

Donna Strickland

Physicist

Date of birth: May 27, 1959

Place of birth: Guelph, Ontario

Also known as: Donna Theo Strickland

Education: McMaster University; University of Rochester

Significance: Donna Strickland is a Nobel Prize-winning physicist whose pioneering work in lasers made possible their use in applications in medicine and industry.

Background

Donna Strickland was born on May 27, 1959, in Guelph, Ontario, Canada, to Edith J. Strickland, a high school English teacher, and Lloyd Strickland, an electrical engineer. She has a sister, Anne, and a brother, Rob, and grew up in Guelph. She attended Guelph Collegiate Vocational Institute, where she excelled in physics and math. After graduating from high school, she enrolled in the engineering physics program at McMaster University. She received a bachelor's degree in engineering physics in 1981. She then attended the University of Rochester for her doctoral studies and received a PhD in optics in 1989.

Donna Strickland in 2012.



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Career in Physics

At the University of Rochester, Strickland conducted research in the laser lab of Dr. Gerard Mourou, her doctoral advisor. They worked together to find a way to amplify high-intensity laser beams without destroying the material used to amplify them. At the time, when a laser beam was amplified to give it the power to cut through something, it also melted the amplifier, such as a crystal. Mourou and Strickland identified a method to amplify lasers without creating the damaging effect. First, they stretched the laser beam to reduce its peak intensity. Next, they amplified the signal and compressed it into a very short pulse of less than a fraction of a second. This created an extremely intense burst of laser light that could cut through materials with great precision without damaging the amplifier. They called their process chirped pulse amplification. They reported their research in the article "Compression of Amplified Chirped Optical Pulses" in the journal *Optics Communications* in December 1985. Strickland built on the discovery of amplified chirped optical pulses for her doctoral research and completed

her dissertation, titled “Development of an Ultrabright Laser and an Application to Multiphoton Ionization,” in 1989. Strickland and Mourou’s discovery revolutionized laser physics and made possible the application of lasers for medical and industrial uses, including eye surgery and industrial machining. It also opened up research into the use of chirping lasers to speed up subatomic particles in particle accelerators.

In 1988, Strickland joined the National Research Council of Canada as a research associate. She moved to the Lawrence Livermore National Laboratory in 1991, where she worked as a physicist in the laser division until 1992. From 1992 to 1997, she was a technical staff member at Princeton University’s Advanced Technology Center for Photonics and Optoelectronic Materials.

Strickland joined the department of physics and astronomy at the University of Waterloo in 1997. She became an associate professor in 2007 and a professor in 2018. She has been the associate chair of the physics and astronomy department since 2007. She teaches physics classes, conducts laser research, and runs the Ultrafast Laser Group laboratory for students. Her research focuses on developing shorter, faster, and more intense laser pulses than the ones she and Mourou discovered in 1985 and using them to investigate physics phenomena, such as the nonlinear optical technique of multifrequency Raman generation and the spectral region. Her research team is developing a two-color, short pulse fiber laser system that could be used to detect trace gases of explosives. The team is also working on a project involving the micromachining of the eye’s lens as a way to cure presbyopia, the gradual farsightedness that comes with aging.

In 2018, the Nobel Foundation awarded half of the Nobel Prize in Physics to Strickland and Mourou for their groundbreaking development of chirped pulse amplification. The other half went to American scientist Arthur Ashkin for his development of optical tweezers, the use of light to trap and manipulate small objects.

In addition to her work at the University of Waterloo, Strickland has been very active with the Optical Society (OSA). She was named an OSA Fellow in 2008 and served as OSA’s president in 2013. She has also served on numerous OSA committees and boards, including the Education Services Council, Board’s Executive Committee, International Commission for Optics Board, Presidential Advisory Committee, Public Policy Council, and International Photonics Advocacy Congress. She also has served on the editorial board of and as a topical editor of its journal *Optics Letters*.

Other professional awards and recognitions include being named an Alfred P. Sloan Research Fellow in 1998, the Premier’s Research Excellence Award in 1999, and the Research Corporation’s Cottrell Scholars Award in 2000.

Impact

Strickland and Mourou’s discovery of how to manipulate lasers into pulses, or short bursts of high intensity, has made possible laser eye surgery and various industrial applications. It also

has been used to develop research tools, such as slow-motion laser cameras that record chemical and physical reactions. Its potential is still being developed as scientists investigate other applications.

Strickland’s Nobel Prize was unusual in that she won the Nobel for research she conducted as a doctoral student. Unlike many graduate students who are not credited for the work they do during a graduate research program, Strickland was listed as an author on the article that reported the work she did with Mourou. While many people have heralded Strickland as a role model for girls, Strickland has told reporters she hopes her Nobel Prize inspires both girls and boys to follow their interests and pursue careers in science if that is what interest them.

Personal Life

Strickland is married to Doug Dykaar. They have two children and live in Waterloo, Ontario.

Bibliography

“Donna Strickland.” *University of Waterloo*, uwaterloo.ca/physics-astronomy/people-profiles/donna-strickland. Accessed 2 Feb. 2019.

McBride, Jason. “Nobel Laureate Donna Strickland: ‘I See Myself as a Scientist, Not a Woman in Science.’” *The Guardian*, 20 Oct. 2018, www.theguardian.com/science/2018/oct/20/nobel-laureate-donna-strickland-i-see-myself-as-a-scientist-not-a-woman-in-science. Accessed 2 Feb. 2019.

McDonald, Bob. “Donna Strickland, Canada’s Latest Nobel Winner, Is a ‘Laser Jock’ Who Loves the Lab.” *CBC Radio*, 5 Oct. 2018, www.cbc.ca/radio/quirks/oct-6-2018-canada-s-newest-nobel-laureate-reading-surgeons-minds-sniffing-out-shark-water-and-more-1.4850312/donna-strickland-canada-s-latest-nobel-winner-is-a-laser-jock-who-loves-the-lab-1.4850340. Accessed 2 Feb. 2019.

Semeniuk, Ivan. “Canada’s Newest Nobel Prize Winner, Donna Strickland, ‘Just Wanted to Do Something Fun.’” *The Globe and Mail*, 2 Oct. 2018, www.theglobeandmail.com/world/article-canadian-scientist-donna-strickland-shares-nobel-physics-prize/. Accessed 2 Feb. 2019.

Strickland, Donna. “Banquet Speech.” *NobelPrize.org*, 10 Dec. 2018, www.nobelprize.org/prizes/physics/2018/strickland/speech/. Accessed 2 Feb. 2019.

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