

# 天文学的兴起

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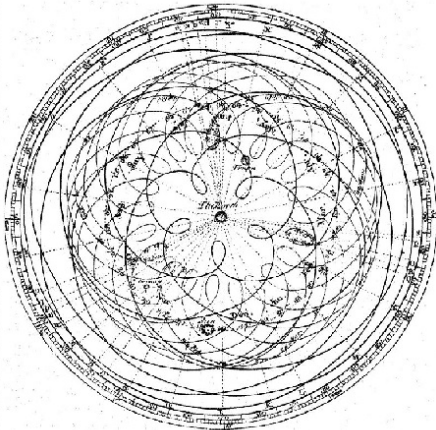
# PERIODS OF WESTERN ASTRONOMY<sup>1</sup>

- ▶ Classical (500 B.C. to A.D. 1400)
  - ▶ Measurements of the heavens
  - ▶ Geometry and models to explain motions
- ▶ Renaissance (1400 to 1650)
  - ▶ Accumulation of data led to better models
  - ▶ Technology (the telescope) enters picture
- ▶ Modern (1650 to present)
  - ▶ Physical laws and mathematical techniques
  - ▶ Technological advances accelerate

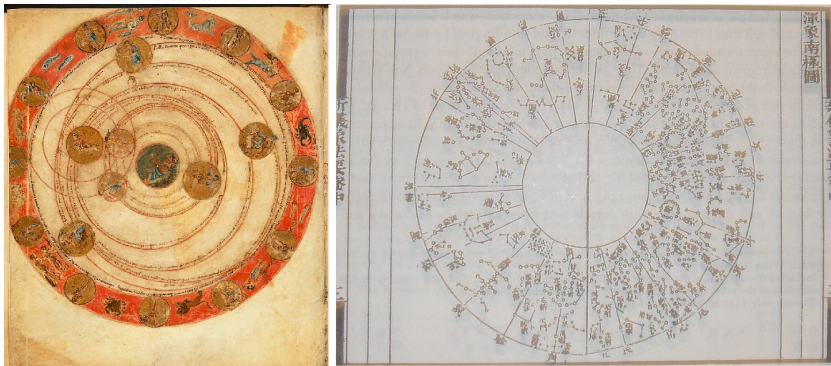
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<sup>1</sup>Arny, T. and S. Schneider 2013: *Explorations: An Introduction to Astronomy*(7th ed.), McGraw-Hill Education.

# CLAUDIUS PTOLEMY (c. AD 100 - c. AD 170)

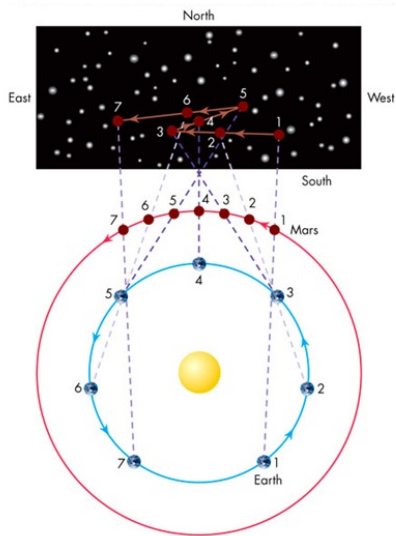
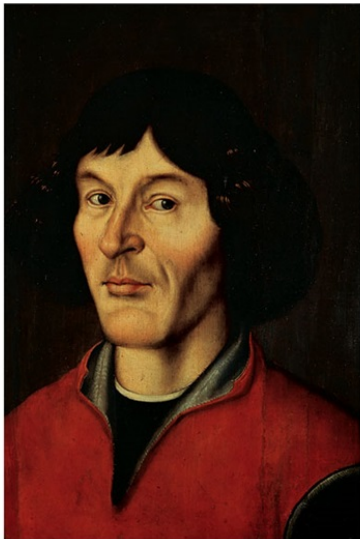


# WEST EUROPE AND CHINA



Note: 'Ninth century diagram of the positions of the seven planets on 18 March 816' (left) and 'Printed star map of Su Song (1020 - 1101) showing the south polar projection' (right).

# NICOLAUS COPERNICUS (1473-1543)



## TYCHO BRAHE (1546-1601)



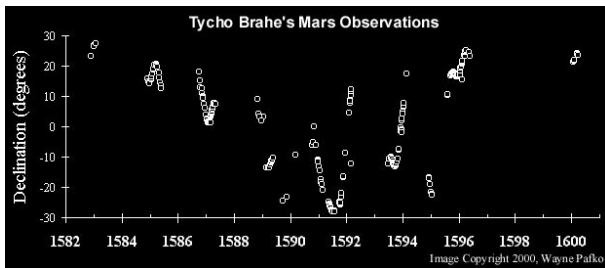
Tycho Brahe (1546-1601) was a famous Danish Astronomer who dedicated himself to obtaining astronomical observations of unprecedented accuracy. Johannes Kepler (1571-1630) used his observations of Mars to uncover the "true" nature of the solar system (the planets travel in ellipses around the sun sweeping out equal areas in equal times). Building on this knowledge, Isaac Newton (1642-1727) later deduced the fundamental mechanisms underlying these celestial motions. ...Tycho's data therefore occupies a privileged position in western science.

Source: Website of Visualizing Tycho Brahe's Mars Data.

