The astronomical achievements of sir isaac newton

Isaac Newton was born in the United Kingdom in 1643. His mother, a widow, soon remarried and Isaac did not like his new step father. He attended school where he did well and then attended to Trinity College, Cambridge.

Here he thrived, but his most fascinating work was done away from school. Trinity College closed during The Great Plague and it was then, when Newton returned home, that he did his best work. Isaac Newton was one of the most important people that every worked in the field of natural sciences. His contributions not only gave way to many phenomenal discoveries of his time, but also many discoveries in the future. The man was simply a genius. He worked in the disciplines of mathematics, physics, astronomy, and philosophy.

Two of Newton's most important contributions were done in the fields of physics and astronomy. These contributions deal with natural forces and motion. In 1687, Newton published his most famous work. The title of the book was Philosophiae Naturalis Principia Mathematica, which means Mathematic Principles of Natural Philosophy. In this book, Newton lays out his three basic laws of motion which are still used today. The first of these laws is thus, in the absence of net uncancelled forces acting on an object, that object coasts (continues in its state of previous motion). The second law is, when the net forces on an object don't cancel, then the state of motion does change. This means the object accelerates and the amount of acceleration relates to the amount of net uncancelled force acting on the object. This law follows the formula force = mass x acceleration (F = ma). The third and final law of motion in Newton's Mechanics is when any object A exerts a force on any object B, the object B exerts a force back on object A of the same strength but in the opposite direction. These three laws explain all of the motion on earth and throughout the entire universe.

The next thing that Newton contributed to astronomy is his theory of gravity. The story behind his first thoughts of gravity came from an apple falling from a tree. One day, Newton was sitting under a tree and an apple fell from the tree. This was the action that lead Newton to think on what causes the apple to fall. But not only why did the apple fall, but why it fell downward instead of sideways or upward? And then it occurred to him that the same force that caused the apple to fall from the tree is the same force that held the Earth and Moon in orbit. It was at this moment that our understanding of how the world and universe worked was changed forever.

So why was this gravity thing such a big deal at the time? To answer this, let’s look into the time period of this grand discovery. During this time in history, the world was not in total agreeance on some of the aspects of nature. Aristotle was still a very prominent and influential figure when it came to the natural sciences. He believed that the earth was the center of the universe and claimed that the laws of Earth were different than that of the heavens (outer space). However, the Copernican revolution, which removed the Earth from its original, universally centered position, and Galileo, who disproved many of Aristotle’s views on the physical laws of Earth, started to shift the tide. But even still, some people still thought the Aristotle way to be truth. Even Newton still thought some of Aristotle’s views of the physical world to be true. However, after his revelation with apples and gravity, he ditched the Aristotelian world view. Newton’s theory of Gravity disproved Aristotle’s view that our universe contained two completely different realms with two different sets of physical laws. Newton's theory accomplished this since it proved that the attractive force of gravity that causes an apple to fall downward from a tree on Earth, is the same attractive force that keeps the moon in orbit around the Earth in outer space (Bennett et al. 115).

Shortly after, Newton discovered the mathematical law that explains how gravity works. He arrived at the fact that the force of gravitational attractiveness between two different masses is directly proportional to the product of their masses and inversely proportional to the square of the distance between them, multiplied by the gravitational constant (which Newton came up with). This formula, is what Newton called the Universal Law of Gravitation and is the is written like this: is the gravitational attractiveness, and represents the two masses being compared, d represents the distance between the two masses, and is the gravitational constant, which is . Gravity is the most important force in the universe because it acts on all masses (Bennett et al. 123).

These three contributions to natural science led to many discoveries about the universe and ourselves. A lot of these discoveries were made by Newton himself. But Newton did not make these discoveries from scratch. One of his most famous quotes is, If I have seen further than others, if is by standing on the shoulder of giants (Meah). Here, Newton is saying that he was able to make the discoveries he did only because of the work that others did before him. Newton made many discoveries from his three laws of motion and the Universal law of Gravitation. For example, Johannes Kepler was a German astronomer who is known for the discovery of the three basic laws of planetary motion. had already made and published his three laws of planetary motion. These laws are (1) planets orbit the Sun in an ellipse, with the Sun as one of the foci, (2) planets most faster when they are closer to the sun and slower when they are further away from the sun, and sweep out equal areas in equal time, and (3) more distance planets orbit the Sun at slower speeds than planets further away from the Sun and they obey the formula where p is a planet’s orbital period in years and a is the planet’s average distance from the sun using astronomical units (1 AU equals the average radius of Earth’s orbit (Bennett et al. 66). At the time Newton published his book Principia, Kepler had already made and published his three laws of planetary motion. They were also verified by using them to calculate certain observations in the sky. The main question people had was why? Why do Kepler’s laws work? Newton showed that all three of Kepler’s laws can be explain using his laws of motion, the universal law of gravitation, and basic calculus.

