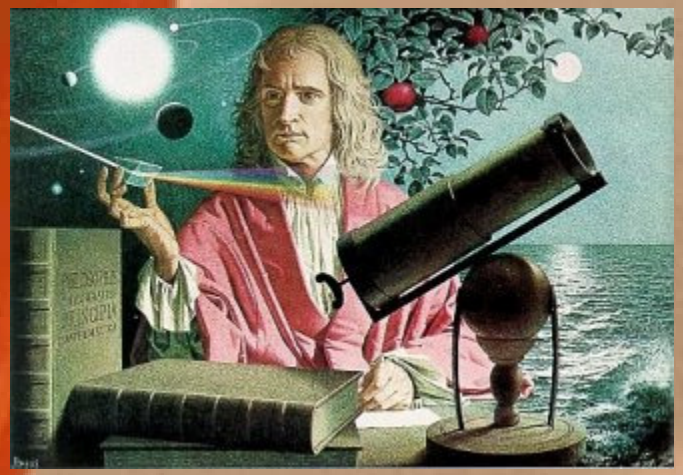
Sir Isaac Newton



Overview

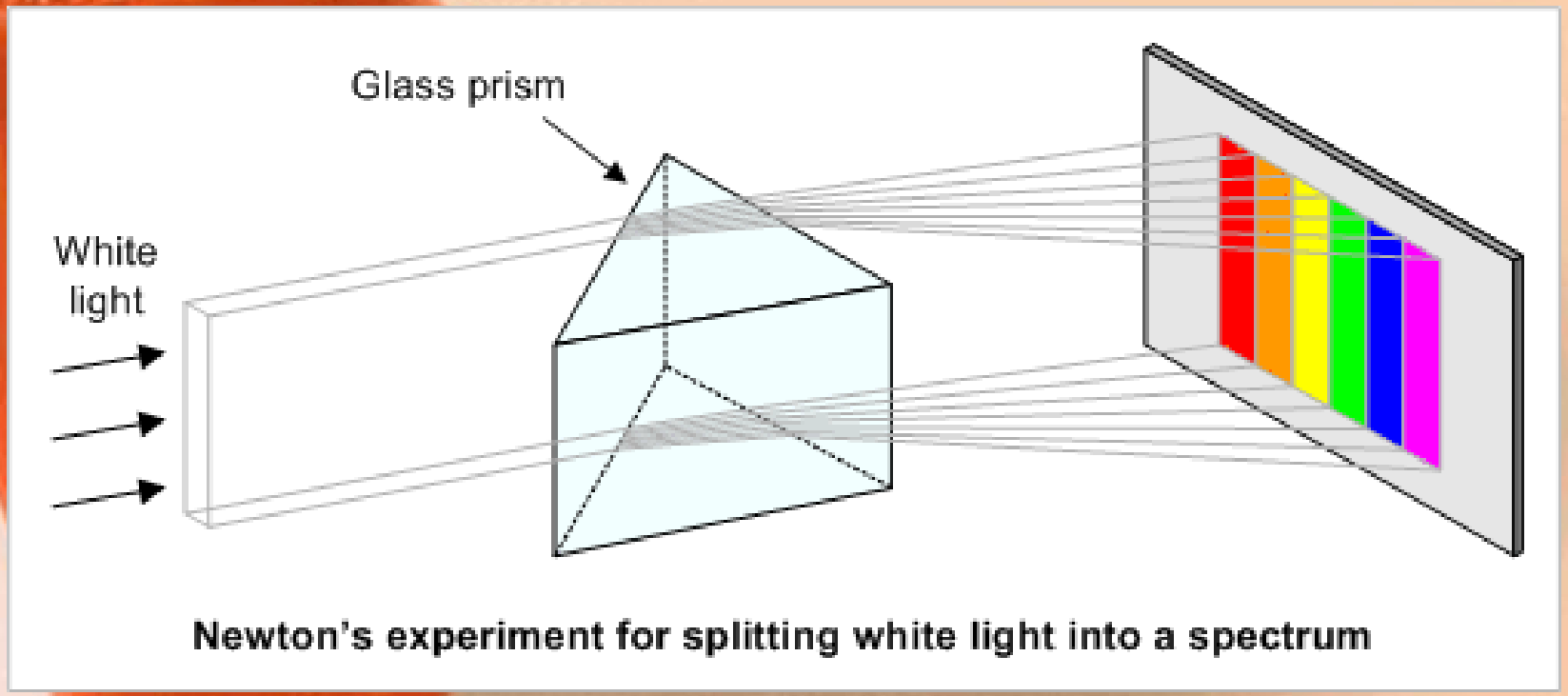
- Newton, Sir Isaac (1642-1727), mathematician and physicist,
- One of the foremost scientific intellects of all time
- Born at Woolsthorpe where he attended school
- Entered Cambridge University in 1661
- Was elected a Fellow of Trinity College in 1667, and Lucasian Professor of Mathematics in 1669
- Remained at the university, lecturing in most years, until 1696.
- During two to three years of intense mental effort he prepared ***Philosophiae Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy)*** commonly known as the ***Principia***
- Not published until 1687.

