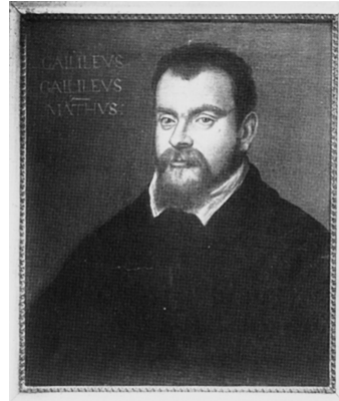


## Galileo & the Telescope—Sept 21

Galileo makes a telescope in 1609

- Galileo discovers
  - Moons of Jupiter
  - Mountains on the moon
  - New stars
  - Milky Way has many stars
  - Phases of Venus
    - Disproves Ptolemy's earth-centered model
- A model of discovery enabled by a new instrument
  - What cannot be seen cannot be discovered
  - Many discoveries were made soon after a new technology or instrument was built.



Galileo by Tintoretto  
[http://galileo.rice.edu/images/people/galileo/g\\_tintoretto.gif](http://galileo.rice.edu/images/people/galileo/g_tintoretto.gif)

# 9/21

- Hwk 3 is due on Mon, 9/28.
  - Late papers OK until Tues, noon, since answers will be put on angel at 12:01pm on Tues. (Test 1 is Wed.)
- Astronomical Horizons
  - Hot Jupiters & Super Earths
  - Prof Arunav Kundu
  - Thurs, 7:30 at Planetarium
- Open house nights at the observatory
  - Friday and Saturday, Sept. 25 and 26, 9-11pm, weather permitting.
  - Observatory:
    - Go south on Farm Lane to the end
    - Turn right. Observatory is 100 yards to the west.

## Galileo's telescope

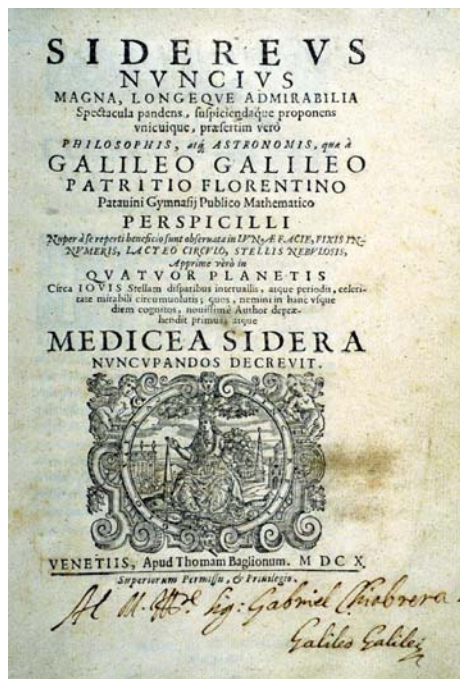


Wood, paper; length: 1360mm, lens diameter 26mm  
<http://galileo.imss.firenze.it>

### Sidereal Messenger

Unfolding great and many wonderful sights and displaying to the gaze of everyone, especially philosophers and astronomers, the things that were observed by **Galileo Galilei, Florentine patrician** and public mathematician of the University of Padua, with the help of a **spyglass** lately devised by him, about the face of the moon, countless fixed stars, the Milky Way, nebulous stars, but especially about the **four planets** flying around the star of Jupiter at unequal intervals and periods with wonderful swiftness; which unknown by anyone until this day, the first author detected recently and decided to name **Medicean Stars**. Venice 1610

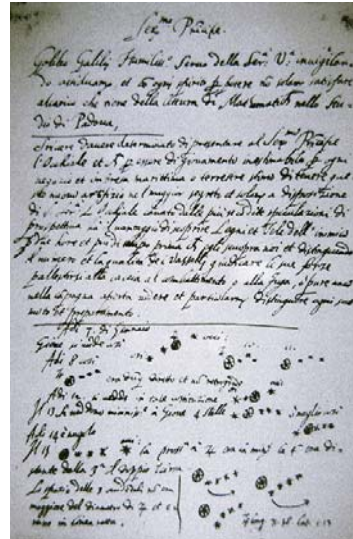
—trans A van Helden, *Siderius Nuncius*, U Chicago, 1989





# Galilean moons of Jupiter

- This was a demonstration that objects orbit something other than the earth.
- On 7 Jan 1610, what unusual hint did Galileo uncover about these “stars”?
    - They were very bright.
    - They were nearly on a line.
  - When did Galileo first know for certain that these were not stars, but moons of Jupiter?
    - 7 Jan 1610
    - 8 Jan
    - 9 Jan
    - 10 Jan
    - 11 Jan



Galileo's journal  
[http://galileo.rice.edu/images/things/journal\\_jup1.gif](http://galileo.rice.edu/images/things/journal_jup1.gif)

- How does the evidence disprove that they are stars?
  - Assume the three objects seen near Jupiter on 7 Jan 1610 were real stars. Draw what Galileo would have seen on Jan 8<sup>th</sup>.
- Spacing between the stars is as on the 7th.
    - the same
    - different
  - Distance from easternmost star to Jupiter is \_\_\_\_\_.
    - precisely the same
    - different.



## Phases of Venus

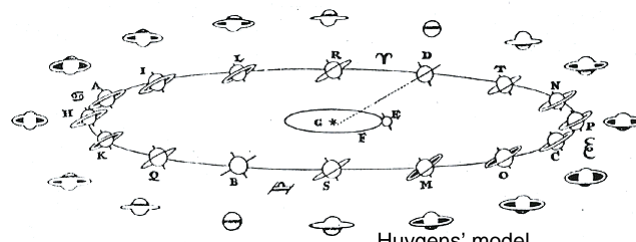
4. When Venus is very, very close to the sun in the sky (for example when Venus sets very shortly after the sun sets), what phases are possible?
  - A. Crescent only
  - B. Nearly full only
  - C. Crescent and nearly full
5. When Venus is very, very close to the sun in the sky (for example when Venus sets very shortly after the sun sets), what phases are possible according to Ptolemy's model?
  - A. Crescent only
  - B. Nearly full only
  - C. Crescent and nearly full

## Phases of Venus

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  - B. Nearly full only
  - C. Crescent and nearly full
- Galileo in a letter to Castelli
  - “Know therefore that about 3 months ago I began to observe Venus with the instrument, and I saw her in a round shape and very small. Day by day she increased in size and maintained that round shape until finally, attaining a great distance from the Sun, the roundness of her eastern part began to diminish, and in a few days she was reduced to a semicircle. She maintained this shape for many days, all the while, however, growing in size. At present, she is becoming sickle-shaped...”
- Galileo disproved Ptolemy's model

## Saturn 1610

- I discovered another very strange wonder, which I should like to make known to their Highnesses . . . , keeping it secret, however, until the time when my work is published . . . . the star of Saturn is not a single star, but is a composite of three, which almost touch each other, never change or move relative to each other, and are arranged in a row along the zodiac, the middle one being three times larger than the lateral ones, and they are situated in this form: oOo. —Letter to Medici
- Circulated an anagram: s m a i s m r m i l m e p o e t a l e u m i b u n e n u g t t a u i r a s.
  - *Altissimum planetam tergeminum observavi*, or "I have observed the highest planet tri-form."
- Tri-form disappeared in 1612.



Huygens' model  
[http://galileo.rice.edu/images/things/huygens\\_phases2.gif](http://galileo.rice.edu/images/things/huygens_phases2.gif)