Lunar CRater Observation and Sensing Satellite

Gravity

The laws that govern the motion of planets around our Sun were derived from observations by German mathematician Johannes Kepler (1571-1630). He discovered that orbits of planets around the Sun were ellipses, that the speed of the planets increased when they were closer to the Sun, and that there was a relationship between the radius of a planet's orbit and the length of time it took to complete one orbit around the Sun. These three "laws" were published in 1609, but at the time no one understand why they were valid. It was not until 1687 when Sir Isaac Newton, British professor of Mathematics at Cambridge University, published his laws of motion in "Philosophiae Naturalis Principia Mathematica" that scientists knew why Kepler's laws of planetary motion worked. The reason was a force called gravity.

Sir Isaac Newton Explains the Solar System
Credit: Enoch Seeman Portrait in 1726

Newton derived the properties of this force of gravity, which it must possess in order to control planetary motion. In fact, according to Newton, every mass, not just planets in orbit around a star, exerts a force of attraction on every other mass, along the line intersecting both masses.

Newton's law of universal gravitation states that the force of gravity must depend upon mass, because more massive bodies like the Sun produce a stronger force than less massive bodies like the Earth. The pull of gravity must also depend upon the mass of the object being pulled, such as the Sun's pull on the Earth. The force of gravity between two objects depends upon the product or multiplication of their masses.

The force of gravity also grows weaker with distance. The strength of gravity is determined by the multiplication of the masses divided by the square of the distance between them.

There are logical consequences of Newton's law of gravity. Consider two massive objects separated by the same distance from one another as two less massive objects. The more massive objects will have a stronger gravitational force of attraction on one another than the less massive objects do. Consider two objects, whose masses do not change, when moved further apart from one another. They will exhibit a weaker gravitational force of attraction than when they were close. The gravitational attraction between two bodies---which is very important when they are close---diminishes with distance until it is so small as to be negligible. For example, the force of gravity exerted on you by a distant star is close to zero and only one among the countless gravitational forces exerted by other objects on you. In fact, nearby mountains, buildings, and even other people can exert more gravitational force on you than distant stars.

1: Ellipses - an oval shape which appears like a flattened circle. 2: Force - a push or pull which can alter the dimension or shape of a body or its state of motion. 3: Mass - a measure of the total amount of material in a body; defined either by the inertial properties of the body or by its gravitational influence on other bodies. 4: Square - the product obtained when a number of quantity is multiplied by itself.