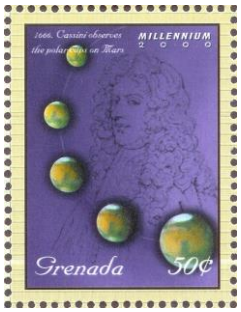
NICOLAS FATIO DE DUILLIER (February 16, 1664 – May 10, 1753)

by Heinz Klaus Strick, Germany

NICOLAS FATIO was one of the most colourful personalities in Europe around the year 1700 – he was a mathematician, philosopher, astronomer, inventor and religious activist.

Born in Basel as the seventh of nine children, he grew up on an estate in Duillier, a town near Geneva. The family, originally from Italy, had become rich through the ownership of iron and silver ore mines, then emigrated to the Protestant Republic of Geneva for religious reasons. NICOLAS'S father, a devout Calvinist, would have preferred NICOLAS, his second son, to become a pastor, while his mother, a follower of MARTIN LUTHER, hoped that he would make a career at one of the Protestant German royal courts. However, NICOLAS was initially less interested in religious questions than in natural sciences.

From 1678 he attended the *Académie de Genève* (today *University of Geneva*). In a letter to JEAN DOMINIQUE CASSINI, head of the Paris Observatory, he put forward his ideas on how the distances of the Earth from the Sun and Moon could be determined more precisely than before. He also developed a theory of how the shape of Saturn's rings came about.



When he came to Paris in 1682, he was warmly welcomed by CASSINI. Together they researched the phenomenon of so-called *zodiacal light*. FATIO published an article about this in which he correctly interpreted the light phenomenon as sunlight being scattered by interplanetary dust clouds.

FATIO studied the phenomenon of dilation and constriction of the eye pupils and he also developed methods to improve the production of lenses for telescopes. Back home, he carried out trigonometric measurements in the Mont Blanc area with his brother, who was five years older than him.

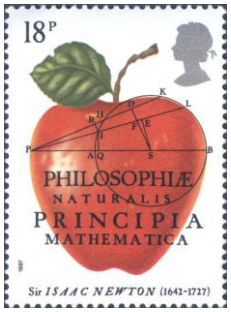
When he learned of a planned plot by a Piedmontese count who – with financial support from France – wanted to kidnap WILLIAM OF ORANGE, the governor of the Netherlands, he travelled to Holland to warn him.

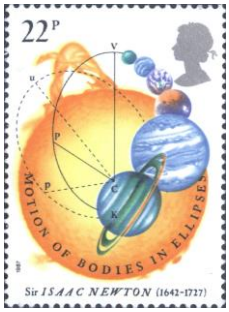
While there, he became friends with CHRISTIAAN HUYGENS and exchanged ideas with him about the newly developed differential calculus. Both remained in lifelong contact with each other.

As a reward for preventing the prince's kidnapping, FATIO was promised a mathematics professorship at Leiden University, but this did not materialise.

IN 1687 FATIO travelled to England. At the *Royal Society* he presented examples of his solutions to ordinary differential equations and the following year he was accepted as a member.

FATIO made a temporary living as a tutor. When the English Parliament deposed the Catholic King JAMES II during the (so-called) *Glorious Revolution* and installed his Protestant daughter MARY and her Calvinist husband WILLIAM OF ORANGE as the new rulers, he again had hopes of getting a job in the Netherlands – in vain.



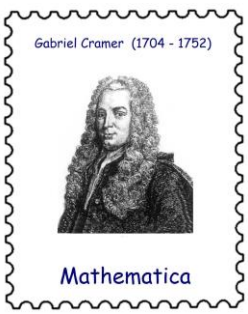


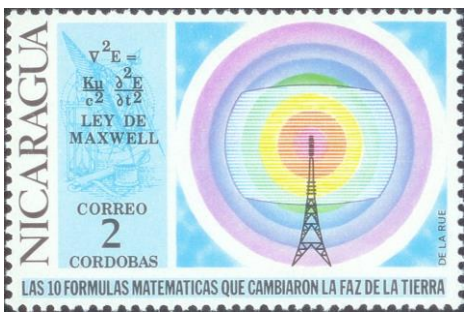
ISAAC NEWTON's work *Principia* was published in 1687, and FATIO developed his own theory of gravity, which he presented to the *Royal Society* and published as a paper in 1690 (*De la Cause de la Pesanteur* - On the Cause of Gravity).

