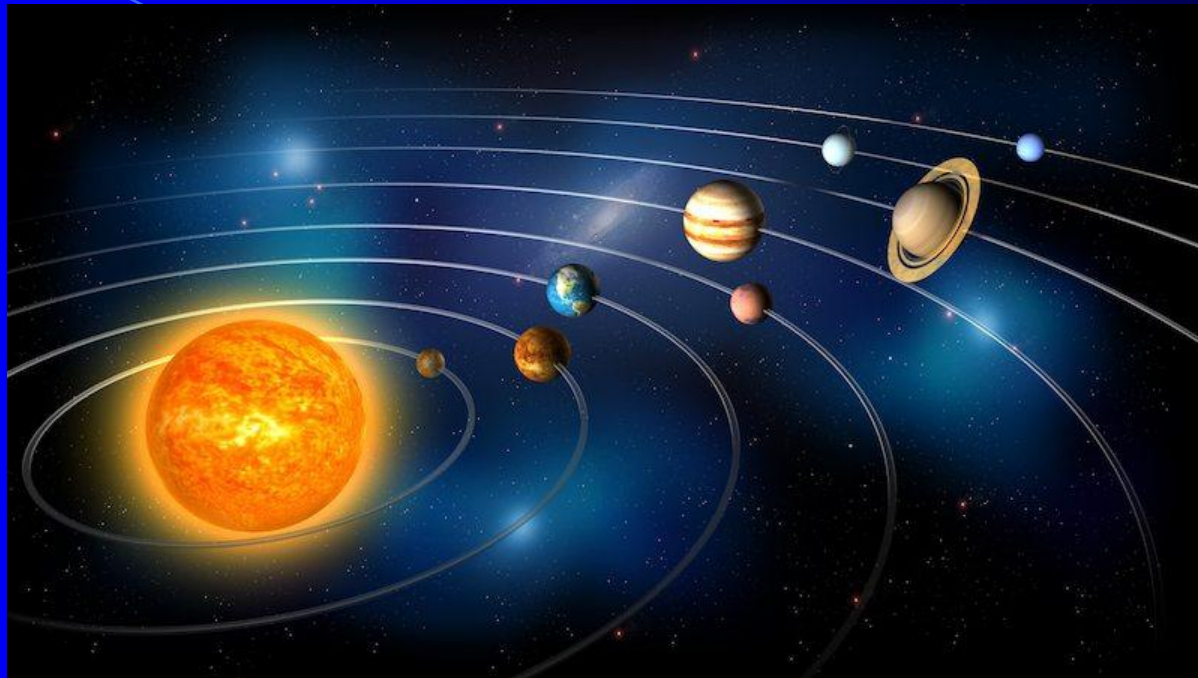


# STORIES BEHIND LANDMARKS IN SC HISTORY

## I. COPERNICUS & GALILEO



V. V. Raman

OLLI: 4 OCTOBER 2021

# FOUR DIMENSIONS OF THE HUMAN EXPERIENCE

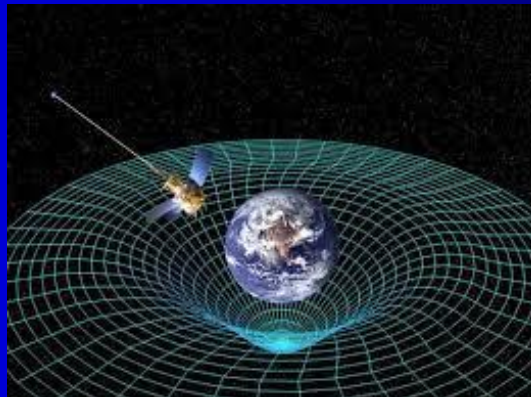
1 The Universe at large.

2 Life Forms.

3. Invisible Forces.

4. Communications

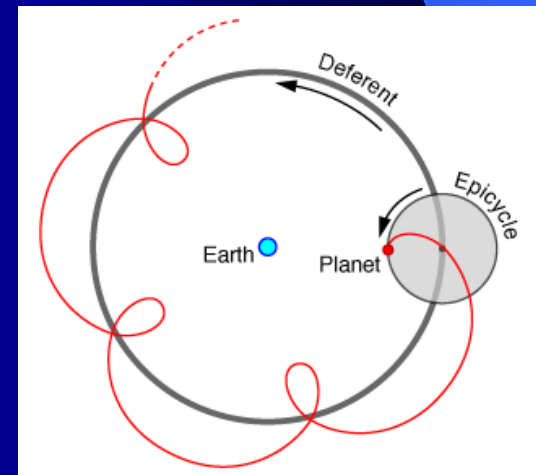
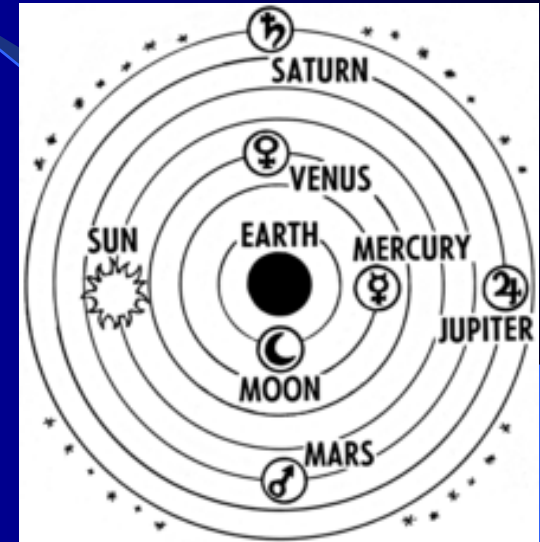
Science has uncovered facts on all these.



