André-Marie Ampère, "the Newton of Electricity"

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On 24 November 1793, four years and a few months after the storming of the Bastille, **Jean-Jacques Ampère**, a prosperous Lyon silk merchant linked to the Girondist party, climbed the final steps to the scaffold. Arrested, tried and sentenced to capital punishment, on that day he was guillotined, one more victim of the vagaries of the revolution. The death by guillotine of his father, to whom he was very strongly attached, had a profound affect on the young **André-Marie Ampère** (1775-1836), then 18 years old, plunging him into a deep depression that kept him isolated for several years on the family's country estate, ten kilometers from Lyon. There, almost completely cut off from the outside world, almost like a person possessed, he devoured his father's magnificent library.

André-Marie Ampère was born on January 20, 1775 in Lyon. He was a prodigy child educated under the influence of the philosopher Rousseau / ***Wikipedia***

André-Marie Ampère was a child **prodigy educated under the influence of the philosopher Rousseau**, of whom his father was a fervent follower. Thus, adhering to the

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ideas set out in *Emile*, **André-Marie never went to school, except to teach classes himself.** After several years teaching mathematics, he held the post of professor of physics and chemistry at the Central School of Ain (Bourg-en-Bresse) until 1804, when he became professor of mathematical analysis at the **École polytechnique** in Paris.

In 1808, **Napoleon appointed him inspector general of the French university system** (a post he held until his death) and in 1814 he became a member of the **French Academy of Sciences**, in the geometry section. In contrast to his professional career, his personal life was complicated and very difficult, with moments like the death of his father by guillotine, the death of his first wife, separation from his second wife, etc.

Ampère is one of the 72 illustrious French scientists and engineers whose names appear over the four arches of the Eiffel tower, including Foucault, Fourier, Fresnel, Laplace, Lavoisier, Malus and Poisson.

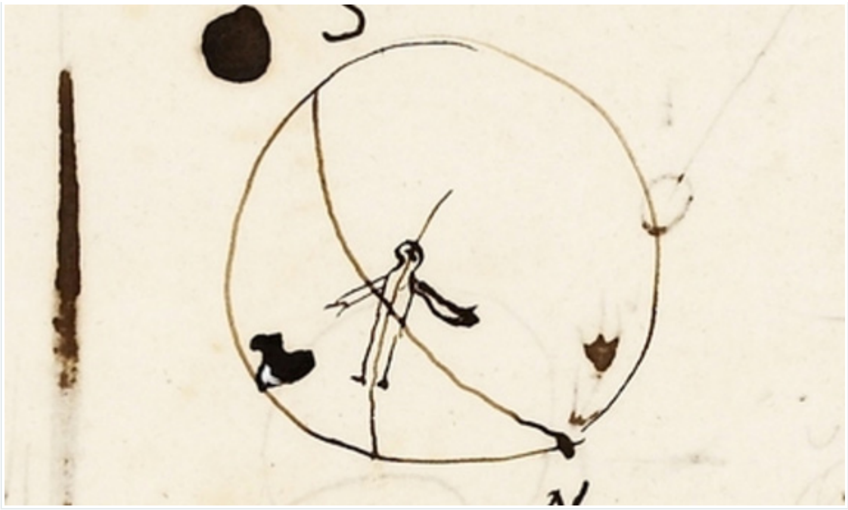
View of the side of the Eiffel tower where Ámpere's name is written (right) / Wikimedia commons/ Author: ***Rama***

André-Marie showed a great capacity for **mathematics** and worked on **optics** and **chemistry**. In fact, he can be considered *almost* an important chemist, since he ***almost* discovered chlorine, *almost* discovered iodine and *almost* discovered Avogadro's law,** which, unbeknownst to him, had been stated 3 years earlier and so in France is also known as *Avogadro-Ampère's law*. Although he made contributions of some importance in mathematics (algebra, mathematical analysis and calculation of probabilities), undoubtedly his greatest contribution was made in the area of electromagnetism, at the age of 45 years.