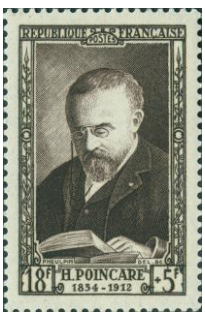
According to his theory, space is filled with particles (*corpuscles*) that move in all directions. If they hit a body, it will not move because the particles act on the body from all directions. However, if two bodies are present, they shield each other and a negative pressure is created between the two bodies, an apparent attraction – gravity.

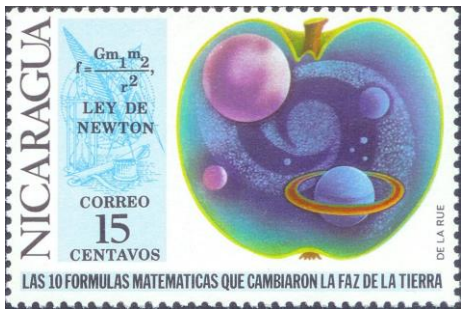
FATIO was convinced of the correctness of his theory and he presented the paper to EDMOND HALLEY, HUYGENS and NEWTON and had them confirm by signature that they also believed the theory to be correct – though there are some doubts that he was actually able to convince them.

Until the end of his life, FATIO repeatedly worked on his theory in order to refute any objections that arose. (The theory was taken up again in 1731 by GABRIEL CRAMER, further developed in 1756 by his student GEORGES-LOUIS LE SAGE ("LE-SAGE Gravitation"), and discussed again and again in the following years – until the final refutation by JAMES CLARK MAXWELL and HENRI POINCARÉ.)







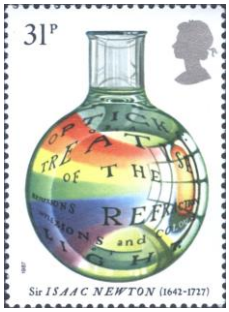


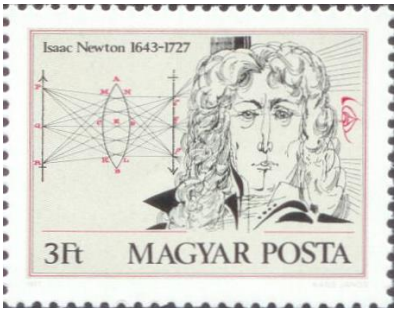
FATIO met NEWTON in person for the first time at the *Royal Society* meeting at which CHRISTIAAN HUYGENS presented his wave theory of light and his vortex theory of gravity, which went back to RENÉ DESCARTES.

A close friendship developed between NEWTON and FATIO, based on a mutual fascination between the 46-year-old NEWTON and the 25-year-old Swiss. The two shared an apartment in London because NEWTON was a member of Parliament as a representative of Cambridge University and had to travel regularly to meetings. FATIO also accepted NEWTON'S offer to work as his assistant in Cambridge. There they conducted alchemical experiments together in the hope of turning mercury into gold.

FATIO applied in vain for the vacant *Savillian Chair* in Astronomy at Oxford. He did not give up hope that a position might become available in the Netherlands and he commuted several times between London, Cambridge and The Hague.

FATIO tried to convince NEWTON that the *Principia* needed to be republished to correct errors it contained, but probably also to add his theory of gravity as a preface. NEWTON, however, gave priority to working on his integral calculus (*De quadratura curvarum*), which he only published in 1704 as part of his *Opticks*.





At the beginning of 1692, relations between NEWTON and FATIO ended abruptly. At the same time, NEWTON was going through a creative crisis from which he never really recovered.

The actual reasons for this will probably never be known – did the personal relationship between the two play a role or was NEWTON's condition caused by mercury poisoning? Maybe it was just the result of NEWTON overexerting himself after years of intensive work.

In 1696, JOHANN BERNOULLI posed the famous *Brachistochrone* problem to the mathematicians of Europe, for which he himself had already found a solution:

- *Which curve must be used to connect two points at different heights so that a mass that slides without friction reaches the lower point in the shortest possible time?*

Five mathematicians submitted solutions: NEWTON, LEIBNIZ, L'HÔPITAL, TSCHIRNHAUS and JACOB BERNOULLI and these were published by LEIBNIZ in the *Acta Eruditorum*.

As expected, NEWTON solved the problem confidently, but only submitted the solution anonymously because he suspected that the problem actually came from LEIBNIZ and that LEIBNIZ wanted to challenge him with the task he had set.

