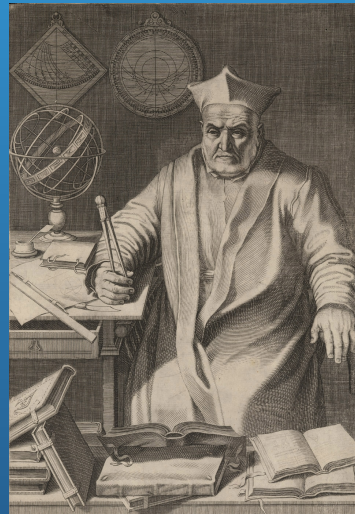


Fr. Christopher Clavius, S.J. (1538-1612)

- Jesuit and Scientist and his Legacy at the Roman College



GABRIELE GIONTI , S.J.



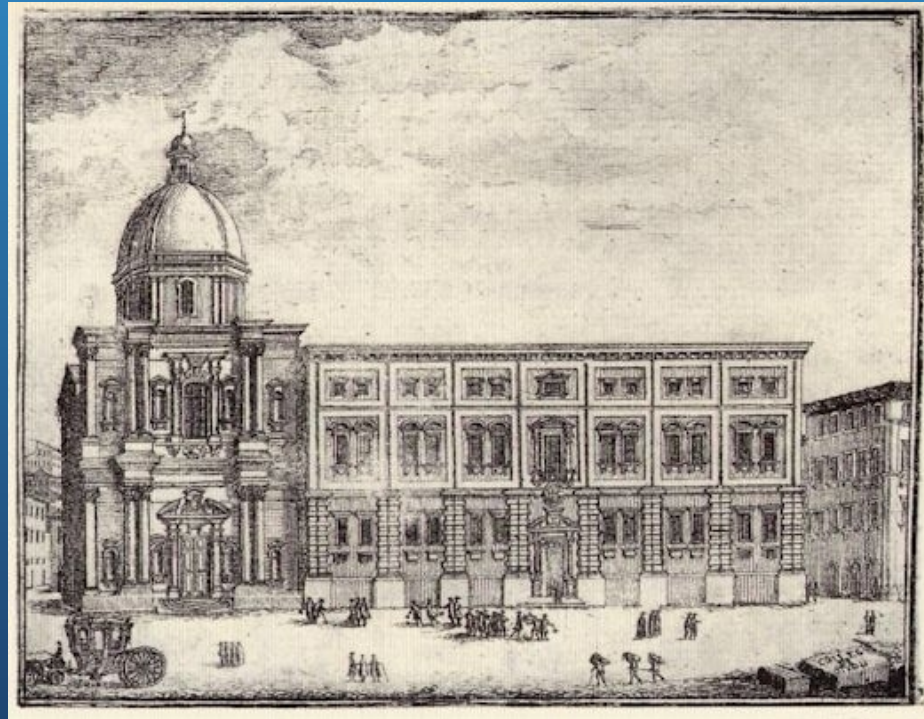
VATICAN OBSERVATORY

Roots in St. Ignatius of Loyola academic formation

- “Modus Parisiensis” matched Medieval Scholasticism with new emerging “positivistic” disciplines.
- There was always a humanistic approach. Science was thought analyzing the Greek and Latin texts of classic scientific authors.
- Three years of Philosophy (which included maths, astronomy and Physics...) as a spiritual training for theology. Studies should be adapted “ad personam”...to help the flourishing of the student’s talents.
- St. Ignatius adopted this teaching method in the early Jesuit Colleges (Original Idea of Lainez)



- Messina (1548) first Jesuit College. Nadal (Rector) thought mathematics as well as Greek and Hebrew.
- Mathematics consisted in elementary arithmetic and the Euclid Elements.



