Biography
The Gravity of Émilie du Châtelet

Gabrielle-Émilie Le Tonnelier de Breteuil, Marquise du Châtelet**.**

Image courtesy of La Château Breteuil, painted by Maurice Quentin de la Tour.

With vital contributions to the advancement of physics, mathematics, and philosophy to her name, Émilie de Breteuil du Châtelet was nothing short of revolutionary. Although she passed away at the age of 42 due to childbirth complications, du Châtelet was an intellectual and a freethinker of her time, continuing to stand up for her own individuality, right to education, and contributions to the sciences while also running both a family and her own experiments and maintaining her position in the 1700s French aristocracy. Some of her most notable work concerned the physics of heat transfer (published anonymously in a compilation with other works by Voltaire and Leonhard Euler), the philosophy of different ways of thinking about physics, reflections and expansions of Newtons ideas, and the translation of Newton's entire *Philosophiæ Naturalis Principia Mathematica* (including her own annotations and explanations of his theory). This last work was published after she passed away.

Gabrielle-Émilie Le Tonnelier de Breteuil, Marquise du Châtelet, was born in 1706 into French aristocracy in Paris. For women, this was a society where being knowledgeable in science and math was more likely to be mocked than respected;[1] looks and poise were far more valuable than intelligence.

[1] Perl Morrow, *Notable Women in Mathematics: A Biographical Dictionary* (Westport, Connecticut: Greenwood Press, 1998), 39.

However, her social position and parents allowed her to pursue far more tutoring than most women at the time, granted her open access to their family library, and provided an environment where other intellectuals of the time would be accessible to her.[2] Émilie's father, Louis Nicolas le Tonnelier de Breteuil, held a position in the court of Louis XIV and was supportive of her curiosity, allowing and arranging her tutoring in six languages, sports, and science.[3] When Émilie had her own house later in life, she made an extensive library holding many thousands of books and was known to invite experts and intellectuals to the house to continue her education.[4] Émilie continued to find creative ways to expand her education, despite her role as a woman, even dressing up as a man to do so. Later in life, as Émilie grew the community of (predominantly male) intellectuals around her, she was known to dress as a man to be allowed into male-only cafes, where intellectual discussions often took place.[5] Although most of her work was published anonymously in order to avoid the stigma of female authorship, it is likely that those working in her fields knew that Émilie was responsible for the work.

Émilie married Marquis Florent-Claude du Châtelet at 18, who was often away in the army during their marriage. As he was away, Émilie continued her intellectual pursuits, cultivated both her connections with scholarly aristocracy and well-known strength in gambling, and continued a longstanding affair with Voltaire (François-Marie Arouet).[6] Émilie and Voltaire worked together on many scientific and philosophical projects, holding frequent discussions within the intellectual community around them and running experiments. However, given her position as a woman in history, Émilie is often remembered as his mistress rather than for her own incredible intellect. Voltaire, as did many of the other members of their society, recognized and respected Émilie's intelligence. Voltaire even called her his "divine Émilie,"[7] often writing notes and poetry inspired by her:

> "Her noble mind brightens every room.
> She's possessed of charm and wit,
> Though sometimes shows too much of it.
> She has, I assure you, a genius rare.
> With Horace and Newton, she can compare…"[8]

Du Châtelet and Voltaire seem to have worked together on many scientific and philosophical projects, although she did not get direct credit for many of them. Their bond ran deep; Émilie even

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[2] Patrick Monahan, "A Pitt science historian shares stories of an overlooked woman scientist," Pittwire, University of Pittsburgh, last modified March 31, 2022, https://www.pitt.edu/pittwire/features-articles/emilie-du-chatelet-newton.

[3] Mary Waithe, *A History of Women Philosophers*, volume 3, (Springer, Dordrecht, 1991), 128. https://doi.org/10.1007/978-94-011-3790-4_8.

[4] Ernie Tretkoff, "This Month in Physics History December 1706: Birth of Émilie du Châtelet," *APS News*, 17, no. 11 (December 2008) https://www.aps.org/publications/apsnews/200812/physicshistory.cfm.

