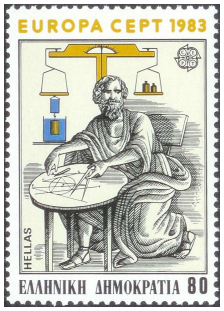
SOPHIE GERMAIN (April 1, 1776 - June 27, 1831)

by HEINZ KLAUS STRICK, Germany

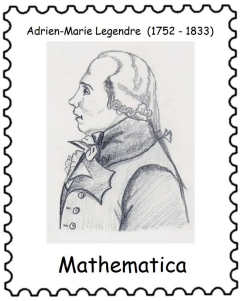
On November 27, 1806, an officer in the NAPOLEONic occupation forces in Braunschweig knocked on CARL FRIEDRICH GAUSS's door and asked about his well-being – on behalf of a lady from Paris. GAUSS was irritated because he knew nobody with the name SOPHIE GERMAIN. He had no idea that the correspondence that he allegedly had had with a certain ANTOINE-AUGUSTE LEBLANC has actually taken place with a 30-year-old French woman.

MARIE SOPHIE GERMAIN was the middle of the three daughters of a wealthy and influential Parisian silk trader. At the age of 13 she read the story in JEAN-ÉTIENNE MONTUCLA's *Histoire des mathématiques* that ARCHIMEDES died because he did not want to be disturbed when he was dealing with a mathematical problem (*Noli turbare circulos meos*).



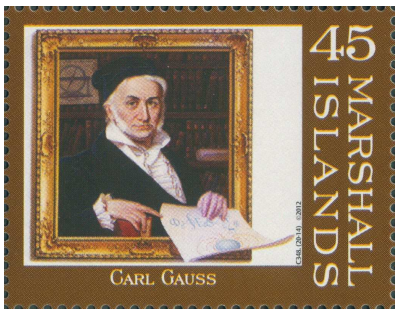
This impressed her so much that she decided to become a mathematician. In the well-stocked parental library, shielded from the turmoil of the revolution, she delved into the mathematics books. When her parents forbade her to do so because such reading was considered inappropriate for a woman, she continued to work secretly, teaching herself Latin so that at night she could read the original writings of ISAAC NEWTON and LEONHARD EULER.

In 1794, the *École Polytechnique* was opened in Paris. Women had no access to this new type of university, but the teaching texts were available to everyone. One of the principles of the *École* was that students submitted their own contributions to their professors at the end of a semester. SOPHIE GERMAIN worked through the notes for the analysis lectures by JOSEPH LOUIS LAGRANGE and presented it to him under the pseudonym LEBLANC, the name of a former student.



LAGRANGE was so impressed with the originality of this contribution that he wanted to get to know the student. So SOPHIE was forced to reveal her true identity. But since LAGRANGE did not mind talking to a woman about mathematics, regular contact developed from their first personal encounter. And because her parents had since given up their resistance to SOPHIE's preoccupation with mathematics, LAGRANGE could even visit her at her home, advise her and encourage further research.

When ADRIEN-MARIE LEGENDRE published his *Essai sur la théorie des nombres* in 1798, she also contacted him. SOPHIE GERMAIN's interest in number theory grew even more when CARL FRIEDRICH GAUSS's *Disquisitiones Arithmeticae* appeared in 1801. For three years she worked through the book and the numerous exercises it contained. From 1804 on, a lively correspondence developed between the "Monsieur Leblanc" and the one year younger GAUSS.



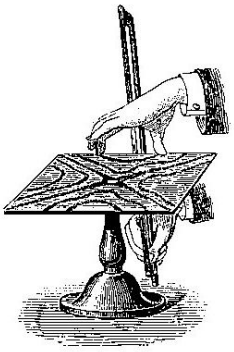
He was so taken with the originality of the proofs that he praised the unknown Frenchman in letters to other mathematicians (something which he rarely did).

At the end of 1806, SOPHIE GERMAIN learned of the occupation of Braunschweig by the NAPOLEONic troops. Because the situation reminded her of the fate of ARCHIMEDES, she was very concerned about the life of the genius whom she admired, and contacted the French city commander who happened to be a friend of her family.

