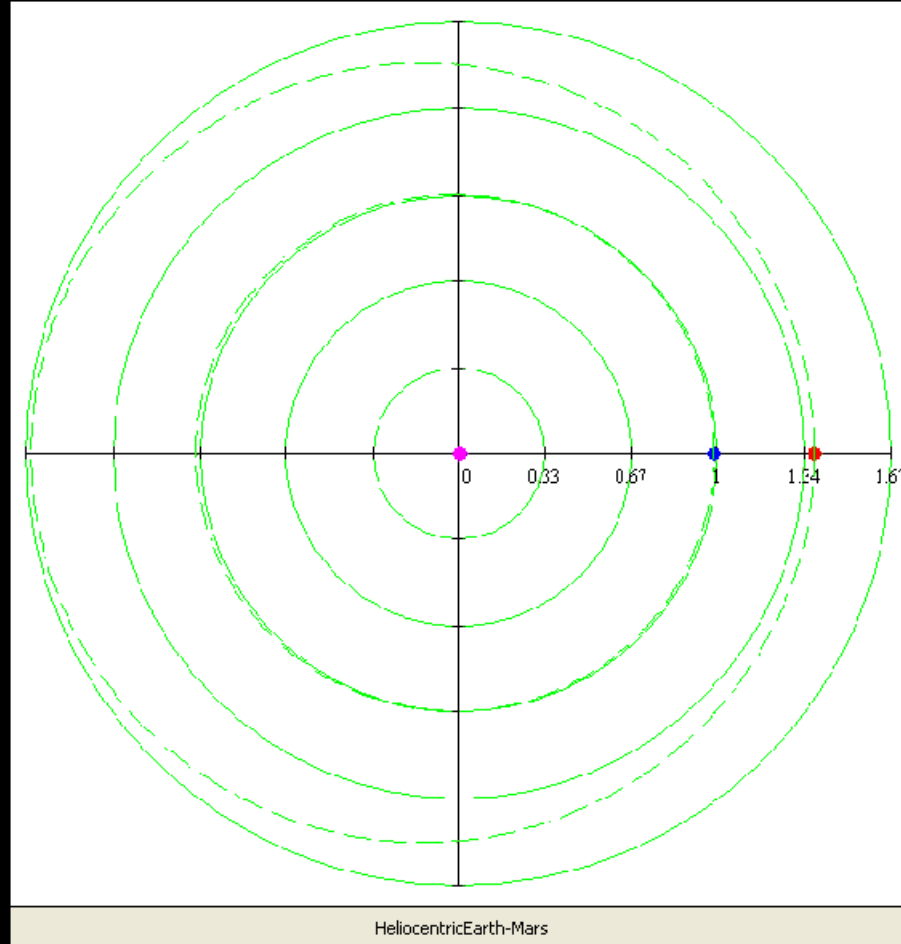
- What a Mars passage looks like from the solar system view
- What a Mars passage looks like from the earth view - “retrograde motion”

Today's Solar System

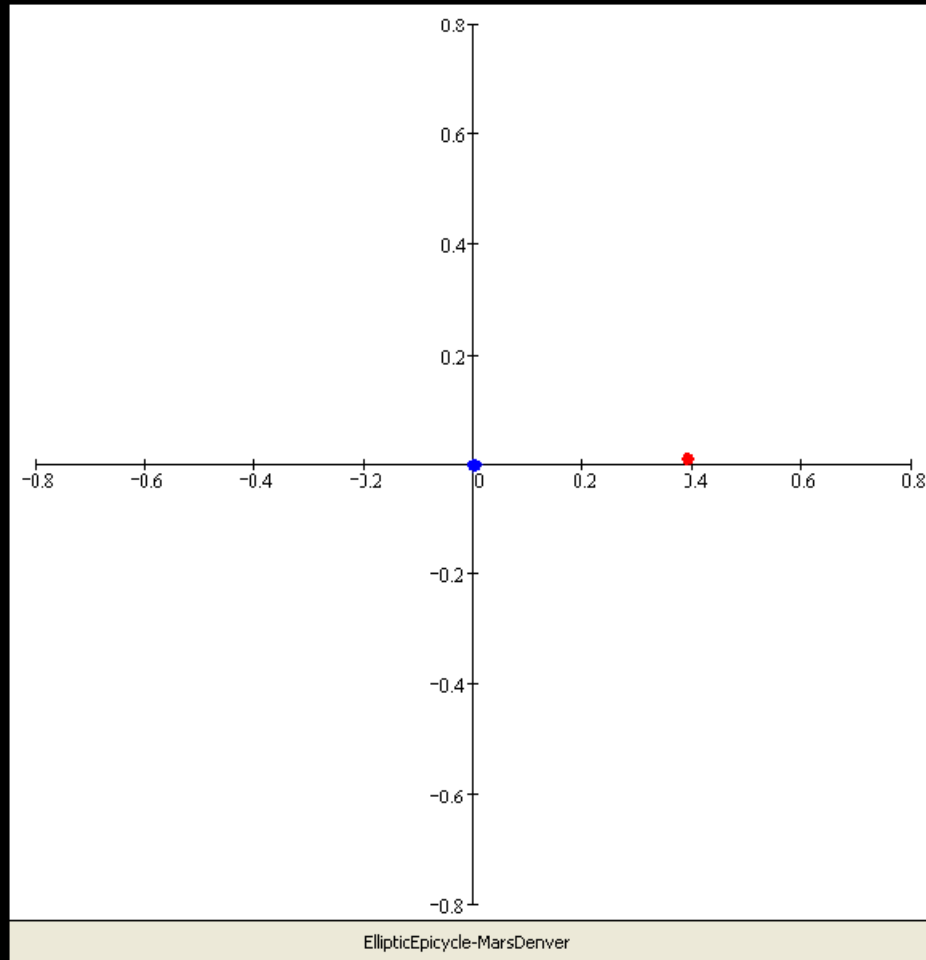
correct orbit scales (AU),
ellipticities, periods



