# Humankind Efforts to Discover the Working of the Solar System

Human beings have always had a quest to discover and explain the working of the solar system and other bodies that are present in the universe. Man has always been fascinated by the workings of the outer world, from the existence of the other bodies to the alien theories that plague science fiction in the 20th and the 21st centuries. The early man held several interesting theories about the universe, but it was until much later that man found a way to either approve or disapprove the theories. Several scientists were instrumental in this process. The most significant ones include Copernicus, Isaac Newton, Johannes Kepler.

## Nicolai Copernicus (1473-1543)

The earth centered theory that was proposed by Aristotle was held by the west for over two centuries. This was in spite the propositions of a universe that was centered by the sun. In the 16th century, however, there was a change in this way of thinking that was proposed by a Polish scientist named Nicolai Copernicus. In his book *On the Revolutions of Heavenly Sphere,* Copernicus proposed that the sun is the center of the solar system and that the planets that were then known to him revolved around the sun. This system is known as the heliocentric system.

The ordering the planets that was used by Copernicus is still the one that is in use in modern science. In this new ordering the sun was just another planet and the sun revolved around the earth, not the sun as it was previously thought. The stars were recognized as distant heavenly bodies that maybe had their own solar systems and did not revolve around the sun. The earth was proposed to rotate on its own axis and make a complete revolution inn 24 hours, thus causing it to seem as if the stars were revolving around the globe in the converse direction.

The Copernicus system offered a straightforward account of the unstable intensity of the planets and the retrograde motion (Jardine 170). The planets in such a system have to display varying levels of brightness as they do not maintain the same distance from the sun. Geometry can explain the retrograde motion as the planets that is closest to the sun tending to have smaller orbits and thus make faster revolutions.

## Johannes Kepler (1571-1630)

Kepler was a German astrologer that was hired by Tycho shortly before he died so that he could interprete the observations that he had made of the planets. At first Tycho was reluctant to share all his data with Kepler I the hopes that he could figure out the planetary system on his own someday. He gave Kepler the data on Mars as it was the most complicate, not knowing that this is what would form the basis for his discoveries. Tycho had observed that Mars’ orbit deviated most from a circle.

Kepler believed in the Copernican system of planets and sought to reconcile the observations of Tycho with a heliocentric model of the solar system. He developed a quantitative account of the planets’ movements and summarized his findings in three statements that are known as the three Kepler’s Laws for planetary motion.

The first law asserts that the orbit of a plane around the sun is an ellipse, where the sun is part of the foci. Major and minor axis can define the dimensions of an ellipse while semi major axis define the orbits in the solar system with the size and the eccentricity describing the shape of the orbit.

Kepler’s second law states that the connection with the sun and the planet covers equal areas in identical periods. This law is important in the quantitative description of the speed of an object at a particular point within its orbit. The planet moves faster when it is close to the sun and the vice verse is true.

Kepler’s third law states that the squares of the planet’s sidereal periods correlate with the cubes of their semi major axes. The sidereal period of the planets is the duration the planet takes to complete one orbit around the sun. Kepler concluded that there is a quantitative relationship between the semi-major axes of the planet and the time it takes to orbit the sun.

## Isaac Newton (1642-1727)

Kepler’s Laws are a great explanation for the planets’ movements, but have no information on why the planets move like they do (Kepler's Laws and Newton's Laws 5). The third Kepler law works only for planets and cannot be applied to the motion of the Earth’s moon or the moons of Jupiter. Isaac sought to fill this gap through the Newton’s laws of motion and the Newton’s law of Gravitation.

Newton’s First Law of motion states that a body remains in a stagnant state or at steady motion unless acted by an external force. This is true since a stagnant body does not accelerate just as a body moving in a straight line at stable speed. Acceleration can only be result of some external force acting in the body.

The second law asserts that acceleration of a body with mass M is a ratio of the force F that acts on the. It supports the first law that requires there to be a force to cause an acceleration in a stagnant body or a body in steady motion. The second law, thus provides a quantitative association of the force and acceleration of a body.

Newton’s third law is the Action-Reaction Law, which confirms that a second body exerts an equal and opposite force on a first body if the first body exerts a force on the second body.

Orbits for the planets have small enough eccentricities that an assumption can be made of them being circles for ease of calculations. According to the Newton’s laws of motion, it can therefore be concluded that there must be a force that pulls the planets towards the center of the planets, the gravitational force of the sun. The magnitude of the force is the product of the mass of the planet and the acceleration that it experiences (Kepler's Laws and Newton's Laws 10). The third conclusion is that there must be a reaction to the gravitational force of the sun from the planet. That the sun moves towards the planets in very small distances that it is almost negligible and the sun can be termed as stationary.

## Works Cited

Copernicus, Nicolaus. *On the revolutions of heavenly spheres*. Prometheus books, 1995.

Jardine, Nicholas. “The significance of the Copernican orbs.” *Journal for the History of Astronomy*, vol. 13, no. 3, 1982, pp. 168-194.

*Kepler's Laws and Newton's Laws*.