Isaac Newton: his science and his faith, Doug Hayhoe, December 2021

No one changed the course of science as much as Isaac Newton. His mathematical and scientific investigations and discoveries were unmatched. And these were made in the context of a profound belief in a God who revealed himself in both nature and Scripture.

My first love in school was physics, and my first job, teaching physics. Isaac Newton became my hero. He intrigued me because, in addition to his scientific breakthroughs, which place him alongside Galileo, Einstein, and other great scientists, he was also a brilliant mathematician, making unique discoveries in geometry, infinite series, and calculus. Even more important, he believed in the Bible as God's Word, and spent a lot of time studying it.

Figure 1 Woolsthorpe Manor, Lincolnshire, England, (Newton's birthplace and family home)

Newton was born to poor parents in 1643, in the small town of Woolsthorpe, England, (Figure 1). His father died before he was born, and his mother married again, leaving him with his grandmother. It doesn't appear that he had a happy childhood, Richard S. Westfall notes, in his detailed biography, *Never at Rest* (1983). At grammar school, Newton studied the classics, Latin and Greek, with scarcely any mathematics or science. Outside of school, however, he had fun creating models of windmills, water wheels, and sundials: "He filled the house with [sun]dials," Westfall notes, "his own room, other rooms, the entry, wherever the sun came in. He drove pegs into the walls to mark the hours, half-hours, and even quarter hours, the and tied strings with running balls to them to measure the shadows on successive days" (p. 62).

At age 18, Newton entered Trinity College, Cambridge. At that time, Cambridge was still following a centuries-old curriculum, with little mathematics or science. Fortunately, the lax school discipline gave Newton time to study ancient Greek texts, such as Euclid's geometry book *Elements*, as well as works by Descartes, Galileo, and Wallis, often written in Latin. His primary school concentration on Greek and Latin, it turned out, served him well!

Newton's great discoveries in physics

Although poor, he was able to continue at Cambridge for a Master's degree. This was fortunate, for the very next year, when only 22, he made some of his greatest discoveries. He worked with abandon, in his small quarters at Cambridge, absorbing and extending all the latest math and science of his day, to solve the challenging problems of force, motion, and orbits of moon and planets. This included the invention of calculus, which he needed for his analysis. Before long, Newton had discovered the Universal Law of Gravitation.

Why was Newton's Law so revolutionary? In the previous century, Kepler had discovered how planets move in the heavens, and Galileo had developed the laws for how things move on Earth. In a brilliant stroke, using all his mathematical discoveries, scientific intuition, and experimental research, Newton unified heaven and earth to explain how everything moves. Every object is attracted to every other object by an inverse square law! This is why we on a spinning earth, why planets travel in elliptical orbits, why the moon causes the earth to have two tides a day, and why satellites can orbit the earth (Figure 2).

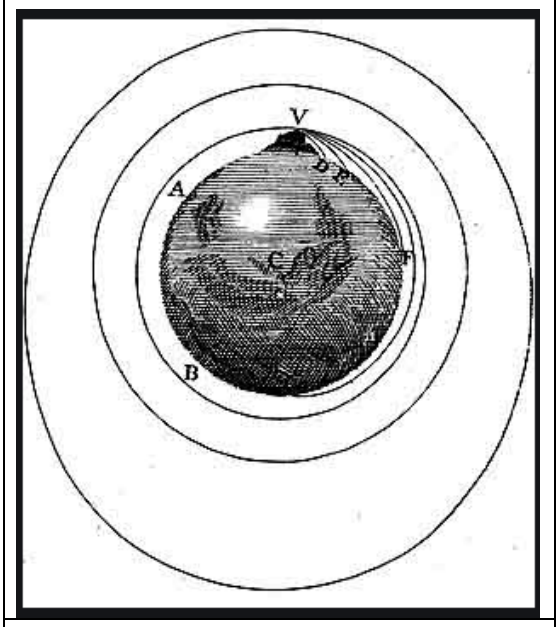

Figure 2 Isaac Newton's drawing of cannon-balls fired fast enough to orbit the Earth.

Newton had a secretive nature. He kept his great advances in physics and calculus hidden for many years. Then, one day, when his friend Edmund Halley asked him for help in calculating the orbit of a new comet, he opened up about his work on gravity. Halley immediately saw its value and offered to pay for its publication. It was printed in 1687, with the title, *Philosophiæ Naturalis Principia Mathematica*, which in English means *Mathematical Principles of Natural Philosophy* (i.e., physics). It was a monumental achievement, giving the foundation for the mechanics still taught in high school and university today, 350 years later (Figure 3).