## TYCHO BRAHE'S MARS OBSERVATIONS

I've studied all available charts of the planets and stars and none of them match the others. There are just as many measurements and methods as there are astronomers and all of them disagree. What's needed is a long term project with the aim of mapping the heavens conducted from a single location over a period of several years.

—Tycho Brahe, 1563 (age 17)

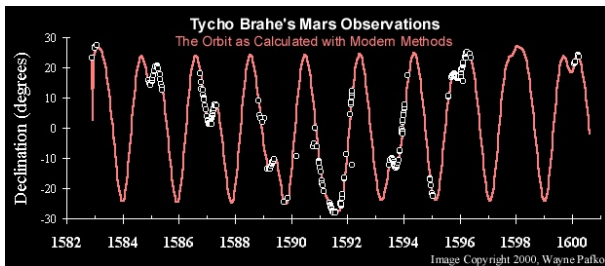


Source: Website of Visualizing Tycho Brahe's Mars Data.

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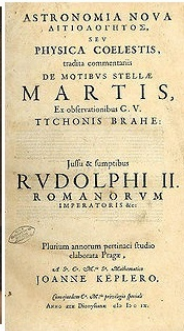
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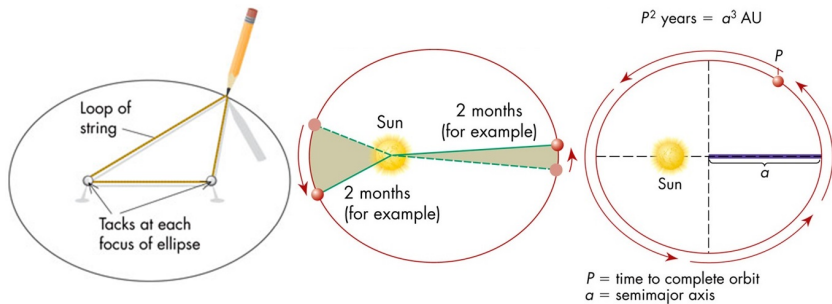


## JOHANNES KEPLER (1571-1630)

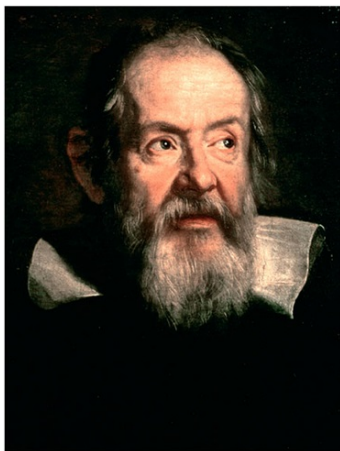


Note: Johannes Kepler and his master work of *Astronomia nova*(1609), *Harmonices Mundi*(1619), and *Rudolphine Tables*(1627).

# JOHANNES KEPLER'S THREE LAWS

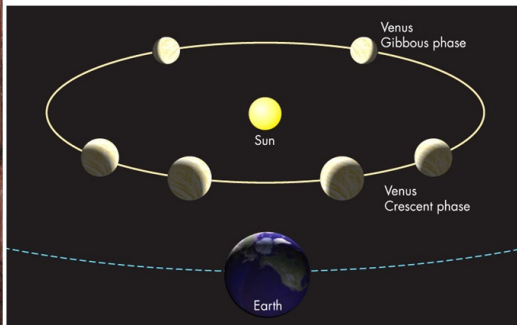


## GALILEO GALILEI (1564-1642)



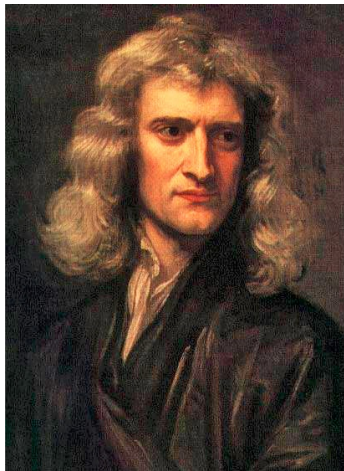
- ▶ First person to use the telescope to study the heavens and offer interpretations.
- ▶ Credited with originating the experimental method for studying scientific problems.
- ▶ Deduced the first correct “laws of motion” .

## GALILEO GALILEI'S TELESCOPE



Note: 'Galileo showed the Doge of Venice how to use the telescope'(left) and 'The phases of Venus, observed by Galileo in 1610'(right).

## ISAAC NEWTON (1642-1727)

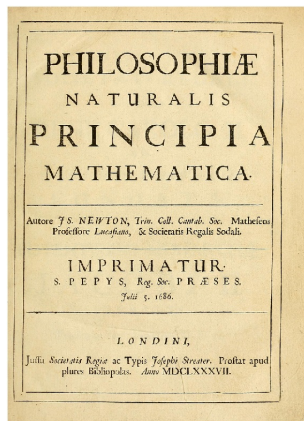


Source: Portrait of Isaac  
Newton in 1689 (age 46) by  
Godfrey Kneller.

沉思里的惊鸿一现  
道来：我不愿耗费心思向世人解释  
无论以何种先人之信条  
抑或计算之结果  
地球围绕太阳旋转  
乃「重力」所致之普遍现象  
此亦凡人所能理解之境  
自亚当，自苹果之堕

— Lord George Gordon Byron

## ISAAC NEWTON (1642-1727)



Source: Title page of *Principia*,  
first edition (1686/1687)

Nature and nature's laws lay hid  
in night;

God said "Let Newton be!"  
and all was light.

— Alexander Pope