Overview

- Has been regarded for almost 300 years as the founding examplar of modern physical science
- His achievements in experimental investigation were as innovative as those in mathematical research
- With equal, if not greater, energy and originality he also plunged into chemistry, the early history of Western civilization, and theology
- Among his special studies was an investigation of the form and dimensions, as described in the Bible, of Solomon's Temple in Jerusalem.

Optics

- Investigated the refraction of light by a glass prism
- Developing over a few years a series of increasingly elaborate, refined, and exact experiments, Newton discovered measurable, mathematical patterns in the phenomenon of colour
- Found white light to be a mixture of infinitely varied coloured rays
- Correlated this notion with his study of the interference colours of thin films
- Held that light consisted of streams of minute particles
- From his experiments he could infer the magnitudes of the transparent "corpuscles" forming the surfaces of bodies, which, according to their dimensions, so interacted with white light as to reflect, selectively, the different observed colours of those surfaces



Newton's experiment for splitting white light into a spectrum

Mathematics

- Made contributions to all branches of mathematics but is especially famous for his solutions to the contemporary problems in analytical geometry of drawing tangents to curves (differentiation) and defining areas bounded by curves (integration)
- Discovered that these problems were inverse to each other
- Also discovered general methods of resolving problems of curvature, embraced in his "method of fluxions“(from Latin meaning "flow") and "inverse method of fluxions"
- Newton's work on pure mathematics was virtually hidden from all but his correspondents until 1704, when he published, with *Opticks*, a tract on the quadrature of curves (integration) and another on the classification of the cubic curves

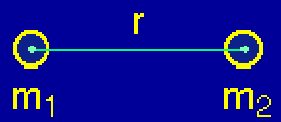
Mechanics and Gravitation

- Seeing an apple fall in his orchard at some time during 1665 or 1666 Newton conceived that the same force governed the motion of the Moon and the apple
- Calculated the force needed to hold the Moon in its orbit as compared with the force pulling an object to the ground
- Calculated the centripetal force needed to hold a stone in a sling
- Calculated the relation between the length of a pendulum and the time of its swing
- These early explorations were not soon exploited by Newton, though he studied astronomy and the problems of planetary motion
- Newton's work in mechanics was accepted at once in Britain, and universally after half a century
- Since then it has been ranked among humanity's greatest achievements in abstract thought

Law of Universal Gravitation

Every object in the Universe attracts every other object with a force directed along the line of centers for the two objects that is proportional to the product of their masses and inversely proportional to the square of the separation between the two objects.

$$F_g = G\frac{m_1 m_2}{r^2}$$



- F_g is the gravitational force
- m_1 & m_2 are the masses of the two objects
- r is the separation between the objects
- G is the universal gravitational constant

What Really Happened

- **Probably the more correct version of the story is that Newton, upon observing an apple fall from a tree, began to think along the following lines: The apple is accelerated, since its velocity changes from zero as it is hanging on the tree and moves toward the ground. Thus, by Newton's 2nd Law there must be a force that acts on the apple to cause this acceleration. Let's call this force "gravity", and the associated acceleration the "acceleration due to gravity". Then imagine the apple tree is twice as high. Again, we expect the apple to be accelerated toward the ground, so this suggests that this force that we call gravity reaches to the top of the tallest apple tree.**

Sir *ISAAC NEWTON*

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