# UNIVERSE BEFORE 1543: GEOCENTRIC MODEL

Since ancient times it was believed that the celestial dome of the heavenly stars turns around our earth that is fixed at the center.

There was one difficulty: Planets periodically reverse their motion and resume the forward motion. This was explained through cycles and epicycles.

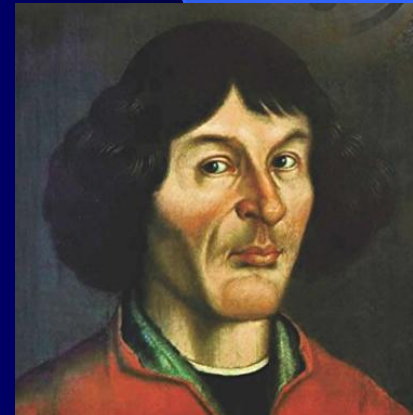


# NIKLAS KOPPERNIGK (1473 – 1543)

Studied at University of Krakow, went to Italy where he studied Canon Law and Medicine.

Returned to Poland as Canon of Frambrok.

Here he devoted himself to astronomy.





# Copernicus WROTE A TEXT

## 1507 - 1512

De Hypothesibus motum  
coelestium commentarilus.

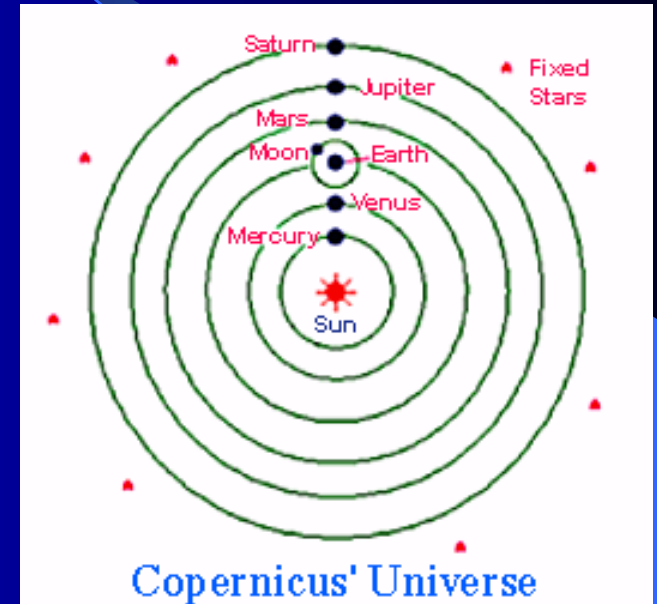
Its 7 propositions included:

**1 No center of motion.**

**2 Earth NOT center of U.**

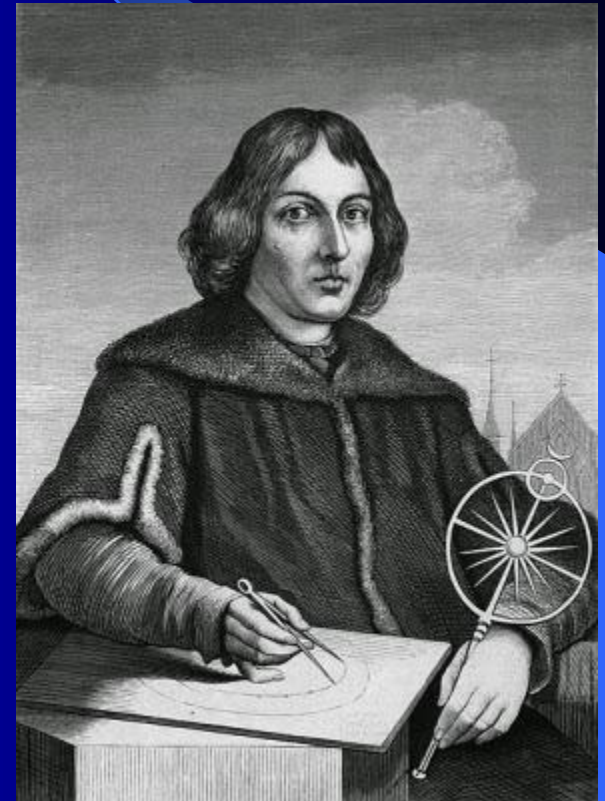
**3 Planets go round Fixed Sun  
(Heliostatic).**

**4 Observed movements are due  
to Earth's motion.**



# GEORG RHETICUS (1514 – 76)

Copernicus gave his long manuscript of *De revolutionibus* to his friend Rheticus who publicized the work as more harmonious than older model. The book was dedicated to Pope Paul III, known for his astrology. The book was published in 1543. But long before that the heliostatic proposal was known to many.