Solar System View of Mars Passage



Earth View of Mars Passage from Denver, CO

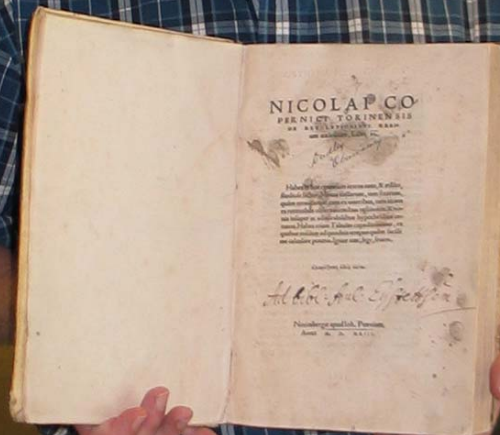
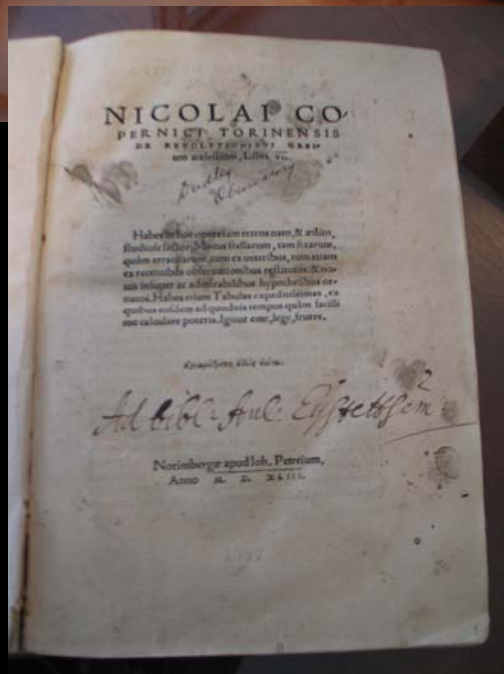
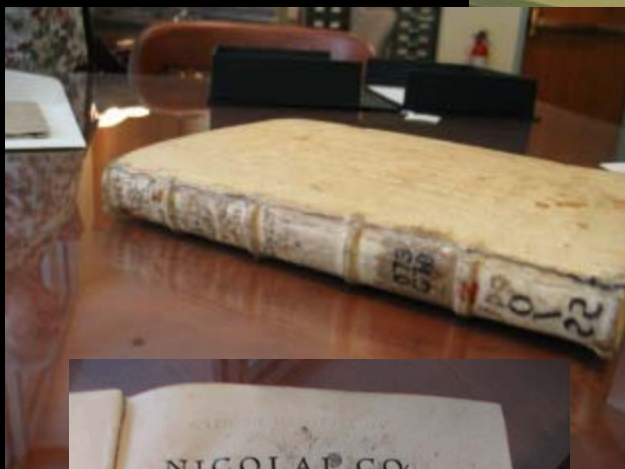


De Revolutionibus

Finally published days before his death
1543

He held it in his hands as he
uttered his last words:

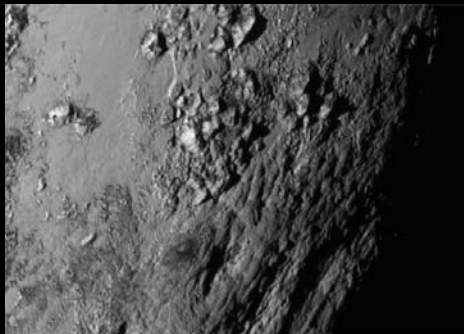
“My work - the stars”



Update - 2015

New Horizon Flyby of Pluto

July 14, 2015



H₂O ice mountains on Pluto

*“If I have seen farther,
it is by standing
on the shoulders of giants”*

Isaac Newton

References

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Physics Today Letters, "*Dispelling Myths and highlighting history of the heliocentric model*", June 2008

Owen Gingerich, "*The Book That Nobody Read*", Walker & Company, NY (2004)

Henry Thomas, "*Copernicus*", Julian Messner, Inc. (1960)

Thanks to "Darius", a Romanian member,
for Latin pronunciation.