- The study of mathematics is mentioned in the S.J. Constitutions section IV, chapter XII.
- Francis Xavier in a letter to Ignatius on January 29th 1552 mentions that Japanese people were attracted by the scientific knowledge of western culture
- Letter on April 9th 1552 highlights that missionaries should be well trained in western science



Fr. Christopher Clavius, S.J. early formation



- Born in Bamberg on March 25th 1538
- Probably attended the local Jesuit College.
- He was received in the Society by St. Ignatius in 1555
- Studied philosophy under Pedro de Fonseca at the Univ. of Coimbra
- Maybe mathematics under Pedro Nuñez Salaciense

- While at Coimbra, he observed the total solar eclipse on August 21th 1560.
- Back to Rome, Roman College, in 1560 where he studied Theology for four years. Ordained Priest in 1564
- He began to teach mathematics in 1563
- He became official professor of mathematics in 1567 and took the place of Baucek



Clavius as professor of mathematics at the Roman College

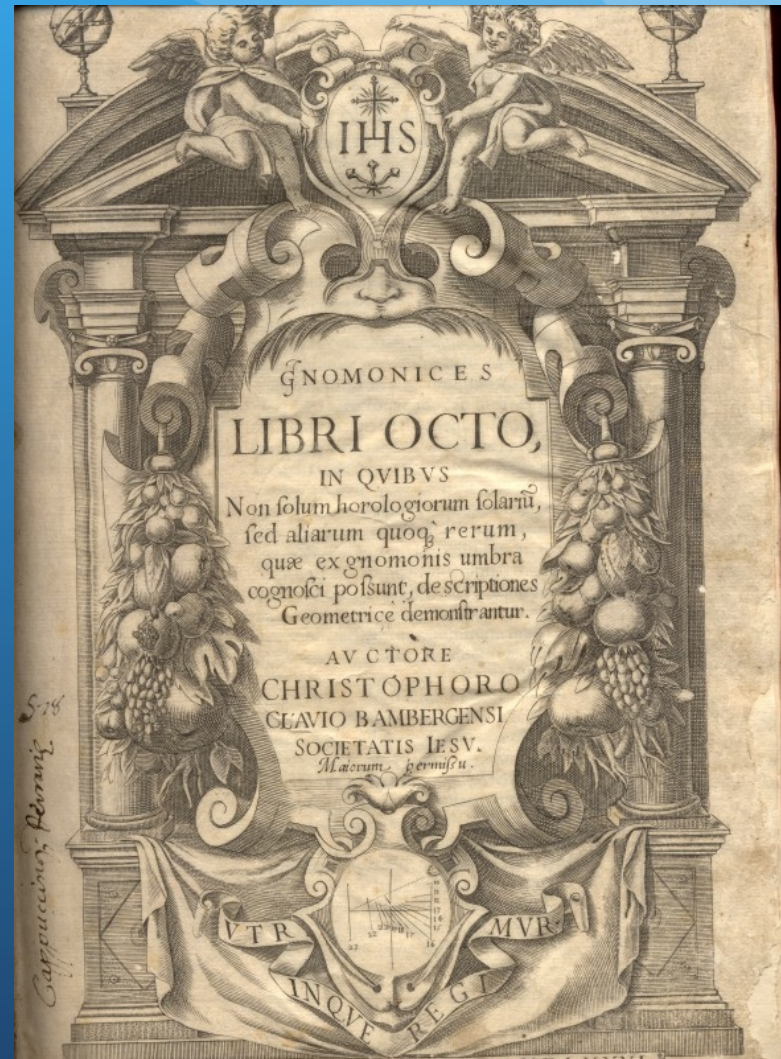
- In the Aristotelian-Thomistic framework, all topics of studies, including science, were seen as “Ancillae Theologiae” (Theology was “The Science”)
- Even the concept of science was different from nowadays. Mathematics (“Mathesis”) different from “Mathesis mixta” (applied mathematics)...(no ontological content...borrowed from philosophy)
- Physics was the Aristotelian Physics (connected to the ontology, the search for reality-essences)



- Mathematics gave probabilities rather than certainties.
- Philosophy and the dialectic reasoning was considered more certain than mathematics.
- Clavius, because of his prestige, was able to be influential in the elaboration of the “Ratio Studiorum” and included the study of mathematics even in the basic program of studies.
- “Ratio Studiorum”= program of studies at Jesuit Colleges.



