

History & Philosophy of Science (Erasmus L6)

The Scientific Revolution

- Nicolaus Copernicus (1473-1543)
 - Heliocentric system (Sun as the center of the solar system)
 - *De Revolutionibus* (On the Revolution of the planets)
- Johannes Kepler (1571-1630)
 - Laws of planetary motion
 - Orbits of the planets: Ellipses
 - Equal areas in equal periods
 - The square of the period proportional to the cube of the semi-major axis



The Scientific Revolution (cont)

- Galileo Galilei (1564-1642)
 - Explicit support of the heliocentric system. Problems with the Roman Inquisition
 - Discovery of the nature of the movement of the terrestrial bodies (acceleration due to gravity)
 - Abstract models of the real phenomena
 - “Dialogue Concerning the Two Chief World Systems” (1632)
 - “Discourses and Mathematical Demonstrations Relating to Two New Sciences” (1638)
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The Scientific Revolution (cont)

- Isaac Newton (1642-1727)
 - Unification of the laws of terrestrial and heavenly movements
 - Universal Law of Attraction (Gravitation) – Introduction of the centripetal force (until then they spoke only about the centrifugal force)
 - Connection of kinematics and dynamics through his 3 laws of motion
 - Law of inertia
 - Force (vector sum of the forces) is equal to the mass multiplied by acceleration: **F=m.a**
 - When a body A exerts a force on a body B, B also exerts an opposite force equal in magnitude on A.
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Logical Principles

- Modus Ponens (rationalistic)
 - If { $p \rightarrow q; p$ } then q
 - e.g. if adult then I am allowed to get driving license + I am 20 years old(adult) so I am allowed to get driving license
- Modus Tollens (rationalistic)
 - If { $p \rightarrow q; \neg q$ } then $\neg p$
 - e.g. to live I need oxygen + there is no oxygen in Mars so I cannot live in Mars
- Induction (empiricist)
 - From many similar particular -> general law
 - e.g. copper metal, iron metal, silver metal etc. undergo thermal expansion -> all metals undergo thermal expansion

Exercise

- The trial of Galileo before the Roman Inquisition
- The influences of ancient philosophers and astronomers on Copernicus
- Letter of Galileo to the Grand Duchess Christina of Tuscany about the distinction between scientific discoveries and religious faith
- Describe an example of behavior following rationalistic logic and another one following inductive-empiricist logic