PIERRE SIMON LAPLACE (March 3, 1749 – March 5, 1827)

by HEINZ KLAUS STRICK, Germany

The pictured French postage stamp from the year 1955 shows a portrait of an elegantly dressed man wearing the large cross of the *Legion of Honor*. The subject of the portrait is Marquis PIERRE SIMON DE LAPLACE, member of the upper house of the French Parliament.

Born the son of a farmer and cider producer in Beaumont-en-Auge (Normandy), he attended a local Benedictine school and then the Jesuit college in Caen, with the goal, typical for a child of the *Third Estate*, of a career in the service of the Church. However, his teachers noted his unusual mathematical ability, and in 1768, without having finished his schooling, LAPLACE went off to Paris with a letter of introduction to JEAN-BAPTISTE LE ROND D'ALEMBERT (1717–1783), the most influential member of the *Académie des Sciences*.

At first, D'ALEMBERT took no notice of the letter, but LAPLACE won him over with his confident and competent demeanor. D'ALEMBERT supported and encouraged the talented student, who soon gained notice with publications on extreme value problems, differential equations, probability theory, and astronomy.

At the age of 22, LAPLACE made his first application for membership in the *Académie*. When the application was denied, D'ALEMBERT obtained for him a position as a mathematics teacher at the *Paris Military Academy*. When his application to the *Académie* again failed the following year, LAPLACE asked JOSEPH LOUIS LAGRANGE (1736–1813), EULER's successor as director of the mathematics division of the *Prussian Academy of Sciences*, whether there might be a position for him at Berlin. But before he received a reply, LAPLACE was offered a permanent position as adjoint member of the *Paris Academy*.

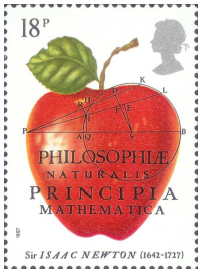
In the years preceding the French Revolution, LAPLACE developed into one of the most influential French scientists. His mentor D'ALEMBERT began more and more to sense that his own life's work was diminishing in significance. LAPLACE did not hide his light under a bushel. He dominated discussions in the *Academy*, taking a firm line on all subjects, even the nonmathematical.

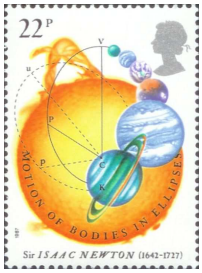
In 1784, he was named examiner at the *military academy*. He put his position to good use, making contacts in administrative circles (the officer class generally came from the nobility). Among the students whom he examined was the sixteen-year-old NAPOLEON BONAPARTE.

In 1790, he became a member of a commission with the charge of standardizing the units of measurement and at the same time to introduce units based on the decimal system. In 1793, he fled Paris with his wife, who was 20 years his junior, and their two children, thereby avoiding the fate of his colleague ANTOINE LAURENT DE LAVOISIER (1743–1794), who was beheaded.

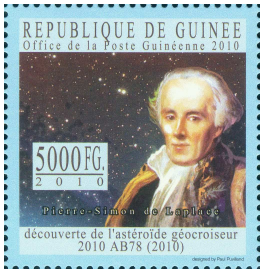
After the end of the Jacobin Terror, he returned and took over the leadership of the *Bureau of Longitude and the Paris Observatory*. The *Académie des Sciences* was reopened as the *Institut National des Sciences et des Arts*. Together with the chemist CLAUDE-LOUIS BERTHOLLET (1748–1822), he began in 1806 to assemble in his hometown of Arcueil (near Paris), together with the *Société d'Arcueil*, a circle of researchers, to which belonged ALEXANDER VON HUMBOLDT. During NAPOLEON's reign, LAPLACE and BERTHOLLET controlled the academic life in France, thanks to their closeness to the emperor.

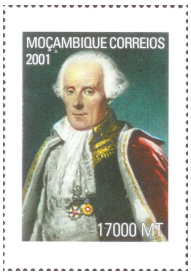
LAPLACE focused much of his research effort on investigating the application of mathematics to questions in astronomy. Observations of the orbits of Jupiter and Saturn indicated a destabilizing influence in the solar system. ISAAC NEWTON had hypothesized that the solar system can maintain its equilibrium through regular divine intervention. In 1776, LAPLACE discovered that the equations of motion established by EULER and LAGRANGE for the motions of the planets were not sufficiently precise and that the terms omitted in their calculations could have a significant effect over the course of a number of years. He proved that from a long-term viewpoint, the solar system is indeed in equilibrium.