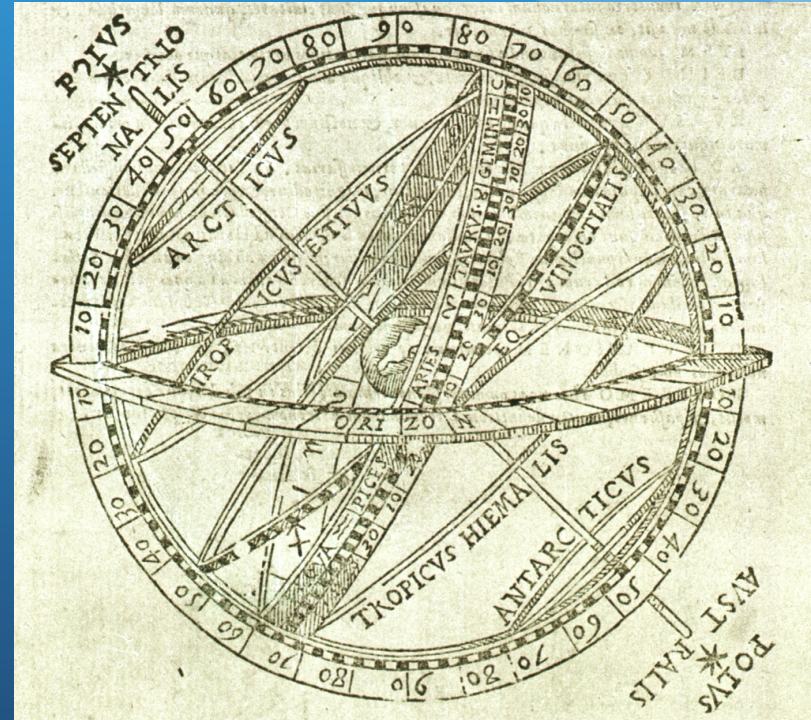
- Three editions of the “Ratio Studiorum”, 1586; 1591; 1599.
- Clavius was able to establish an “Accademia” for mathematicians at the Roman College
- There were standard classes in math and advanced classes for talented Jesuits, who were trained for teaching mathematics



- These writings for the “Ratio” highlighted, in Clavius’ mind, the importance of mathematics for natural science before Galileo.
- The members of the Academia were listed as “mathematici” in the Jesuit catalogues
- The programs were quite intense and the members were allowed to skip some philosophy or theology classes.



- Main Classes on the “*Sphaera*” of “*Sacrobosco*” (Geocentric system)
- The fifteen book of the Euclid Elements (with Clavius comment)
- “*Gnomonica*” and “*Centrobarica*”
- “*Geometria Practica*” and “*Algebra*”



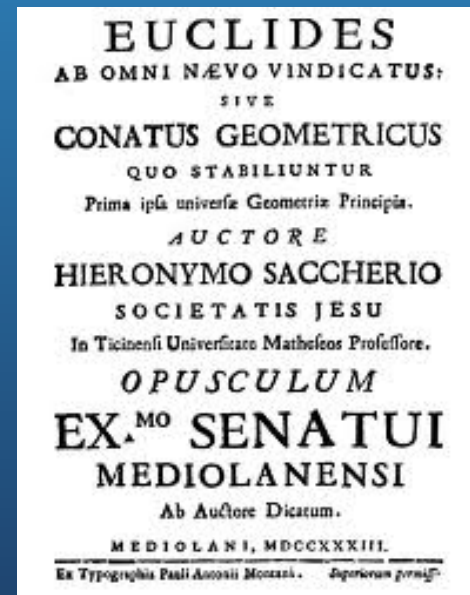
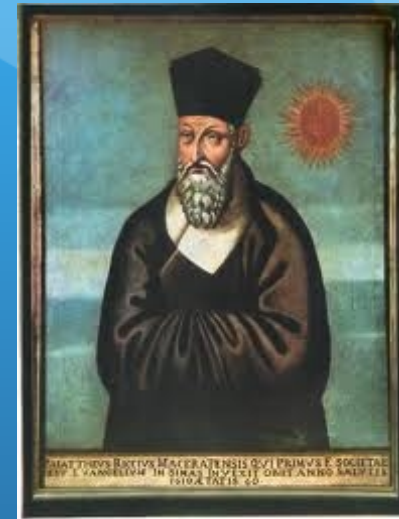
- It is probable some studies on Statics-Equilibrium problems.
- These studies were carried reading ancient Greek and Latin authors.
- Very good mathematicians and missionaries were formed at the accademy