LEIBNIZ's comment in the *Acta Eruditorum* was the initial spark for the dispute over priorities regarding the invention of infinitesimal calculus:

... *only those* [whom] *I had assumed could solve the problem solved it ...*

FATIO, who had to deal with inheritance matters in Duillier for a while after his mother's death, saw this comment as a personal, discriminatory attack on his abilities – a reason to attack LEIBNIZ:

I recognize that NEWTON was the first and by many years the most senior inventor of this calculus: whether LEIBNIZ, the second inventor, borrowed anything from him, I prefer that the judgment be not mine, but theirs who have seen NEWTON's letters and his other manuscripts. Nor will the silence of the more modest NEWTON, or the active exertions of LEIBNIZ in everywhere ascribing the invention of the calculus to himself, impose upon any person who examines these papers as I have done.

This provoked angry reactions from JOHANN BERNOULLI and also from LEIBNIZ in the *Acta Eruditorum*. LEIBNIZ emphasised that NEWTON himself had admitted in the *Principia* that both had developed calculus independently of each other.

Although it turned out that FATIO had made his statement without consultation with the *Royal Society* and that neither NEWTON nor LEIBNIZ had any interest in any kind of dispute, from then on the dispute between the supporters from both camps could no longer be stopped ...

FATIO subsequently dealt with the problem of constructing a clock that was less prone to failure and with which time could be measured more precisely. Together with the clockmakers PETER and JACOB DEBAUFRE, who, like many other Huguenots, had fled France in 1685 after the repeal of the Edict of Nantes, he demonstrated at the *Royal Society* in November a clock with a hairspring, for which FATIO had prepared specially drilled rubies. In 1704 he even received a patent for this invention for a period of 14 years, but this was not extended further due to objections from the watchmaking lobby.

FATIO also looked into the possibilities of increasing the growth of plants; to this end, he had fruit trees planted on a specially shaped sloping wall in a castle park (*fruit walls*) and thought about mechanical devices that would make better use of the sun's rays. He further investigated the influence of the number of sunspots and comet orbits on the weather.

The "FATIO method" was named after him – a trick with which the convergence of series can be accelerated. The idea he conceived was taken up by LEONHARD EULER in 1755 and generalised.

Instead of the slowly converging LEIBNIZ series itself

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - + \ldots$$

one considers the two representations

$$\frac{\pi}{4} = (1 - \frac{1}{3}) + (\frac{1}{5} - \frac{1}{7}) + (\frac{1}{9} - \frac{1}{11}) + \ldots = \frac{2}{1 \cdot 3} + \frac{2}{5 \cdot 7} + \frac{2}{9 \cdot 11} + \ldots \quad \text{and}$$

$$\frac{\pi}{4} = 1 - (\frac{1}{3} - \frac{1}{5}) - (\frac{1}{7} - \frac{1}{9}) - \ldots = 1 - \frac{2}{3 \cdot 5} - \frac{2}{7 \cdot 9} - \ldots$$

and then forms the arithmetic mean of the sums:

$$\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1 \cdot 3} - \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} - \frac{1}{7 \cdot 9} + - \ldots$$

This results in a series that converges considerably faster.

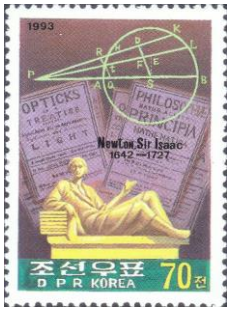
In 1706 he joined the *Camisards*, a group of radical Huguenots who had fled to England and who went down in history as the “French Prophets”. In their sermons they announced the imminent end of the world. At the request of the moderate Huguenots (and with the support of the English government), their leaders ÉLIE MARION and JEAN DAUDÉ as well as NICOLAS FATIO were charged with incitement and preparing a plot, convicted and pilloried. FATIO was saved from the worst by the Duke of Ormand, for whom FATIO once worked as a tutor.

FATIO then travelled through Europe as one of the sect's emissaries, preaching the impending Last Judgment in Berlin, Halle, Vienna, Stockholm, Constantinople, Smyrna (today: Izmir) and Rome. After a long stay in the Netherlands, he returned to England in 1717 and settled near Worcester for the remaining 36 years of his life.

He meditated on the biblical prophecies, wrote a long poem on his theory of the cause of gravity (in the style of LUCRETIUS's *De rerum natura*), which he submitted (unsuccessfully) to a competition at the Paris *Académie des Sciences.*

However, he still had certain doubts about the fundamental necessity of a theory:

... it is not impossible, nor improbable that God has determined by a law that masses attract one another with a force that is proportional to the mass and reciprocal to the square of the distance.



After NEWTON's death in 1727, he wrote a hymn in Latin to the genius he always admired and designed the inscription for the monument that was erected in Westminster Abbey.

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https://www.spektrum.de/wissen/nicolas-fatio-mathematiker-philosoph-astronom-erfinder-und-prophet/2204241

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