# BOOK IN THE DEATHBED

The book was published in less than three years, Copernicus survived long enough to see his book.

He received a copy in his deathbed, died the same day: May 24, 1543.

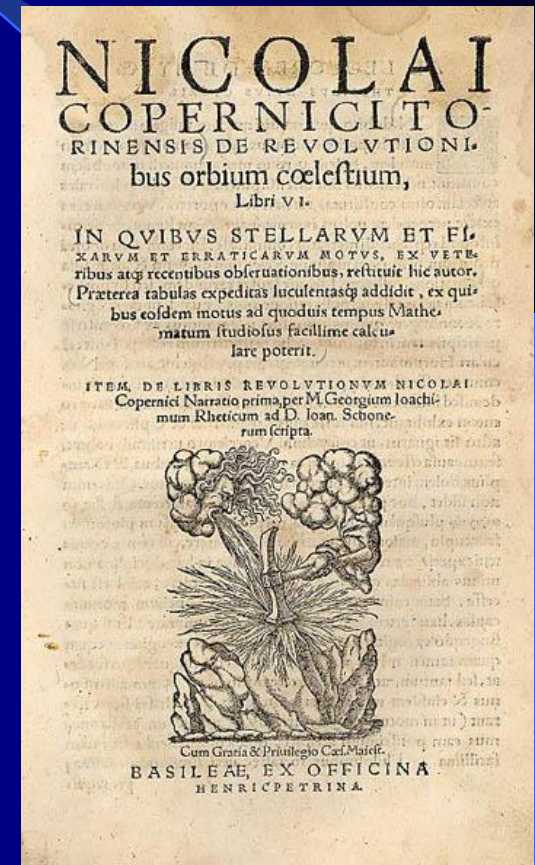


# DE REVOLUTIONIBUS ORBIUM COELESTIUM (1543)

"The world is a visible god on account of its extraordinary excellence."

Copernicus pays homage to Ptolemy "who stands far in front of all others in the divine science of astronomy.

The world is spherical, so is the earth. In Chap 5: Does the earth have a circular movement?



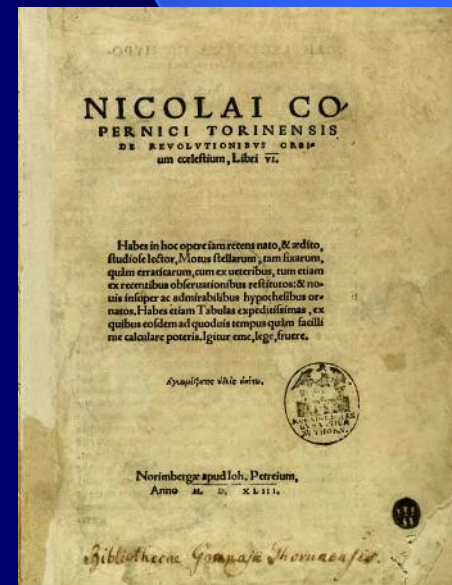


# FALSE PREFACE

Andreas Osiander inserted an opening Preface that misconstrued hypothesis.

"The hypotheses need not be true or even probable; if they provide a calculus for consistent with the observations, that alone is sufficient."

Discovered in the 19<sup>th</sup> cent.

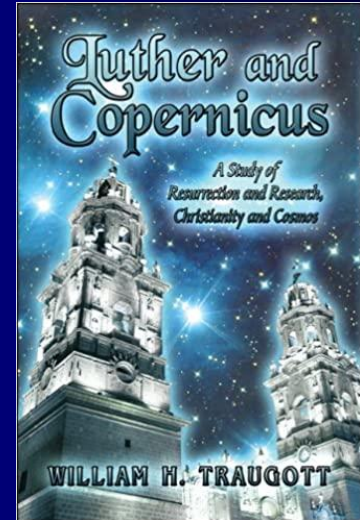


# REACTIONS TO COPERNICUS

The Copernican idea was revolutionary in that it contradicted the Scriptures. Martin Luther called him a foolish astronomer because he contradicts Joshua's order to the Sun to stand still.

Philip Melanchthon said Copernicus' pernicious notions lack honesty and decency.

The Book was on the Papal index in 1616 Removed in 1835.