[5] Morrow 40.

[6] Tretkoff.

[7] Judith Zinsser. "Translating Newton's Principia: The Marquise du Chatelet's Revisions and Additions for a French Audience," *Notes and Records of the Royal Society of London* 55, no. 2 (May 2001): 227, https://doi.org/10.1098/rsnr.2001.0140.

[8] "Emilie du Chatelet," History 60, University of California Irvine, accessed June 30, 2022, http://faculty.humanities.uci.edu/bjbecker/revoltingideas/Émilie.html#divine.

secretly housed Voltaire in a country home while he was being persecuted for his radical public criticisms of Parisian society.[9] It was also at this country estate that Émilie's extensive library could be found, and where many notable experts gathered for discussions and networking, giving Émilie even more opportunity for intellectual challenge and stimulation. Émilie produced some of her most well-known works during this time when she predominantly lived and experimented at her estate, both in tandem with Voltaire and on her own.

She and Voltaire both entered papers into a 1737 competition by the French Academy of Sciences, where her experiments on light and heat, which had been performed in secret, were first published. Then in 1738, Émilie co-wrote *Elements of Newton's Philosophy*, to be published under Voltaire's name.[10] Two years later, she published a manuscript, *Foundations of Physics*. This text concerned the philosophy of physics, discussing the ideas of Newtonian, Cartesian, and Leibnizian philosophies. The work was both highly praised and controversial, as views on different interpretation of physics were hotly debated at the time, along with enlightenment debates (such as those surrounding the basis of religion in science).

She was not only well educated on Newtonian physics, but also expanded on Newton's ideas. In one of her many experiments, Émilie adapted Willem Jacob 's Gravesande's experiment by combining it with Gottfried Leibniz's theory. Gravesande's experiment involved dropping heavy balls into soft clay to study gravity and kinetic energy. Newton had previously thought that $E = mv$, but, with this experiment, Gravesande was able to show that it was more likely that $E = mv^2$. (We now know it today to be $E = ½ mv^2$). Émilie and Willem likely had many discussions on the matter, and Émilie provided further justification for the idea in her *Foundations of Physics* manuscript.

However in 1749, at the age of 42, Émilie du Châtelet became pregnant with her fourth child. Geriatric pregnancies at the time came with a likely death sentence, and Émilie recognized that she probably had limited time left. With this knowledge, Émilie did not submit to a peaceful end-of-life, but instead dedicated sleepless nights to her final project. During her pregnancy, du Châtelet made a full translation of Newton's *Philosophiæ Naturalis Principia Mathematica*, not only translating it, but also adding her own annotations, explanations, and comments to his work. Finishing the piece took immense amounts of work, with Émilie herself writing that she would "… get up at nine, sometimes at eight… and keep on till five in the morning."[11] Her work was published after she passed away and continues to stand as the sole French translation.

In her lifetime, Émilie du Châtelet not only contributed to the worlds of mathematics, philosophy, and physics, but she also remained outspoken for women's right to education. In the 1735 preface of du Châtelet's translation of Mandeville's *Fable of the Bees*, Émilie wrote "…women have a right to speak out for their education… I confess that if I were king, I would conduct the following experiment. I would correct this abuse that has cut short a full half of the human race. I would get women to participate in all

[9] Morrow, 41.
[10] Morrow.
[11] Morrow, 42.

the privileges of humanity, especially those of the mind."[12] She repeatedly used her wit and education to enter intellectual debates and advocate for herself.

After her death, Voltaire wrote a preface to du Châtelet's translation of Newton's *Philosophiæ Naturalis Principia Mathematica* that honored Émilie's role as a revolutionary woman: "It is unusual for a woman to know simple geometry, let alone the sophisticated mathematics needed to understand the ideas in Newton's immortal work. Clearly, Mme la Marquise du Châtelet has mastered the teaching of that great man. We have seen two miracles: one, that Newton wrote this work in the first place; the other, that a lady has translated and explained it… Mme du Châtelet has rendered a double service to future generations of scholars…"[13]

[12] "Emilie du Chatelet."
[13] "Emilie du Chatelet."