MARIN MERSENNE (September 8, 1588 – September 1, 1648)

by HEINZ KLAUS STRICK, Germany

(drawings © Andreas Strick)

Although no stamp with a portrait of the French mathematician MARIN MERSENNE has yet been issued, the postal administration of the Principality of Liechtenstein took the discovery of the 39th MERSENNE prime number

$M_{13,466,917} = 2^{13,466,917} - 1$

as an opportunity to select this number as the motif for a stamp of a series on science (the graphic on the stamp below shows a logarithmic spiral).

EUCLID had already dealt with numbers of the type $2^n - 1$ and, among other things, proved the theorem: If $2^n - 1$ is a prime number, then $2^{n-1} \cdot (2^n - 1)$ is a perfect number.
Until the end of the 16th century it was believed that all numbers of the type $2^n - 1$ were prime numbers if the exponent *n* was a prime number.

In 1603, the Italian mathematician PIETRO CATALDI, who was also the first to write a treatise on continued fractions, proved the following:

> If the exponent *n* is not a prime number, i.e. if it can be represented as the product of $n = a \cdot b$ with $a, b \in IN$, then $2^n - 1$ is not a prime number either; because then the number can be broken down into at least two factors:
>
> $2^{a \cdot b} - 1 = \left(2^a - 1\right) \cdot \left(1 + 2^a + 2^{2a} + 2^{3a} + \ldots + 2^{(b-1) \cdot a}\right)$.

He also showed by systematic trial and error with all prime divisors up to the root of the number in question that $2^{17} - 1$ and $2^{19} - 1$ are prime numbers. He also assumed that $2^{23} - 1$ and $2^{37} - 1$ would also be prime numbers, which was disproved by PIERRE DE FERMAT in 1640.

In 1644, MERSENNE mentioned in the preface to his work *Cogitata Physico-Mathematica* that $M_2 = 3$, $M_3 = 7$, $M_5 = 31$, $M_7 = 127$, $M_{13} = 8{,}191$, $M_{17} = 131{,}071$, $M_{19} = 524{,}287$, $M_{31} \approx 2.1 \cdot 10^9$, $M_{67} \approx 1.48 \cdot 10^{20}$, $M_{127} \approx 1.7 \cdot 10^{38}$ and $M_{257} \approx 2.3 \cdot 10^{77}$ are prime numbers. He was wrong about the numbers M_{67} and M_{257}, for which ÉDOUARD LUCAS in 1876 and FRANK NELSON COLE in 1903 found decompositions.

Even if MERSENNE's compilation was not complete (the numbers M_{61}, M_{89} and M_{107} were missing in his list of prime numbers up to $p = 257$), prime numbers of the type $2^p - 1$ are called MERSENNE prime numbers in his honour.

Nowadays, enormous computing power is expended to check whether a number is a MERSENNE prime number (GIMPS = *Great Internet MERSENNE Prime Search*).

To date (2020), only 51 MERSENNE primes have been found, and it is not known whether there are an finite or infinite number of primes of this type.

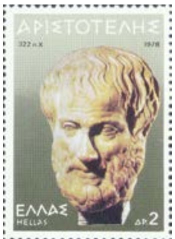
MARIN MERSENNE, who grew up in simple circumstances near Le Mans (then the department of *Maine*, now the *Pays de la Loire* region), showed great curiosity as a child, so his parents allowed him to attend the *Collège du Mans*.

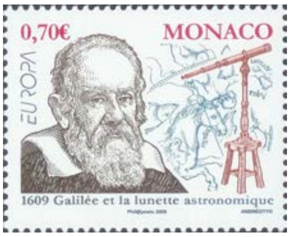
At the age of 16, he moved to the school founded by HENRY IV: *Collège of La Flèche*, where Jesuits encourage gifted children without regard to their origin (the eight years younger DESCARTES would also attend this school later). MERSENNE then moved on to Paris, where he completed his studies in philosophy and theology at the *Collège Royale de France* and the *Sorbonne*.

In 1611 MERSENNE joined the *Order of Minims* (set up by St Francis of Paula in 1436) to dedicate his future life to prayer and scientific research and teaching. After a probationary period (during which he was also ordained a priest) and teaching in the province, he was elected abbot of the convent in *Place Royale* in Paris in 1616, where he lived – apart from a few trips – until his death.

