History of motion

History

Prior to Copernicus' heliocentric model, the Ptolemaic system was, with the assistance of the Roman Catholic Church, the prevailing astronomical model of the universe in Europe leading up to the 16th Century. A geocentric model, it stated that Earth was the stationary centre of the universe, and used a system of epicycles and deferents (when a planet revolved in a small circle, and this small circle revolved in a bigger circle) were used to describe anomalies such as the retrograde motion of planets.

Equants (a point which the centre of a planet's epicycle moved at a uniform velocity) were used to approximate where planets would be at a certain time. Even though the Ptolemaic model had various defects, as astronomers assumed that all the planets revolved at a uniform rate, planets revolved in perfect circles, and didn't explain the retrograde motion of planets that it was formulated to do; it was still widely accepted by Western society for the next 1400 years. Nicolaus Copernicus (19 February 1473 – 24 May 1543) was Renaissance mathematician and astronomer who formulated the heliocentric model of the universe.

Copernicus formulated a heliocentric model whilst studying in Lidzbark-Warminski in around 1508, now modern day Poland, after he was dissatisfied with the geocentric models of Ptolemy and Aristotle. Using astronomical observations and mathematical, Copernicus refined his ideas and published De revolutionibus orbium coelestium. This book outlines Copernicus' 5 key ideas on motion, such as: 1. Planets do not revolve around one fixed point. 2. The Earth is the centre of the Moon's orbit. 3. The sun is the centre of the universe, and all celestial bodies revolve around it. 4. Stars are stationary, and only appear to move because the Earth is itself moving. 5. Earth moves in a sphere around the sun, causing sun's year movement. Copernicus' De revolutionibus orbium coelestium was banned by the Roman Catholic Church, but when the ban was lifted in the 17th Century, the scientific community immediately expanded and refined his work. This suggests that the Roman Catholic Church held an enormous amount of power and dictated everyday life, and as a result, people became hungry for knowledge they could not acquire as a result of the Church'scensorshipof new and modern ideas.

Galileo Galilei. Prior to Galileo's study of falling objects, Aristotle stated that heavy objects would fall faster than lighter ones in direct proportion to weight, and that objects do not retain their velocity and naturally slow down even when no force is acted upon the object. Galileo Galilei (15th February 1564 – 8th January 1642) was an Italian physicist, mathematician, astronomer and philosopher. Studying free-fall, Galileo dropped 2 balls, both of the same material but different masses, from the top the Leaning Tower of Pisa to demonstrate that the mass of the object was independent from its time of descent.

The balls fell at the same time, contradicting Aristotle's widely accepted teachings. Galileo, whose works on motion are linked to the discovery of inertia, and proposed that a falling body, regardless of weight or material, would fall with a uniform acceleration in a vacuum, and that the object would retain their velocity unless another force, such as friction, acts on the object. Galileo also derived the kinetic law for the distance covered during a uniform acceleration from start to finish: d ? t 2 (distance travelled is proportional to square of time period).

Galileo was convicted of heresy as a result of his revolutionary scientific works and was put under house arrest for the rest of his life. Despite his imprisonment, he still expanded and published his works. The Church was a tyrannical figure in society, who imprisoned those who went against their scientifically flawed ideals, but their censorship of such scientific material such as the works Copernicus only inspired people like Galileo to expand their ideas and develop their own ideas.

Sir Isaac Newton. The Church's repression of Galileo prevented him from expanding his revolutionary ideas of inertia, and Aristotle's scientifically incorrect theories were still the prevailing ideas of motion, including the belief that the speed of a falling body was dependent on the mass of the object, and that inertia was non-existent and that an object need to be constantly applied with force in order to keep moving. Sir Isaac Newton (25 December 1642 – 20 March 1727) was an English physicist and mathematician who formulated the 3 Laws of Motion. . If the net force is zero, then the velocity of the object is constant. 2. The net force on an object is equal to its rate of change. 3. For every action there is an equal and opposite re-action. Newton's Law of Universal Gravitation states that every point mass in the universe attracts every other point mass with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

The greater the mass, the greater the attrition. This is shown in the formula: Newton was knighted by Queen Anne in April 1705. This suggests that the Church's attitudes towards scientific progression had changed, and instead of supressing it as it did with Copernicus and Galileo, it was recognised as great achievement, and this scientific progression led to many discoveries that would contribute to the world we live in today.

Albert Einstein’s Theory of Special Relativity. Albert Einstein’s Theory of Special Relativity, published in 1905, is a theory of measurement that only applies to uniform velocities. According to his theory, Einstein states that all motion is relative and every concept involving space and time are also relative, therefore there is no constant point of reference to measure motion. Example: a ball falling from the mast of a ship would appear to an observer standing on the ship’s deck as falling straight down.

However, to a person standing in the distance, the ball would appear as if it followed a curved trajectory. If asked which trajectory the ball followed considering both people’s perspectives, Einstein’s Theory of Special Relativity states that they are both right and wrong, as there must be a measurement of motion, but there cannot because there is no constant point of reference to measure motion. Albert Einstein’s Theory of General Relativity.

Einstein’s Theory of General Relativity, published in 1916, states that every object causes a distortion in space-time and the larger the object, the further space bends. This distortion in space-time is felt as gravity or inertia, therefore meaning that gravity is the product of mass bending space-time geometry. Example: a large body lay at the centre of a trampoline. A marble rolling around the edge of the trampoline would spiral inward toward the body. The body being a large object bends space-time geometry, resulting in gravity and pulling the marble towards itself.