- P. Greinberger, S.J. succeeded to Clavius.
- P. Orazio Grassi, S.J. entered in polemic with Galileo on the nature of comets (Galileo was wrong...)
- P. Gregorie de Saint Vincent, S.J. worked at the squaring of the circle. Thought at the Jesuit College at Antwerp and was appreciated by Huygens

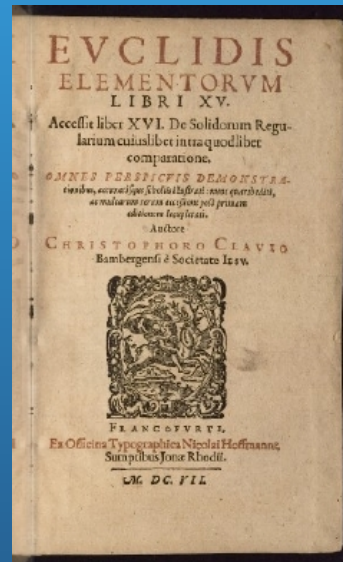


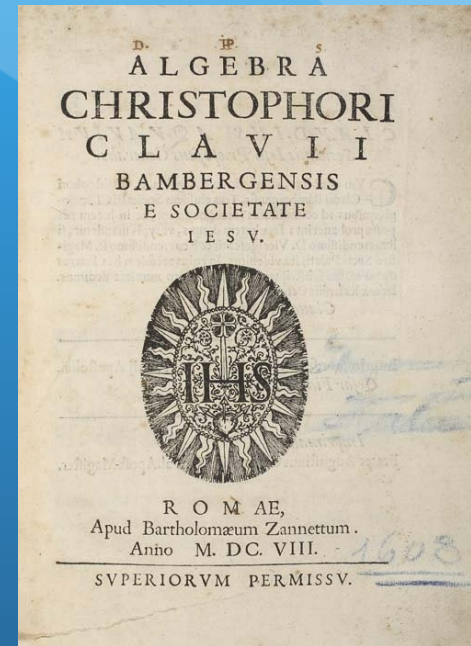
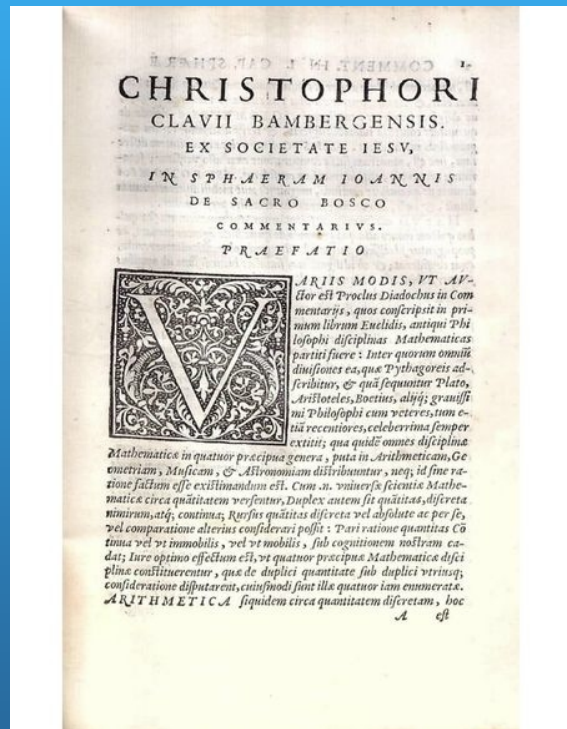
- P. Girolamo Saccheri, S.J. was the latest, before the suppression of the Society 1773, and most famous exponent.
- As a Geometer tried to prove the necessity of the V Euclide's postulate on the parallel lines. He arrived close to non-Euclidean geometries.
- Famous missionary was Fr. Matteo Ricci, S.J.
- Translated into Chinese the first VII books of the Euclide Elements of Clavius.
- Ricci was mainly appreciated for his astronomical and mathematical knowledge.
- Many famous scientists in Europe attended Jesuit Colleges like, for example, Descartes.