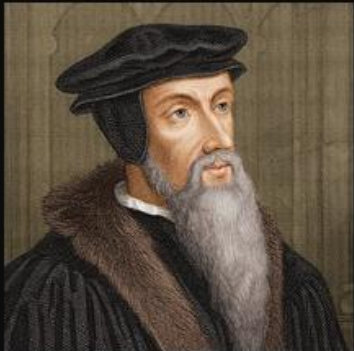


**Joshua 10:12-14** "At that time Joshua spoke to the Lord in the day when the Lord gave the Amorites over to the sons of Israel, and he said in the sight of Israel. "Sun, stand still at Gibeon, and moon, in the Valley of Aijalon." And the sun stood still, and the moon stopped, until the nation took vengeance on their enemies."

# OTHER OPPOSITION

Calvin insisted on the literal interpretation of the Scriptures.

The Catholic Church called it 'philosophically foolish and absurd and expressly heretical.'



Who will venture to place the authority of Copernicus above that of the Holy Spirit?

~ John Calvin



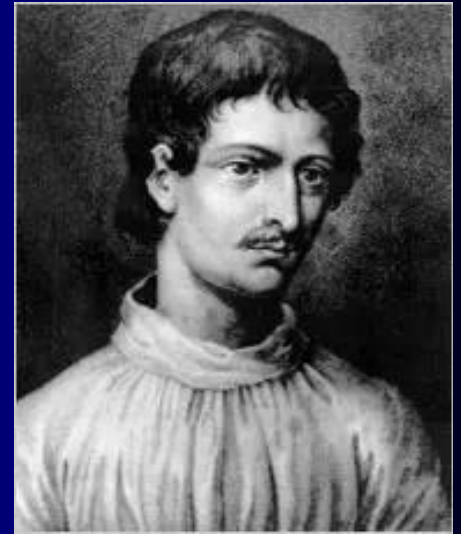


# GIORDANO BRUNO

## (1548 – 1600)

Bruno propagated unpopular views: Space is infinite. The earth is in motion. He had scant respect for Authorities.

He fled from Rome to Geneva with the name of Filippo. He was arrested in Venice After a 7-year trial He was tortured and burned at stake for upholding the Copernican idea.



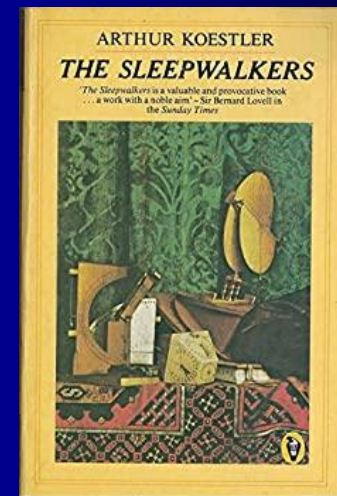
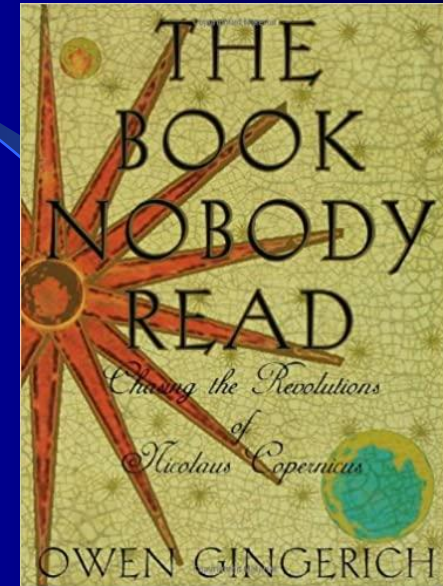


# THE BOOK NOBODY READ

Arthur Koestler  
(1959)

Sleepwalkers said  
it was The book  
that Nobody read.

Owen Gingerich  
(2004) , after than  
a decade of  
research  
established this was  
completely wrong.



# STATUE IN WARSAW

Because of the Church's opposition there was no statue of Copernicus.

When Napoleon invaded Poland, he visited C's home and noticed this.

As a result, in 1839 a statue was erected. But no Catholic priest to officiate.



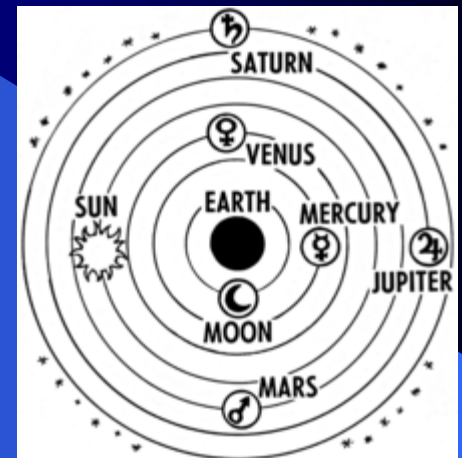
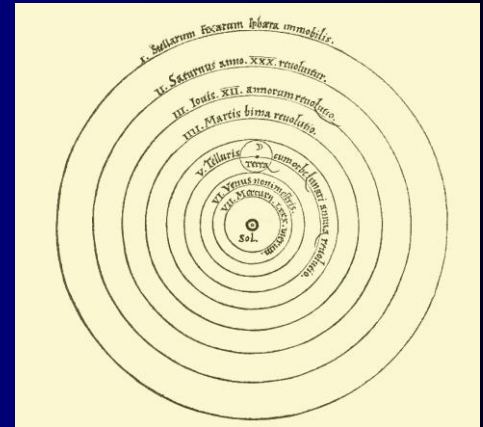
# The Copernican Revolution

The emergence of Modern Science. For the first time:  
We realized we are NOT in the Center of the Universe.