Now SOPHIE GERMAIN alias MONSIEUR LEBLANC had to explain to the irritated GAUSS who she really was. His admiration was now almost limitless; he praised her extraordinary talent and her courage to have dealt with the difficult problems of number theory – despite all social prejudices against women. Only a few mathematicians of that time understood GAUSS's work of the century – SOPHIE GERMAIN was probably one of them.

However, after his appointment as director of the new observatory in Göttingen in 1807, Gauss's interest in number theory subsided. The correspondence between the two then ended without them ever meeting each other personally.

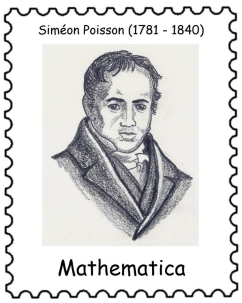
In 1787, ERNST FLORENS FRIEDRICH CHLADNI, originally from Wittenberg, actually a doctor of law, published a booklet on acoustics in which he described how patterns develop on a thin metal plate sprinkled with sand, if it is set in vibration (e.g. by stroking the edge with a violin bow). Through lecture tours, in which he produced these fascinating *CHLADNI sound figures* named after him, he was able to make a living and carry out further research. This was how CHLADNI came to Paris in 1808 and excited visitors of his performances. The *Académie des Sciences* announced a competition that aimed to find a theoretical explanation for the phenomenon with a two-year deadline.



Wikipedia : Création des figures de Chladni
by Emile Desbeaux (1845-1903)

LAGRANGE was not sure that this was possible at all, because known mathematical methods were not suitable for this. When the deadline expired, the jury had only one entry – from SOPHIE GERMAIN. However, this did not win the award because it did not go into the physical basis of the experiment nor did it adequately represent the mathematical context.

After this, LAGRANGE, one of the jurors, was able to use her contribution to develop an equation that captured certain aspects of the phenomenon. When the deadline was extended on a further two occasions, again SOPHIE GERMAIN submitted the only entry.



Finally, despite continuing deficiencies, she received a kilogram of gold as a prize. The criticism voiced about her contribution, the fact that it was not published by the *Académie*, and the ignoring of her work, among others by jury member SIMÉON POISSON, led her not to attend the award ceremony.

Only after a delay of seven years would she, the award winner, be the first woman to have the right to attend the *Académie* meetings. In fact, only LAGRANGE and LEGENDRE had regular contact with her. When POISSON used the results of her competition entry in his own publication in 1821, she made this clear by publishing her own work (*Recherches sur la théorie des surfaces élastiques*).

After FERMAT's death in 1663, numerous mathematicians had attempted to prove the claim that the equation $x^n + y^n = z^n$ for $n > 2$ has no integer solutions.

SOPHIE GERMAIN dealt with this problem time and again. Already in the early letters to GAUSS she suggested some approaches. However, GAUSS did not deal with this in any of his replies. (He always kept his head down when he was asked about his thoughts on this problem).

When in 1815 the *Académie des Sciences* tendered a prize to solve the problem, SOPHIE GERMAIN was again looking for evidence. In 1819 she wrote to GAUSS to find out what he thought of a strategy to tackle the problem – without a reaction from the *princeps mathematicorum*.

While the evidence available so far has been related to concrete exponents (FERMAT for $n = 4$, EULER for $n = 3$), she had a certain set of prime numbers p in mind, namely those for which $2p + 1$ is also a prime number (today these are called *SOPHIE GERMAIN prime numbers* in her honour).

Based on her preparatory work, LEGENDRE succeeded in 1825 in proving FERMAT's conjecture for the prime number $p = 5$ for which $2p + 1 = 11$ is also a prime number. In the extended edition of his *Théorie des nombres*, he added some of SOPHIE GERMAIN's contributions as a supplement and described them as *très ingénieuse*.

In 1829 SOPHIE fell ill with breast cancer. Despite her weakened constitution, she was still writing two scientific papers. Based on a proposal by GAUSS, the University of Göttingen decided to award SOPHIE GERMAIN an honorary doctorate – too late: she died before the decision was announced.

