Chapter 4. The Renaissance

Note. In this section we quickly consider the contributions of Copernicus, Brahe, Kepler, and Galileo.

Note. Nicholas Copernicus (1473–1543) was a Polish astronomer who advocated a Sun centered universe (or *heliocentric*). He published *On the Revolutions of the Celestial Sphere* in the preface of which he said (out of fear of persecution by the church) that his model was simply for calculations and that it was not actually true. This worked, and he never was persecuted by the church. His model said the planets orbit the sun in perfect circles.

Note. Tycho Brahe (1546–circa 1600) observed a supernova in 1572 (the last one observed in our galaxy) and showed that it was very distant from the Earth and concluded that the heavens are not perfect and immutable. He also observed a bright comet in 1577 and showed that it penetrated the alleged crystalline spheres. He didn't accept the heliocentric view. He is best known for very detailed observations of the planets, though he never analyzed his data.

Note. Johannes Kepler (1571–1630) studies the data of Brahe. Based on this data, he stated his three laws of planetary motion:

1. **Kepler's First Law of Planetary Motion.** The planets orbit the Sun in ellipses with the Sun at one focus.

2. **Kepler's Second Law of Planetary Motion.** For a given plant, the area swept out by a line joining the planet and the Sun is equal in equal lengths of time.

3. **Kepler's Third Law of Planetary Motion.** The square of the period P of a planet is proportional to the cube of the semimajor axis a of the orbit; $P^2 = a^3$.

Note. Galileo Galilei (1564–1642) seriously applied the scientific method to the problems that he studies. He made many advancements in the mechanics ("laws of motion") of a pendulum and objects in free fall. In astronomy, he:

- was the first to point a telescope to the heavens,
- saw that the Moon was not a perfect sphere,
- observed that Jupiter has four satellites that orbit it (today called the "Galilean satellites),
- saw that Venus has phases and shines from reflected sunlight,
- saw sun spots and that the Sun is "imperfect" and it rotates.

Galileo was persecuted by the church and was blind for the last 4 years of his life.

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