The earth is a planet.

Sun and Moon are not planets.

To remember the old worldview we have the seven-day week dedicated to: Sun, Moon, Mars, Mercury, Jupiter, Venus, and Saturn.

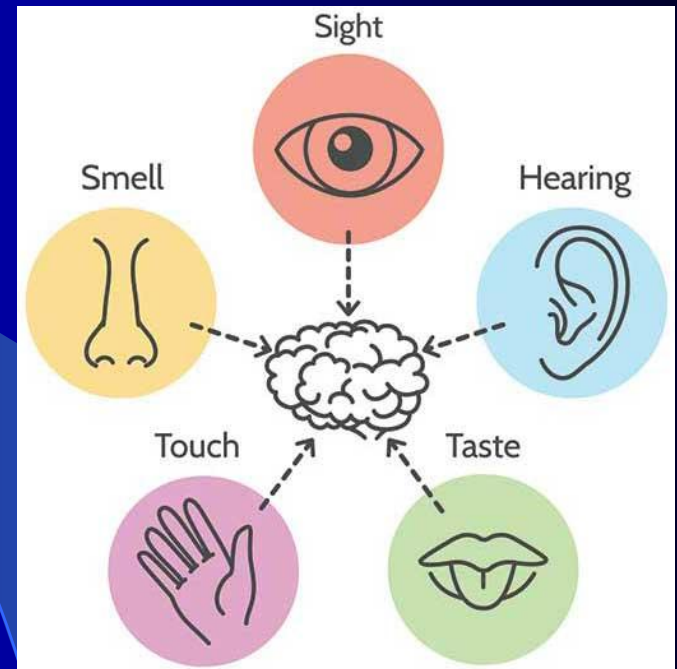


# ENHANCING VISIBILITY

We perceive the world through our five senses. They give knowledge and experience.

But these are limited in range and sensitivity.

We cannot see things too faint or far away, or too small.

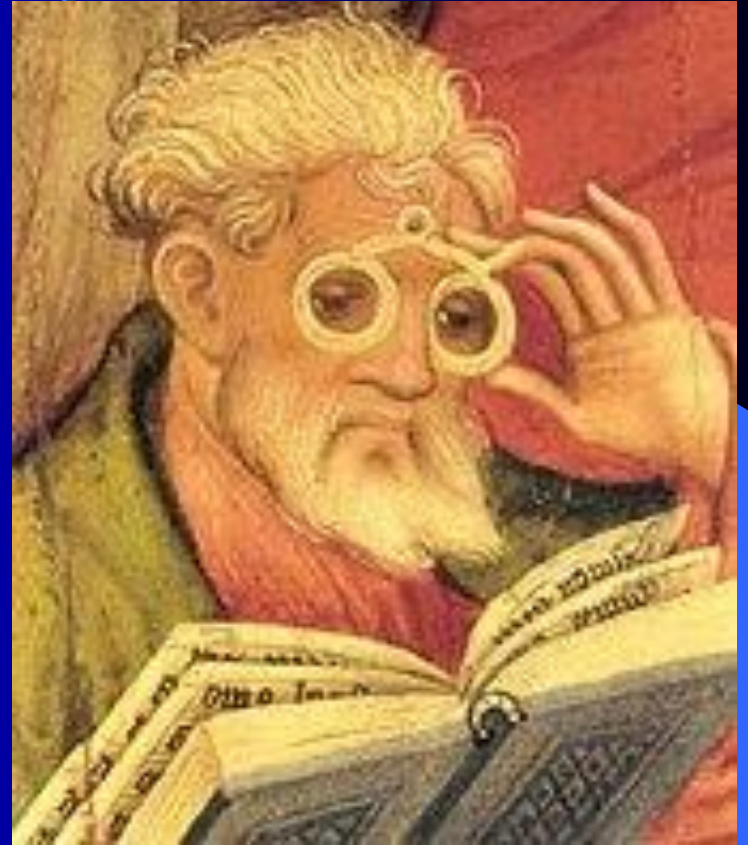




# EYE-GLASSES

The history of eye-glasses is not very clear.

But they seem to have come into general use in the 14<sup>th</sup> century.



# HANS LIPPERSHEY

## (1570 – 1619)

He was a lens-grinder making spectacles.

An assistant accidentally found that two lenses held together, made a distant object look closer.

Lippershey mounted them in a tube and sold them to the government for spotting enemies in a battle.