First published 2016 by Spektrum der Wissenschaft Verlagsgesellschaft Heidelberg

https://www.spektrum.de/wissen/sophie-germain-1776-1831/1409002

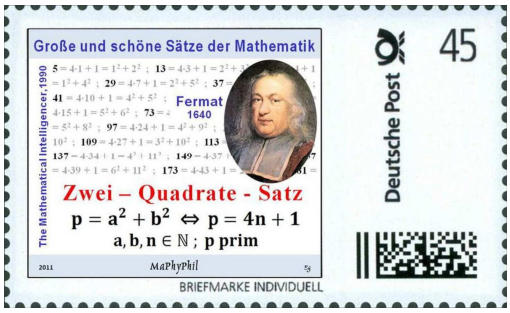
Translated 2020 by John O'Connor, University of St Andrews

Here an important hint for philatelists who also like individual (not officially issued) stamps. Enquiries at europablocks@web.de with the note: "Mathstamps".


Sophie Germain
55
1776
1831
Auguste Antoine Le Blanc
2p + 1 prim
Sophie-Germain-Primzahlen
Liechtensteinische Post AG


Der große fermatsche Satz
Pierre de Fermat
1637
$X^n + Y^n \neq Z^n$
für alle n>2
Andrew Wiles
1993/95
Leonhard Euler
Sophie Germain
Peter G. Lejeune-Dirichlet
Adrien-Marie Legendre
Gabriel Lamé
Eduard Kummer
Harry Vandiver
Gerd Faltings
Gerhard Frey
Jean-Pierre Serre
Ken Ribet
Richard Taylor
2011
MaPhyPhil
Deutsche Post
45
BRIEFMARKE INDIVIDUELL


Carl F. Gauß (1777 – 1855)
DISQVISITIONES
ARITHMETICAE
AVCTORE
D. CAROLO FRIDERICO GAVSS
$a \equiv b \mod m$
Zahlentheorie
2011
MaPhyPhil
Deutsche Post
45
BRIEFMARKE INDIVIDUELL


Große und schöne Sätze der Mathematik
The Mathematical Intelligencer 1990
Fermat
1640
Zwei – Quadrate - Satz
$p = a^2 + b^2 \Leftrightarrow p = 4n + 1$
$a, b, n \in \mathbb{N}$; p prim
2011
MaPhyPhil
Deutsche Post
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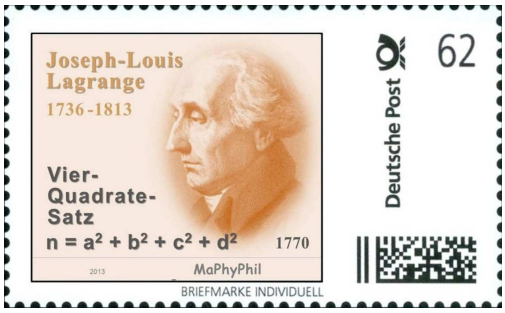
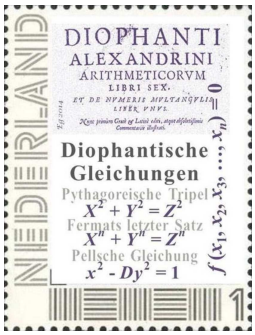
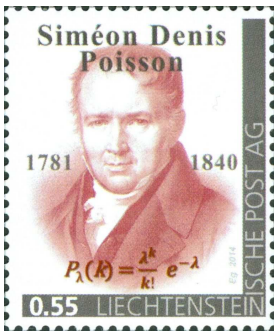
BRIEFMARKE INDIVIDUELL


Joseph-Louis Lagrange
1736-1813
Vier-Quadrate-Satz
$n = a^2 + b^2 + c^2 + d^2$
1770
2013
MaPhyPhil
Deutsche Post
62
BRIEFMARKE INDIVIDUELL


NIEDERLAND
DIOPHANTI
ALEXANDRINI
ARITHMETICORVM
LIBRI SEX.
Diophantische Gleichungen
Pythagoreische Tripel
$X^2 + Y^2 = Z^2$
Fermats letzter Satz
$X^n + Y^n = Z^n$
Pellsche Gleichung
$x^2 - Dy^2 = 1$
$f(x_1, x_2, x_3, \ldots, x_n) = 0$


12. Januar 1665
Zum Gedenken an
den Mathematiker
Pierre de Fermat
1607-1665
0.55 LIECHTENSTEINISCHE POST AG


Siméon Denis Poisson
1781
1840
$P_\lambda(k) = \frac{\lambda^k}{k!} e^{-\lambda}$
0.55 LIECHTENSTEINISCHE POST AG