Clavius Scientific Production

- Comment to the XV books of the Euclid's Element (very good exegesis of the text...studied in many schools in Europe).
- Mathematicians in Europe acknowledged his competence in the Elements and called him “The Euclid of the XVI century”.
- Clavius, since he became a famous mathematician, was called by Gregory the XIII to take part to the committee on a reform of the Julian Calendar proposed by Luigi Giglio. He was asked to explain and spread the New Gregorian Calendar “*Novi Calendari Romani Apologia*”

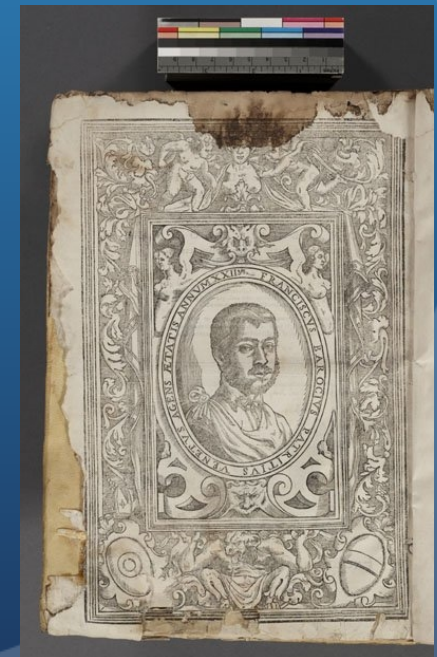
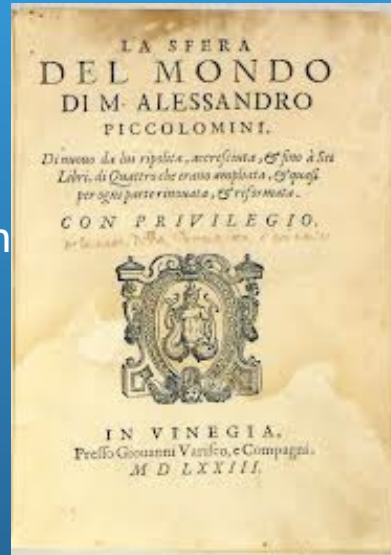




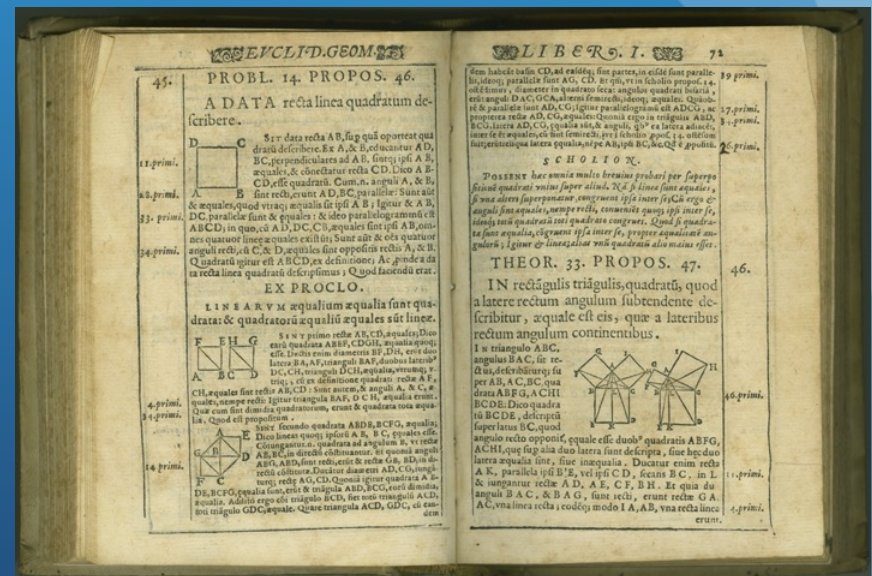
- Comment to the “Sphaera”, “Geometria Practica” and other book we already mentioned.
- He passed slowly from a typical attitude of teaching commenting Greek and Latin classic authors, to the need to write manuals for his classes.