# GALILEO'S VERSION

When Galileo heard about the Flemish invention in he got to work and made one himself. In a letter to his brother.

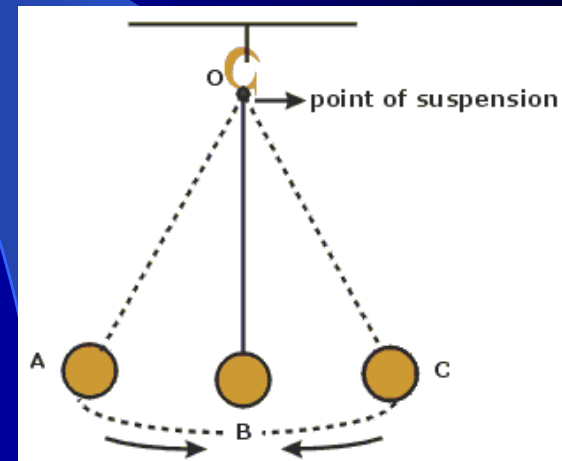
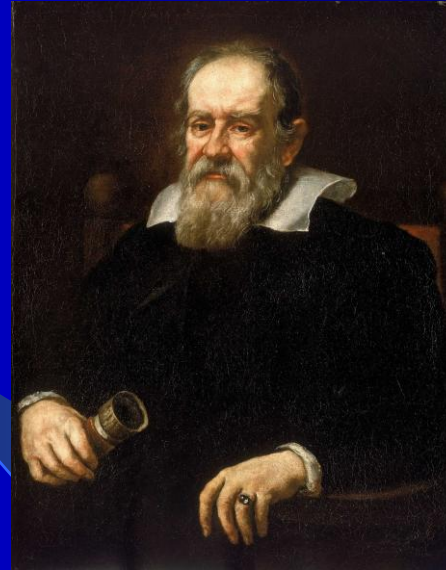
Michelangelo (19 Aug 1609) he said he had perfected it to an optical power of 10. He kept improving it an reached a power of 30.



# GALILEO GALILEI

## (1564 – 1642)

G started as a medical student. He was drawn to math after listening to a lecture on geometry. He did experiments with falling bodies and pendulums.





# TELESCOPE TO STUDY CELESTIAL BODIES

Galileo turned the telescope,  
not to a distant enemy-army,  
but heavenwards. Thomas  
Harriot tried to make a Moon-  
map a year earlier]

Saw aspects of celestial  
bodies that no one had even  
imagined before.

He revolutionized observational  
astronomy.



# VIA GALACTICA: MILKY WAY

The whitish continuous patch across the night sky, visible to the naked eye looked granular.

It is actually made up of millions of very distant stars.

Now we know that it is only one of millions of galaxies in the universe.

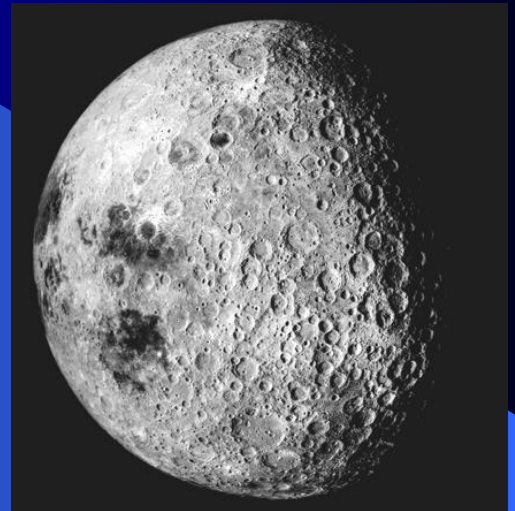


# Lunar Surface

The moon is not a smooth ball with dark patches here and there. It has a rugged surface with plains and mountains.

The dark patches are shadows cast by sunlight.

This contradicted the Aristotelian idea that celestial bodies are all perfect and smooth.



# JUPITER'S FOUR MOONS

His telescope revealed that four tiny bodies were moving around the planet Jupiter. They were named Io, Europa, Ganymede, Callisto. Kepler called them satellites.

*Observations of Jupiter*  
1610

20. Jan. mod. H. 12	○ **
30. Jan.	** ○ *
2. Feb.	○ ** *
3. March	○ ** *
3. Nov. 1610	* ○ *
4. March	* ○ **
6. March	** ○ *
8. March H. 12.	* * * ○
10. March.	* * * ○ *
11.	* * ○ *
12. H. 4. 1610	* ○ *
17. March	* ** ○ *
14. June.	* * * ○ *



Ganymede

Callisto

Io

Europa



# BODIES CIRCLING A PLANET?

This was another blow to geocentrism.

Some objected there can't be more than 7 bodies in the solar system because 7 is a sacred number.

Today we know that Jupiter has 79 moons.