In 1796, there appeared a general work, the *Exposition du système du monde*, which contains the following hypothesis on the origin of the solar system: Gas clouds broke away from the Sun and condensed to form the planets. Similar ideas had been formulated by IMMANUEL KANT (1724–1804) in the year 1755.



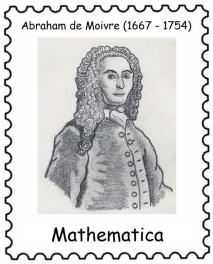


After an intensive involvement with a variety of problems in astronomy, LAPLACE finally collected the results of his research in a comprehensive book: Beginning in 1799, he published the five volumes of *Mécanique céleste*, in which – as the physicist JEAN-BAPTISTE BIOT (1744–1862) noted – "NEWTON's *Principia* was translated into the language of calculus".

When NAPOLEON observed that God is nowhere to be found in the *Mécanique céleste*, LAPLACE is said to have answered, “Sire, je n’avais pas besoin de cette hypothèse.” (Your Majesty, I had no need of such a hypothesis.)

LAPLACE has also to his credit important advances in the theory of probability. In his *Théorie analytique des probabilités* (1812) and in the more generalist *Essai philosophique sur les probabilités* (1814) he adopts the definition, today considered classical, of probability given by ABRAHAM DE MOIVRE (1667–1754), a Frenchman who had emigrated to England (*Doctrine of Chances*, 1738):

$$probability\ of\ an\ event = \frac{number\ of\ favorable\ cases}{number\ of\ possible\ cases}$$



This approach of “equiprobability” seemed to him justified “insofar as nothing compels us to believe that one of the cases must occur more easily than the others.”

(drawing © Andreas Strick)

This textbook concerned itself intensively with the investigation of games of chance, but also with conditional and independent events (here he acknowledged the contributions of THOMAS BAYES (1702–1761) on conditional probabilities), with actuarial statistics, with geometric probabilities, with BERNOULLI’s *law of large numbers*, with special cases of the *central limit theorem* (DE MOIVRE and LAPLACE theorems), as well as the *method of least squares*.

For LAPLACE, there exist questions of probability only because we lack complete knowledge. He was convinced that if some “intelligence” were able to know at a certain moment all the forces and motions of all particles and could use all the methods of mathematical analysis, then all motions could be accurately predicted: “Nothing would be uncertain for [such an intelligence], and both the future and the past would lie clearly before its eyes.” This hypothetical intelligence, which embodies the fundamental idea of causal determinism, is known in philosophy as “LAPLACE’s *demon*”.

LAPLACE doubtlessly belongs among the most important mathematicians of all time; in particular, his contributions to probability theory and celestial mechanics were taught unchanged for decades. One should mention as well his articles on determinants (LAPLACE *expansion*), differential equations (LAPLACE *operator*), and theoretical physics (LAPLACE *equation*).

Part of his genius lay in the capacity to recognize useful approaches for further development of an idea in the work of others. His use of such sources, however, was somewhat problematic in that his frequently adopted an idea without acknowledging its source.

Throughout his life, LAPLACE changed his political affiliations frequently. On account of this opportunistic behavior, he increasingly lost respect. After a period of active support by the republican regime, he became a supporter of Consul NAPOLEON, who appointed him (for six weeks) to the post of interior minister, then to membership in the senate, and later to the vice-presidency, which gave him a substantial income. As emperor, NAPOLEON bestowed on LAPLACE the title of *count*. As NAPOLEON’s star began to sink, LAPLACE shifted his loyalty to the Bourbons, who rewarded him with the title of *marquis* and *peer of Paris*.

In contrast to other famous French scholars, such as LAGRANGE, for example, LAPLACE was not laid to rest in the Panthéon in Paris.

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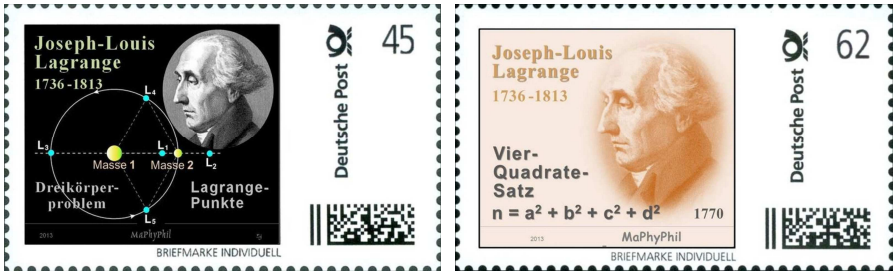
Here an important hint for philatelists who also like individual (not officially issued) stamps:



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