Isaac Newton's *Mathematical Principles of Natural Philosophy*
By William A. Dembski

Isaac Newton (1642 – 1727) is widely regarded as the greatest scientist of all time. His claim to fame rests chiefly on his *Mathematical Principles of Natural Philosophy*. In this work, or the *Principia Mathematica* as it is also called, Newton invents the infinitesimal calculus and with it delineates the fundamental laws governing the structure and dynamics of physical reality. From the motion of billiard balls to the motion of planets and everything in between, Newton's *Principia Mathematica* was thought to give the final word.

Sometimes genius is underappreciated during the life of the genius. Not so with Newton. His genius was evident and reverenced from the start. Isaac Barrow, Newton's predecessor in the prestigious Lucasian Chair of Mathematics at Cambridge, was so impressed with Newton that he resigned and had Newton assume his chair (a professorship subsequently held by such luminaries as Charles Babbage and Paul Dirac and, presently, by Stephen Hawking).

Newton's contemporary Edmund Halley, the famed astronomer remembered for the comet named after him, even wrote an ode to Newton. It closes with the effusive praise,

> Come celebrate with me in song the name
> Of Newton, to the Muses dear; for he
> Unlocked the hidden treasuries of Truth:
> So richly through his mind had Phoebus cast
> The radiance of his own divinity.
> Nearer the gods no mortal may approach.

In the same spirit, Alexander Pope, a younger contemporary of Newton, wrote the following epitaph:

> Nature and Nature's laws lay hid in night:
> God said, "Let Newton be!" and all was light.

Even the 20th century economist John Maynard Keynes recognized how profoundly Newton's genius had impacted 17th century intellectual life, referring to him as "the last wonder-child to whom the Magi could do sincere and appropriate homage."

Although Newton's *Principia Mathematica* is highly technical, it contains several extended passages of interest to the general reader. Thus, for instance, we find in it bold statements about God's role as a designing intelligence behind the world. Contemporary scientists who feel passionately about the religious significance of their scientific work may still offer up such statements, but usually they will keep them off to one side. Newton, by contrast, saw no contradiction in doing his best science and then immediately, in the same written work, giving it a theological interpretation.

Although we think of Newton as the preeminent scientist of his age (and indeed any age), it is remarkable that Newton's scientific hat was only one of the many professional hats that he wore. His greater passion seems to have been theology, and he spent much time studying and writing about the Bible. He was also an avid alchemist. Moreover, in the 1690s, he abruptly left his ivory-tower professorship at Cambridge to assume duties heading the government mint in London (imagine contemporary string-theorist Ed Witten leaving Princeton's Institute for Advanced Study to move to Washington D.C. to head the U.S. Treasury).

Yet for all the other hats Newton wore, he achieved nothing like the distinction that he achieved in science. In science he was a soaring figure. In theology, by contrast, he was a well-read but self-schooled amateur. Moreover, his theological views were heterodox: though accepting the Bible as largely factual (including the miracles ascribed to Jesus), Newton sided with Arius against Athanasius, rejecting the divinity of Christ.

As master of the mint, he was energetic and did much to increase the efficiency of coinage. At the same time, his broader economic recommendations at times left something to be desired. For instance, his recommendation about the proper pricing of gold and silver proved thoroughly mistaken: he thought the price of gold would correct itself in the free market; instead, the price of gold stayed put and silver fluctuated – none of this was good news for the economic policies he recommended.

In ancient Athens, Socrates would go about asking recognized experts in a given area broader philosophical questions: What is justice? What is truth? Etc. He found that expertise in one area tends not to transfer to other areas, especially when these require wisdom. Newton seems to fit this mold. In the science of physics, he was preeminent. And yet when he delved into other areas, he was undistinguished and, at times, even a duffer.

What is Newton's legacy? His legacy properly belongs to science. There he still ranks in the number one spot. That said, he has some close seconds and thirds (such as Albert Einstein and James Clerk Maxwell). In Newton's day, it was thought that he had once and for all nailed down the deep structure of the physical universe. With the revolutions in electro-magnetism, general relativity, and quantum mechanics in the 19th and 20th centuries, it's now clear that Newton's physics was only part of the picture.

Newton's physics captures the motion of medium sized objects at medium speeds. That's why it's still the first thing beginning physics students learn. But it's now clear that the scope of Newton's physics is strictly limited. The odes by Halley and Pope celebrating him and his achievements could no longer be written with a straight face. In his day, he was, as John Locke referred to him, "the incomparable Mr. Newton." Nowadays, he is a *primus inter pares*. He remains the greatest of scientists, but one who now rubs shoulders with other great scientists and not as one who towers above the rest.

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This preface is to appear before the following excerpts from Newton's *Principia*, using the William Donahue translation as found in Dana Densmore, ed., *Newton's Principia: The Central Argument*, 3rd ed. (Santa Fe, New Mexico: Green Lion Press, 2003). Page numbers from this book are provided in brackets. Use only the text in red (the rest is commentary).

1. Newton's Preface to the Reader [pp. 3-4]
2. Scholium on Absolute Space, Time and Motion [pp. 22-27]
3. Axioms, or Laws of Motion [pp. 29-30]
4. Rules of Philosophizing [pp. 303-305]
5. General Scholium [pp. 485-489]