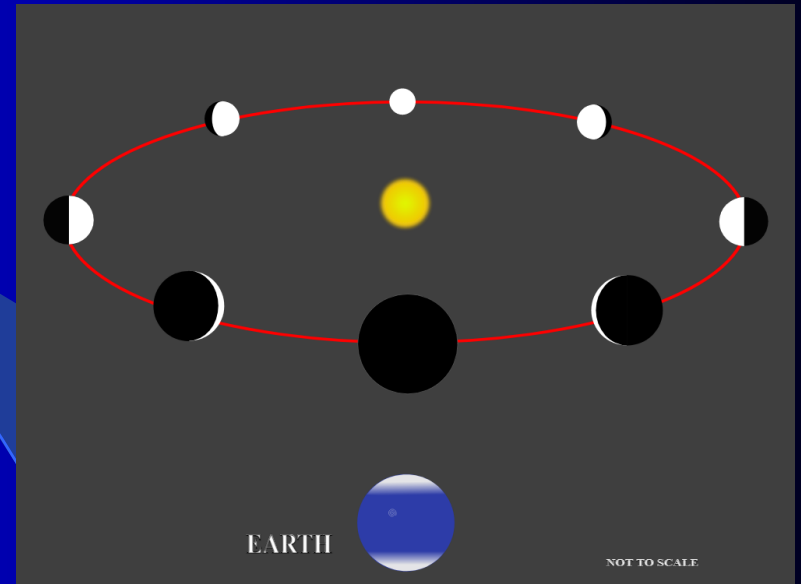
Therefore, 3 + 4 = 7, symbolizes those things which **REPRESENT** the 'FULLNESS', the 'COMPLETION' or 'PERFECTION' of that which is '**SACRED**'!



# PHASES OF VENUS

Galileo's telescope revealed that Venus also changed phases exactly like the moon.

This was another confirmation of the Copernican model.

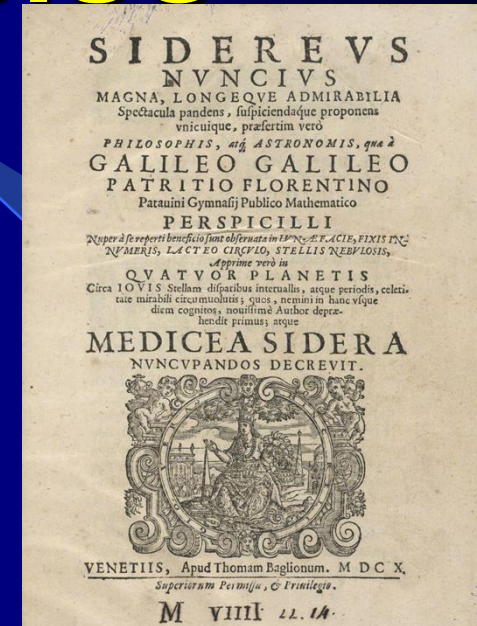


# SIDEREUS NUNCIUS

The Starry Messenger (March 1610) reported Galileo's astronomical discoveries.

The book was in Italian to reach the public. Jupiter-moons were Cosmin stars. Cosimo called them Medicean stars.

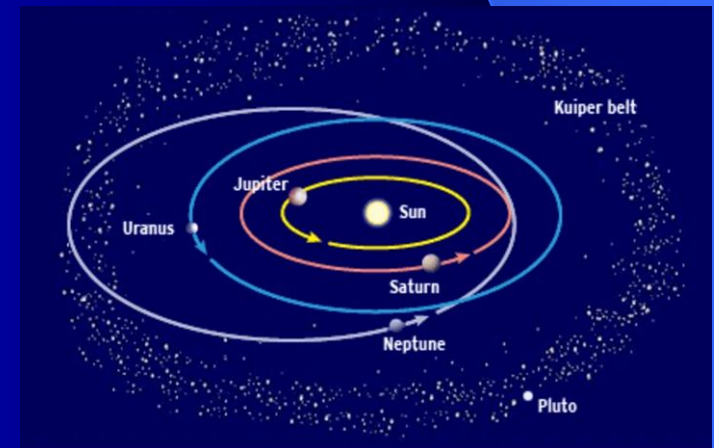
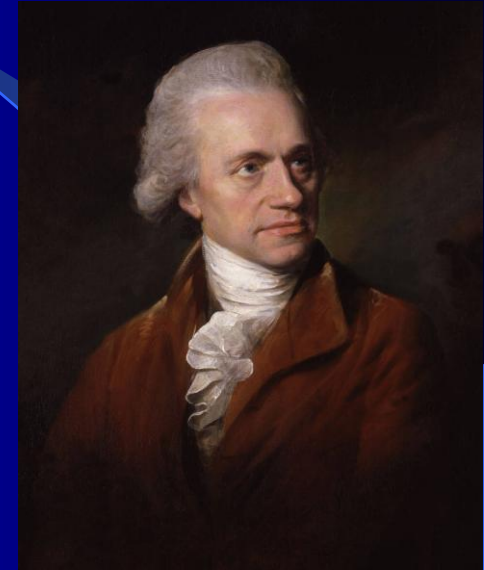
Galileo became court mathematician and at U of Pisa. The book was an instant international success.