Additionally, not only did Newton prove Kepler’s formulas, he also added on to them. Newton proved Kepler’s first law of motion by using the Universal law of gravitation and calculus. Newton also showed that this law is not only for planets, but it actually works for all objects in the universe. Planets, satellites, comets, humans, etc. all orbit in the shape of an ellipse. He also used his work to show that not all orbiting objects are ellipses. He showed that the orbit can be any type of conic section. That is, the orbit can be in the shape of an ellipse, circle, parabola, or hyperbola. You can obtain these shapes in the way a plane intersects with a cone. Newton also discovered that two objects attracted by gravity actually orbit around a common center of mass. This was odd to think about during that time. From the looks of it, it appears that a planet orbits the Sun while the Sun remains stationary, this is a totally understandable misconception. From our point of view, it does appear that that is the case, however this is wrong. Using his laws and understanding of motion and forces, Newton showed that both objects rotate around a common center of mass. The last discovery Newton made with Kepler's laws, is a change he made to Kepler's third law of planetary motion. Recall that Kepler's third law of planetary motion follows the formula, . For this law, p can only be a measurement of time using years and a can only be a measurement of distance using astronomical units. Newton made additions to the formula to make it more usable in that you can use in ways that it was not previously designed to be used for. Here is an explanation, in Kepler's original law, there are only two parameters, p and a. Because of this, we can only use that original law to find planets orbital period or average distance from the sun. What Newton did is simply add some more parameters that ultimately relates the orbital period, distance, and masses of two orbiting bodies. The benefit of the additional parameters by Newton is twofold. It allows us to calculate the mass, period, and distance of any pair of orbiting objects and it allows us to do it for objects that are more distant than our solar system (Bennett et al. 124-126). This discovery was so big that Newton's version of Kepler's third law, is the primary means by which we determine masses throughout the universe (Bennett et al. 125).

The amount of natural processes that can be explain because of Newton's three laws of motion and gravity are endless. From this information, we gained insight on how tidal forces work which explains the waves in the oceans. We also learned about the Earth's equatorial bulge through Newton's laws. Every type of motion can be explained through Newton's laws of motion. Whether that's people walking on the face of the earth, a space shuttle flying through space, or a satellite orbiting the earth, all follow the same laws of motion that are universal throughout the whole cosmos.

Newton was not right in everything that he did. One may think this, but this is not the case. One of these things was his work with light and optics. Newton's work on light and optics starts with his invention of the reflection telescope in 1668. This telescope consisted of two mirrors, the first is called an objective mirror, which gathered the desired viewing picture, and the other was a flat, diagonally mounted mirror that reflected the picture given by the objective mirror in a 90-degree angle. This reflection allowed for the image to be viewed through an eyepiece (King 68-71). It was through this telescope and his work with prisms that Newton tried to prove his theory of light and color.

So, what was Newton's theory of light and color? Newton believed that light was made of small particles, that he called corpuscles, that had properties such as shape, size and color. He also thought white light to be the combination of all the colors. He argued that, the geometric nature of the laws of reflection and refraction could only be explained if light was made of particles (Klus). He argued this because he knew that waves do not typically travel in straight lines. This was not very popular among Newton's peers. Many of his peers still believed that light was made up of only waves. To disprove this common thought theory, Newton composed a series of experiments that involved prims and light. In one experiment, Newton took a prism and shined white light through it, this revealed the spectrum of colors and is what caused newton to believe that white light is a combination of all colors. The common theory of this prism color thing was that the prism corrupted the white light. And color is the result of this corrupted white light. He then used the second prism and held it at a certain angle and Newton showed that if held at the right angle (not 90 degrees but the proper angle), the spectrum of colors is recomposed back into white light. Since this was the case, Newton concluded that white light is the combination of colored particles (Klus). This theory was soon disproved by Christiaan Huygens who showed, reflection and refraction can be derived from his wave theory of light (Klus). Now, we know that light is both particle and wave. From this, we know that Newton was right in his belief that white light is a combination of all the colors in the spectrum. This also shows us that even though Newton’s theory has been disproven, he was so much further ahead in his thinking than anyone of his time.

Another thing that Newton has credit for inventing is the mathematical discipline of Calculus. There is extreme controversy for if he actually came up with the idea of calculus first or if another person did, whose name was Gottfried Leibniz. The general conscious is that Leibniz and Newton both invented calculus independently. But this again shows the wondrous academic achievement and contribution of Isaac Newton.

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