◢ The *conflictus electrici* and the "little guy" rule

In 1820 the Danish scientist **Hans Christian Oersted** discovered that an electric current deflected a nearby magnetized needle. If the electric current was capable of making a magnetized needle rotate, Oersted concluded, this current produced magnetic effects and **so electricity and magnetism were not independent phenomena.** He published his results in the article *"Experimenta circa effectum conflictus electrici in acum magneticam"* (Experiments on the effect of an electric current on a magnetic needle). This same year, Ampère heard of Oersted's incredible discovery, **the *"conflictus electrici"* capable of deflecting a magnetized needle.** Oersted had found that electricity produces magnetic effects. Unlike other French scientists who thought great discoveries could only be made in France, Ampère studied and drew important conclusions from this experiment, which up to this time had been great discovery, but nothing more. In the summer of 1820 he repeated Oersted's experiment and concluded that if an electric current produces magnetic effects on a magnet, "why would it not produce magnetic effects on another current?" In September of that year he presented his results to the Academy of Sciences in several sessions. In one of these sessions he presented **his little guy rule ("reglè du bonhomme"):**

> "This little man is placed in the direction of the current (the current runs through his body from the feet to the head), the man looks at the point that interests us and extends his left arm so that it indicates the direction of the magnetic field".

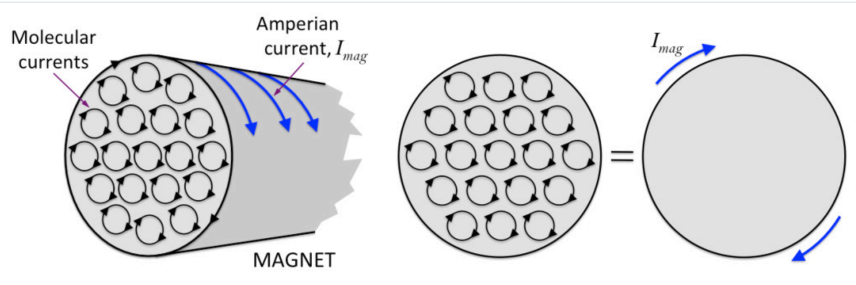


Ampère's "little guy". Credits: Ampère Collection. ***Archives of the Academy of Sciences, Paris.***

In another of the sessions given to the Academy, Ampère announced a new finding: it was possible for there to be mutual action between currents without the intervention of a magnet. Two parallel wires carrying electric currents attract or repel each other depending on whether the direction of the currents is equal or opposite. Shortly after this Ampère formulated the mathematical expression that explained these forces between electrical currents.

◢ The Newton of electricity

In 1826 he published *"The Mathematical Theory of Electrodynamic Phenomena Deduced Solely from Experiment"*, a book in which he states that **"magnetism is electricity in motion"** and "magnetic phenomena depend only on the existence and motion of electrical charges". Ampère explained the existence of permanent magnets, introducing the idea that the magnetism of permanent magnets is produced by a small current at molecular level, **which he called an *electrodynamic molecule*** and which results in a surface current, **la *Ampere current***, similar to the real current flowing through a solenoid. Thus, all magnetic effects are due to the movement of electric charges, both at the macroscopic and microscopic level. The **ampere**, the unit of electric current intensity, one of the basic units in the **International System of Units**, is so named in his honor.



Ampere currents in a magnet. Credits: ***A. Beléndez***

There is no doubt that Ampère is one of the "greats" of electromagnetism and it was precisely another of the "greats", **James Clerk Maxwell**, who, in his Treatise on Electricity and Magnetism, named him **"the Newton of electricity"**:

> "The experimental investigation by which Ampere established the law of the mechanical action between electric currents is **one of the most brilliant achievements in science.** The whole theory and experiment, seems as if it had leaped, full grown and full armed, from the brain of the "Newton of Electricity". It is perfect in form, and unassailable in accuracy, and it is summed up in a formula from which all the phenomena may be deduced, and which must always remain **the cardinal formula of electro-dynamics**».

André-Marie Ampère died on **10 June 1836** in Marseille, where, despite his poor state of health, he had traveled to carry out a university inspection. He is buried in the Montmartre cemetery in Paris, in a tomb that he shares with his beloved and admired son Jean-Jacques.

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