# NEW PLANET: URANUS

In the following centuries more planets were discovered: Uranus was the first planet to be discovered (1781) through a telescope.

William Herschel. First called Georgium Sidus in honor of George II of England.



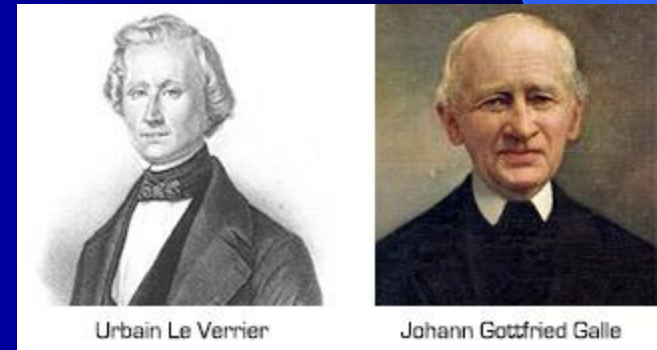


# NEPTUNE

Neptune was postulated September 23, 1846, by Urbain Le Verrier.

He calculated the approximate location of the planet by studying gravity-induced disturbances in the motions of Uranus.

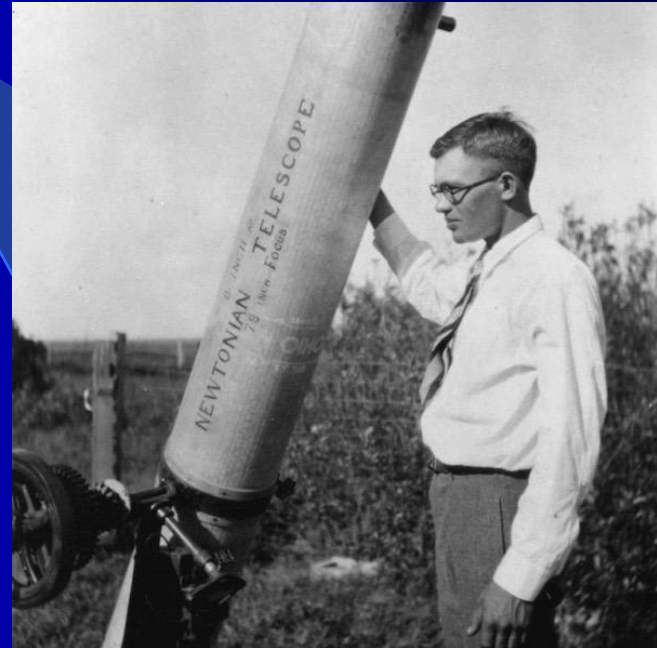
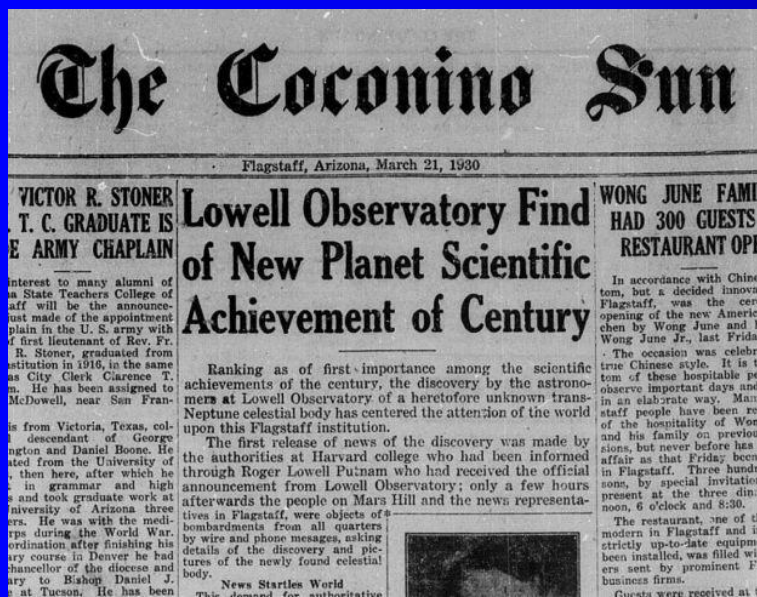
Johann Gottfried Galle discovered it Oct 10, 1846. Neptune was named for the Roman god of the sea.



# PLUTO AND OTHERS

Pluto was discovered at the Lowell Observatory in Flagstaff, Arizona.

It was discovered by astronomer Clyde W. Tombaugh.



# CHAOS THEORY IN KNOWLEDGE EXPLOSION

Small disturbance somewhere leads to large impact elsewhere. Butterfly effect.

Lippershey tried to improve reading glass.  
Effect: Telescopic astronomy.