In 1623 he published his first writings against atheism and scepticism (*L'usage de la raison*).

Initially he defended the teachings of ARISTOTLE against the advocates of a new philosophy of nature. But barely 10 years later (*La vérité des sciences*) he came to the conclusion that the views of GALILEO GALILEI were correct.

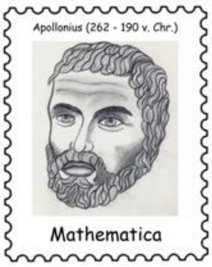




MERSENNE contacted scholars throughout Europe by letter. He met regularly with scholars living in Paris such as RENÉ DESCARTES, GIRARD DESARGUES, GILLES PERSONNE DE ROBERVAL and ÉTIENNE PASCAL, whose son BLAISE joined them later.

This *Academia Parisiensis* (also known as the *Académie de Mersenne*) has gone down in the history of science as the forerunner of the *Académie des Sciences*.

The circle around Mersenne also included the theologian and natural scientist Pierre Gassendi, who was the first to succeed in observing a transit of Mercury predicted by Kepler, and later also the Englishman Thomas Hobbes, who fled into exile in France for political reasons.



In 1626 Mersenne published translations of works by the Greek mathematicians Euclid, Apollonius and Archimedes.

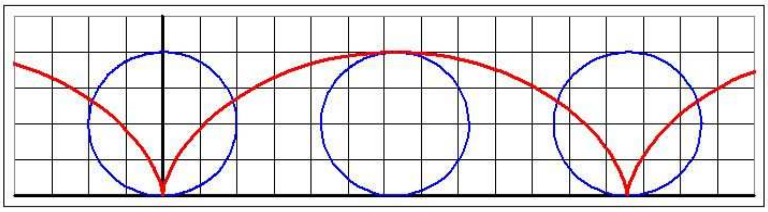
In 1627 Mersenne published his own investigations into acoustics (*L'harmonie universelle*), in which he described the relationship between the tension, length, diameter and specific weight of a string and the frequency of the sound produced. His simple experiments to measure the speed of sound yielded the amazingly accurate value of 316 m/s.

He also made a proposal for the definition of a "well-tempered" semitone: $q \approx \sqrt[4]{\frac{2}{3-\sqrt{2}}} \approx 1{,}0597$.

In 1629/30 Mersenne travelled to the Netherlands for a cure and used this to make contact with local scientists.

During a trip to Italy in 1644 he met Evangelista Torricelli personally. After his return, he reported on his experiments with columns of mercury, which Pascal took up and developed further. Finally in 1646 he visited Pierre de Fermat in Bordeaux, with whom he had had intensive correspondence for years.

In 1648, after a visit to Descartes, Mersenne fell seriously ill. The surgeon treating him was unable to remove an abscess from his lungs. So he died, a few days before his 60th birthday. The letters and writings found in his monastery cell showed that he had corresponded with a total of 78 scientists in Europe.



Mersenne's achievements as a mathematician are not limited to his insights into the prime numbers later named after him. Even in his early years he studied the *cycloid* (he called it a *roulette*). This is the curve on which a point on a circle moves when the circle is unrolled (e.g. along a straight line). Thanks to his approaches, Roberval, Descartes and Fermat were able to determine the corresponding areas.

Mersenne's special merits lay less in his own further development of mathematical or physical theories than in the passing on of the information resulting from his correspondence. Without his work, some physical discoveries would certainly have been made later.

He also intervened as a mediator in priority disputes, for example between Roberval and Torricelli (both had developed a method of determining tangents to curves) or between Roberval and Bonaventura Francesco Cavalieri.

In the dispute between Descartes and Fermat over which of the two "invented" analytical geometry, no conciliatory agreement was possible because of Descartes' stubbornness.

Thanks to his clever approach, the new ideas of Nicolaus Copernicus and Galileo could be discussed in the *Académie Mersenne* without the Church, which he actually represented as a monk and priest, finding any reason to intervene. In the background, he saw to it that Descartes' *Meditationes* printed in the Netherlands were also distributed in France and at the same time he encouraged Gassendi and Hobbes to respond to them critically.

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https://www.spektrum.de/wissen/marin-mersenne-1588-1648/1205037

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