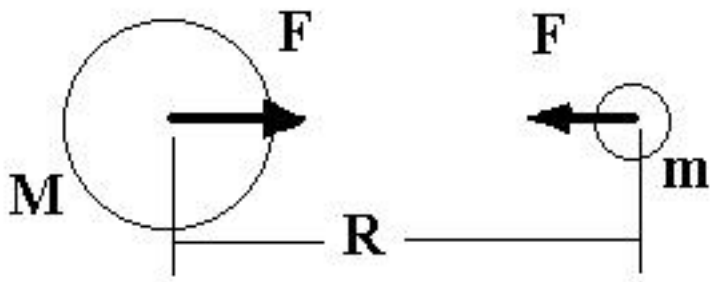
Isaac Newton (1643 - 1727)

Woolsthorpe, Birthplace and Study Residence of Isaac Newton.

Newton came back to Woolsthorpe several times in his life. During the plague years , 1665-1667, he resided there. It is believed he performed the experiment on the spectrum of light in this study.

Isaac Newton can arguably be called the greatest physicist known to history. He contributed significantly to the fields of mathematics, mechanics, and optics. His philosophical approach to Nature was a natural development from what had preceded him in the work of Kepler, Galileo, Bacon, and others. This approach, very clearly enunciated by Newton, was radically different from the Peripatetic approach criticized by Galileo. For example, the role of hypotheses is to suggest experiments, rather than to be a foundation upon which to build a physical interpretation of the world. He concluded that the laws of motion were the same for the celestial bodies as for terrestrial bodies. The planet Neptune was theoretically predicted and then discovered by astronomers who tried to account for the anomalous planetary orbits beyond Saturn. They concluded, based on Newtonian mechanics, that other planets had to exist beyond Uranus to cause the perturbations in the planetary orbits. His great work on mechanics, the *Principa* (1687) was used for a textbook in certain places for nearly 200 years. In fact, his formulation of the Law of Universal Gravitation is still the form used except when relativistic effects need to be considered.

$$F = \frac{GMm}{R^2}$$



Law of Universal Gravitation

Newton calculated the distance that the moon falls towards the earth using this formula. Since we know the distance to the moon and the radius of the earth we can determine the acceleration experienced by the moon based on the acceleration experienced at the earth's surface. The moon is continually falling towards the earth in the sense that it deviates from a straight trajectory. If we imagined that gravity could be suddenly shut off, then after one second the moon would be 1/20th of an inch farther away. We say therefore, that the moon falls 1/20th inch per second in order to keep in orbit. Newton calculated that this is indeed the case, verifying the law out to the moon. From Kepler's data on the orbital periods(Kepler's third law) he also verified the gravitational law out to the planets.

Distance to the Moon

From a contemporary physics textbook.

" The temple of Aristotelian physics had been crumbling for more than a century. But all through that time, no one imagined that an experiment done on the earth could reveal the laws of the heavens. The moment when Isaac Newton realized that the moon falls 1/20th of an inch every second, just as his theory of universal gravitation predicted, was the magic moment in human history when the physics of the heavens and physics on Earth became united in one coherent science."

***The Mechanical Universe*, Steven C. Frautschi, Richard P. Olenick, Tom. M. Apostol, David L. Goodstein, Cambridge University Press, 1986, p. 154**

" Newton gave us not only a series of scientific discoveries, but more important, a coherent view of how and why the universe works. That view has dominated Western thought from his time right down to our very own. Isaac Newton was a human being with faults and flaws - maybe even more than his share of them. But he was also a giant, almost unparalleled in our history."

***The Mechanical Universe*, Steven C. Frautschi, Richard P. Olenick, Tom. M. Apostol, David L. Goodstein, Cambridge University Press, 1986, p. 159**

Isaac Newton's tomb in Westminster Abbey
West Minster Abbey in London