Newton wasn't satisfied with just publishing the results of his studies on gravity. He first wanted to prove the hundreds of mathematical lemmas, theorems, and propositions needed to confirm his results. This is what occupies the first two volumes of *Principia*. These aren't easy to read, I can testify, having had them on my shelf for many years. I found volume 3 quite

In his *Principia,* Newton laid down the basis of high school and university mechanics

- The laws of motion, why car accidents at high speed are so dangerous,
- The law of universal gravitation, explaining why apples, for example, fall to the earth
- Proving that if planets travel in ellipses with the sun at one focus, the force of gravity acting on them is inversely proportional to the square of the distance between the sun and the planet
- Extending this proof to all planets, their moons, and some comets
- Calculating the trajectory of projectiles launched on the earth, such as long-range cannon balls
- Explanation for why the Moon causes the Earth to have two tides a day
- Explanation for why the Earth is not a perfect sphere in shape, but an oblate spheroid
- The laws of angular momentum, used to understand and predict hurricanes
- The physics of how things move through a fluid, such as a submarine through water
- The movement of the centre of mass of several attached bodies, such as the Earth-Moon system, or binary star systems, used today to detect extra-solar planets
- The motion of pendulums used in grandfather clocks

Figure 3 A list of some of Newton's discoveries in mechanics both on the earth and in the sky

useful as a high school physics teacher, however, as it is the first document in history to show how the force of gravity drives the motion of the planets. This is also where Newton describes his belief in God, referring to him as omnipotent, omniscient, and omnipresent.

In 1986, I took my family to the outer banks of North Carolina to see Halley's Comet. Since it wasn't predicted to return for another 76 years, I knew this was my only chance! For, in his *Principia*, when explaining how planets and comets move, Newton had predicted far off things, such as when the new comet discovered by his friend Halley, would return, long after they both were dead. Which is precisely what it did in 1758, 1835, 1910, and 1986.

There isn't space here to share Newton's other discoveries and inventions. But we still benefit today from both his theoretical and practical work. Take the telescope, for example. Refracting telescopes, invented by Galileo, use lenses and therefore suffer from chromatic aberration. Reflecting telescopes, however, invented by Newton, use mirrors that get around this problem. In fact, you can buy an 8-inch Dobsonian reflector today for as little as $600 Canadian and with it see amazing galaxies and globular clusters.

Newton's interests in alchemy and theology

After making most of his ground-breaking discoveries, Newton then took a break from physics to focus on alchemy. He bought small chemical furnaces, and maintained them in his room, while he conducted experiments tied to alchemy's mysterious world. But in contrast to his mathematics and physics, his work on alchemy never amounted to much.

He also turned his attention to theology, in these middle years. In his study of Scripture, Newton had learned that two verses about the Trinity, 1 John 5:7 and 1 Timothy 3:16, have variant readings. He began to question all the New Testament verses about the Trinity, saying that the church fathers had corrupted the text. Newton's distinguished biographer, Richard S. Westfall, feels that Newton's research into the ancient manuscripts was influenced by his prior rejection of Christ's equality with the Father. In his 1983 biography, Westfall states that "Though he [Newton] wrote at some length about Christ, his interest largely exhausted itself in proving that Christ was not God" (p. 827).

Andrew Briggs, professor and physicist at Oxford University, has another perspective. In his book *The Penultimate Curiosity* (2016), co-authored by Roger Wagner, he devotes considerable space to Newton's beliefs and how they might have influenced his physics. He agrees with Westfall that Newton departed from the doctrine of the Trinity due to the influence of the "Polish Brethren," a radical Reformation sect. But at the same time, Briggs defends Newton's personal belief and devotion to Scripture and to Christ as Lord. "In his own writings Newton speaks of Jesus as 'our Lord' and of having 'made an atonement for us & to have … merited our pardon & to have washed away our sins in his blood" (p. 266).

Briggs also cites evidence that Newton maintained a deep devotion and reverence for God. He writes, "Voltaire described how Newton's disciple, Samuel Clarke, always mentioned the name of God with great reverence, and told him that he had learned the habit from Newton" (Briggs & Wagner, p. 265).

Newton's later years

In later years, Newton was made head of the British mint, elected president of the Royal Society, and knighted by Queen Anne. He didn't lose any of his mathematical brilliance, however. He was challenged one day to solve a problem in mathematics that top European mathematicians had taken months to solve. So, he focused on it one night, and by the next day had the solution. Neither did he lose his unorthodox beliefs about the divinity of Christ, as he got older, although he continued to keep them under wraps, not wanting to jeopardize the leading position in London he had come to enjoy.

Figure 4: Newton in 1702, by Godfrey Kneller (Wikipedia, Public domain)

Newton had a difficult personality, as everyone recognizes, and was often getting into scraps with other scientists and mathematicians over inconsequential details, whether with the brilliant German mathematician Gottfried Leibnitz, or England's own Astronomer Royal, John Flamsteed. As he got older, he used his influence to have more and more paintings and statues made of himself (Figure 4). Some historians have even thought he was autistic. Others have considered whether he had bipolar or schizophrenic tendencies, or was suffering from mercury poisoning, left over from his experiments with alchemy.

Was Newton a great scientist and mathematician? Yes, indeed! Made in God's image, he was given a brilliant mind to see farther than any other into the making of the universe. Was he a Christian? There's no doubt he had a Christian worldview and accepted the Bible as God's word. By not believing Christ's claim to be equal to the Father, however, he failed to give Christ the honour due him (John 5:23 KJV).

The present-day astronomers David L Block and Kenneth C. Freeman have made plenty of use of Newton's physics in their scientific work on stars and galaxies. However, in their recent book *God and Galileo* (2019), they have also written about how we understand Scripture. They point out that "There is intellectual discernment, and there is spiritual discernment; the two should not be confused" (p. 97). Few if any have had the intellectual discernment of Isaac Newton in understanding God's book of nature. There is widespread agreement, however, that Newton fell short in his spiritual discernment in trying to understand God's book of Scripture, even though he spent many years investigating it.