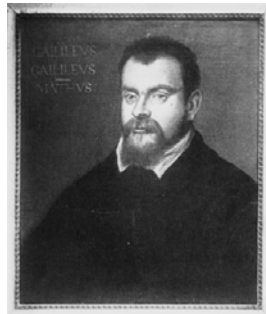


Galileo & the Telescope—Sept 12

- 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.nice.edu/images/people/galileo/g_tintoretto.gif

Abrams Planetarium

- Sky preview 2008-2009
 - September 26-28, Fri & Sat at 8:00 pm, Sun at 4:00 pm.
 - A live show highlighting the current sky, spectacular gatherings of Venus with the moon and other planets in coming months. This program will get you primed to observe what Galileo saw through his telescope 400 years ago, the Milky Way and the Pleiades, details on the moon, the four moons of Jupiter, the phases of Venus, and the mysterious disappearance of Saturn's rings. Long-time skywatcher, Bob Victor, author of the planetarium's *Sky Calendar*, comes out of retirement to give the presentations.

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 **Midicean Stars**. Venice 1610

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



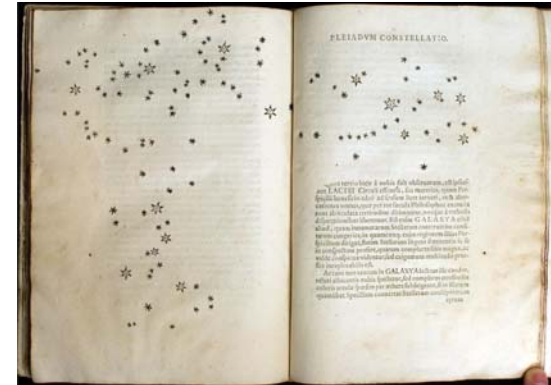
Mountains on the Moon

- Imperfections on a heavenly object

<http://hsci.cas.ou.edu/exhibits/>



Countless stars (Pleiades)



Galilean moons of Jupiter

- This was a demonstration that objects orbit something other than the earth.
1. When did Galileo first know that these were not stars, but moons of Jupiter?
 - A. 7 Jan 1610
 - B. 8 Jan
 - C. 9 Jan
 - D. 10 Jan
 - E. 11 Jan
 2. On 7 Jan 1610, what hint did Galileo uncover about these "stars"?

Galileo's journal
http://galileo.rice.edu/images/things/journal_iup1.gif



Galilean moons of Jupiter

2. On 8 Jan 1610, what did Galileo mean "contrary to the astronomical computation, his motion was direct"?
 Read 1st paragraph p65.

Galileo's journal
http://galileo.rice.edu/images/things/journal_iup1.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 8th.
- 3. Spacing between the stars is ___ as on the 7th.
 - A. the same
 - B. different
- 4. Distance from easternmost star to Jupiter is ___.
 - A. precisely the same
 - B. different.



Phases of Venus

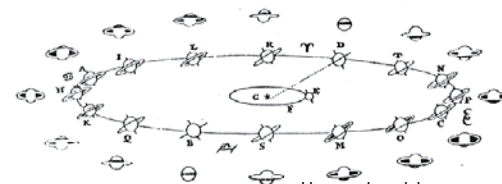
4. When Venus is very, very close to the sun in the sky (for example when Venus sets very shortly after the sun sets), what phases are possible?
 - A. Crescent only
 - B. Nearly full only
 - C. Crescent and nearly full
5. When Venus is very, very close to the sun in the sky (for example when Venus sets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

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
- 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.
 - *Attissimum 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