Clavius' Philosophy of Mathematics

- Questions on Mathematics' certainty. Still dominance (and Clavius was formed in that) of the Aristotelian Thomistic view. (Mathematics gives "probabilities" on reality)
- Piccolomini [Paduan Aristotelian]: Mathematics less certain than Natural Science (Aristotelian Physics). Thesis backed by Jesuit philosophers at Roman College (Pereira)
- Barozzi, Neoplatonist and followers of Proclus: Mathematics less certain than divine science (theology) but more precise than natural science.

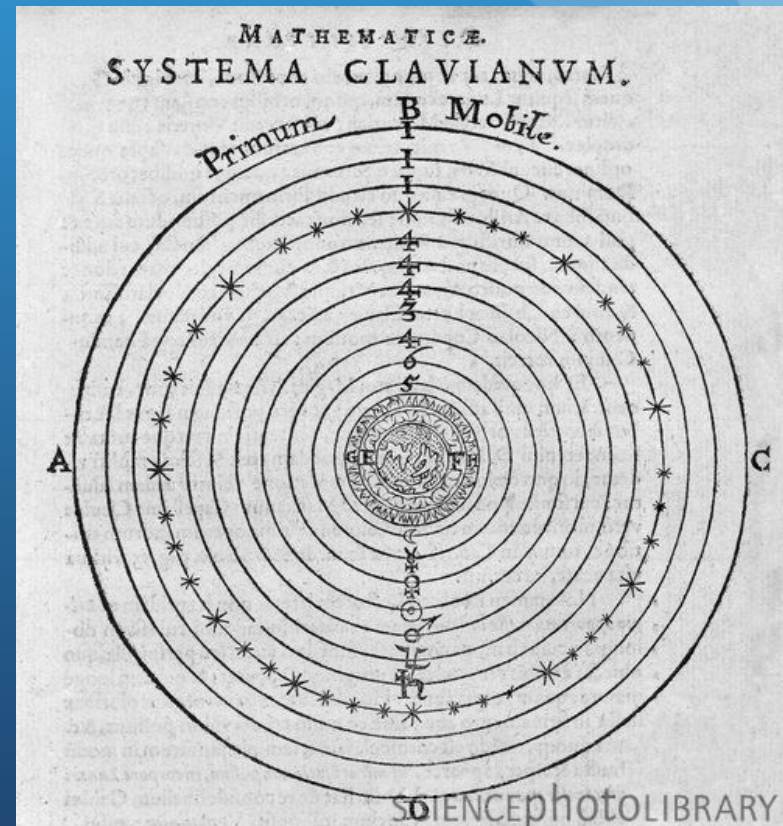


- In the *Prolegomena* of his comment to the *Elements*, Clavius highlights that mathematics 'certainty' was between metaphysics and natural science and the degree of its demonstrations was the highest
- Notice that in this way he is paving the way to the importance of mathematics in the scientific revolution
- He still remained a man of his time, definitive truth of things was given by philosophical and theological reasoning.



Clavius, Geocentrism and Copernicanism

- Being a scientist of the “Old Times”, he believed and thought the geocentric system.
- He believed that Ptolemaic and Copernican systems explained the same astronomical data.
- Mistakes explained by Kepler
- The latest edition of the “In sphaeram Ioannis de Sacro Bosco Commentarius” asked the astronomers to find a variation of the geocentric system to fit with Galileo observations



Clavius and Galileo

- Galileo met Clavius in 1587 at the Roman College and gave a copy of his works (theorems on the barycenter) to Clavius.
- Impressed by the young scientists, Clavius wrote a recommendation letter to Galileo for a position at the University of Bologna.
- Clavius helped Galileo in improving his knowledge on Logic.
- Asked by Card. Bellarmine, he read the "*Sidereus Nuncius*" and, with a good telescope, confirmed in 1610 Galileo's observations.

