In 1687, Sir Isaac Newton published the *Philosophiae Naturalis Principia Mathematica*, his magnum opus describing the laws of motion and the secrets of the universe. One such secret is Newton’s law of *universal gravitation*, which states that the same gravitational force that pulls us down to the Earth holds the planets in their orbits around the sun. Indeed, every mass attracts every other mass through gravity.

This means that not only are we pulled downwards towards the Earth, but we are pulled towards *pieces of the Earth*. We are all gravitationally attracted to mountains. In fact, this is an excellent test of Newton’s theory: if we could measure the gravitational attraction of a test mass to a mountain, we could confirm whether or not gravitation is indeed universal. And thus men began to weigh mountains.
Newton rejected the possibility of weighing mountains... he felt that the effect would be much too weak. However, others were convinced it should be possible. In 1738, French astronomers Pierre Bouguer and Charles Marie de La Condamine travelled to the mountain Chimborazo in Ecuador. They were there for other reasons, but they took the opportunity to test Newton’s theory. They brought a large, heavy pendulum with them, with a heavy mass suspended on a string. If the mass felt no force, other than the pull straight down due to the Earth, the string of the Pendulum should stand perpendicular to the ground. However, if the mountain attracted the mass, it should be deflected towards the mountain and the string wouldn’t quite be perpendicular to the ground, as shown in figure 2. Moreover, the amount the pendulum was deflected would be proportional to the ratio of the density of the mountain to the density of the Earth itself.

The conditions were difficult and the measurement wasn’t very precise. However, Bouguer and Condamine believed they had detected a deflection. They argued that this confirmed Newton’s theory. Moreover, they said, it showed that the Earth was not a hollow shell, disproving the belief held by several major thinkers of the day.

Given the tentative success of Bouguer and Condamine’s experiment, in 1772, Nevil Maskelyne, Astronomer Royal (that is a real title, I promise!) proposed a more careful repeat experiment. His proposal gathered quite a lot of enthusiasm and it became something of a political endeavor. The Royal Society of London formed a committee, the Committee of Attraction, whose members included Benjamin Franklin, to pick a mountain to use. And for political reasons, they wanted the mountain to be part of the United Kingdom.
With the aid of surveyor Charles Mason, the committee eventually settled on Schiehallion, shown in Figure 3 in Scotland. Then, with the aid of Charles Hutton and Reuben Burrow, Maskelyne performed the pendulum experiment. This time, thanks to the political enthusiasm, the experimenters had the time and money to do things right. They carefully surveyed the mountain and its terrain to measure any effects due to the curvature of the Earth and they purchased expensive surveying equipment.

The Maskelyne team’s endeavours were a complete success. After several years of work, they measured a deflection of the pendulum by 11.6 arc seconds. This told them that the density of the mountain was approximately half that of the Earth. By measuring carefully measuring the volume of the mountain and the density of the rocks composing it, they found that the density of the Earth was 4.5 times the density of water. This is different from the modern value by 20% or so! An amazing triumph.

Because of the Maskelyne team’s triumph, both Bouguer and Condamine’s and the Maskelyne team’s measurements are called the Schiehallion experiment.

One page of the Maskelyne team’s first report of their findings is shown in figure 4.
In the year 1772, I presented the foregoing proposal, for measuring the attraction of some hill in this kingdom by astronomical observations, to the Royal Society; who, ever inclined to promote useful observations which may enlarge our views of nature, honoured it with their approbation. A committee was in consequence appointed, of which number I was one, to consider of a proper hill whereon to try the experiment, and to prepare every thing necessary for carrying the design into execution. The Society was already provided with a ten-feet zenith sector made by Mr. Sisson, furnished with an achromatic object glass, the principal instrument requisite for this experiment, the same which I took with me to St. Helena in the year 1761; which wanted nothing to make it an excellent instrument but to have the plumb-line made adjustable, so as to pass before and bisect a fine point at the centre of the instrument. This was ordered to be done, and a new wooden stand provided for it, capable of procuring a motion of the sector about a vertical axis, by means of which it could be more easily brought into the plane of the meridian.

FIGURE 4. THE FIRST PAGE OF A REPORT ON THE SCHIEHELLION EXPERIMENT. SOURCE.

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