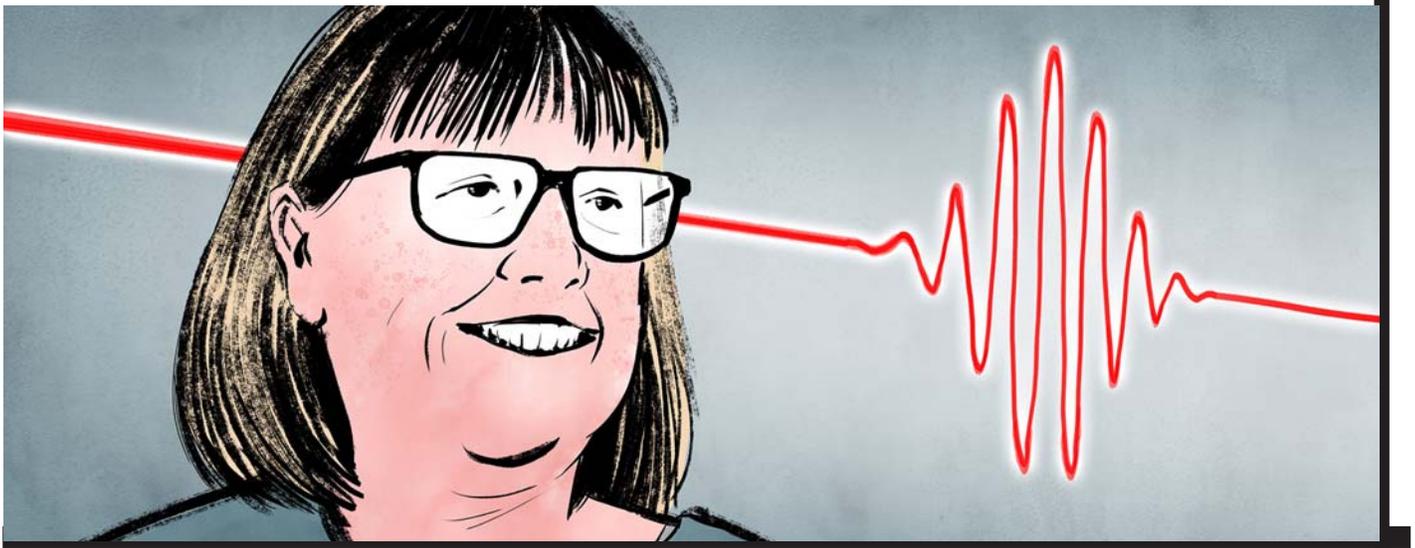




DONNA STRICKLAND, NOBEL WINNER

— A PRESTIGIOUS PRIZE FOR A CANADIAN PHYSICIST



In 1985, Donna Strickland was a **Ph.D.** student at Rochester University in New York state. The Guelph-born physicist was studying laser pulses – ultrashort bursts of intense laser light.

Lasers weren't as strong back then. That's because researchers couldn't figure out how to boost the power and intensity of short laser pulses. When they combined high energy and short pulses, the lasers blew up.

Donna Strickland wanted to solve this problem.

A DIFFERENT SOLUTION

Her doctoral advisor, French physicist Gérard Mourou, suggested a new approach. Why not start by spreading the laser pulse into a longer, less intense beam? Then boost its energy, before squeezing the beam back together again. That would pack

more light into a smaller space. Maybe this powerful ultrashort laser pulse wouldn't explode.

Donna Strickland built a device to test Dr. Mourou's theory. It worked! It created ultrashort pulses of the most intense laser light ever generated. This breakthrough technique, known as chirped-pulse amplification (CPA), was a gamechanger.

BROAD APPLICATIONS

Today, CPA has applications in physics, biology, chemistry, materials science, industry, and medicine. It creates blasts of laser light that can deliver massive amounts of energy in a trillionth of a second. That's fast enough to see electrons moving inside atoms and molecules. CPA is precise, too.

Lasers are used to cut through glass and metal. They play a key

role in corrective eye surgery. High-intensity lasers also speed up electronics, spot and treat cancer, and open up unexplored areas of research.

'LASER JOCK'

Donna Strickland is now a professor at the University of Waterloo. She oversees an ultrafast laser lab and a group of student researchers. She still loves pushing the envelope, shooting for the shortest laser pulse with the biggest punch.

"The most fun part of my day is when I get to play with my lasers," she says.

5 A.M. PHONE CALL

In October, Sweden's Royal Academy of Sciences called her with exciting news. She, Dr. Mourou, and American physicist Arthur Ashkin had won the 2018 Nobel Prize in

DEFINITIONS

PH.D.: doctorate – the highest degree awarded by a university, usually based on at least three years of study and a dissertation

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Physics for “groundbreaking inventions in the field of laser physics.” The trio will share the \$1.1 million (US) award.

“We are very proud of her,” says one of Dr. Strickland’s graduate students. “She’s a very hard-working, brilliant, talented professor. We are still applying the technique that she co-invented in 1985.”

WOMEN IN PHYSICS

A Nobel Prize is one of science’s biggest awards. It often comes years after a breakthrough discovery. That’s because it takes time to measure the impact of the work.

Donna Strickland is the third woman in history to win a Nobel Prize in Physics. Marie Curie received it in 1903. Maria Goeppert Mayer won it in 1963.

Why have so few female physicists won the award? In the past, women were not encouraged to study STEM subjects (Science, Technology, Engineering, and Math). As a result, physics was dominated by men, and offered few female role models.

Dr. Strickland says women are still under-represented

ABOUT THE NOBEL PRIZES

Alfred Nobel discovered dynamite. It made the Swedish inventor a very rich man. His huge fortune funded the Nobel Prizes. After his death in 1896, his will set up annual awards for the most important work in physics, chemistry, physiology or medicine, literature, and peace. The Nobel Committee added an award for economics in 1968.

Some famous Nobel-winning scientists include physicists Albert Einstein (1921) and Niels Bohr (1922), chemist Linus Pauling (1954), and Sir Alexander Fleming, who discovered penicillin (1945).

Arthur Ashkin, who shares the 2018 Nobel Prize in Physics with Gérard Mourou and Donna Strickland, is 96 years old. He is the oldest-ever Nobel winner. His work with laser beams developed ‘optical tweezers’. This valuable tool can grab tiny particles like viruses without damaging them.

The most recent Canadian to earn a Nobel in physics was astrophysicist Arthur McDonald. The Queen’s University professor was honoured in 2015 for his work in particle physics.

Other well-known Canadian Nobel **laureates** include Alice Munro, who won the Literature Prize in 2013, and former Prime Minister Lester Pearson, awarded the Peace Prize in 1957 for his help resolving the **Suez Crisis**.

and unrecognized in the field. They have, however, come a long way. She notes that while Maria Goeppert Mayer’s award-winning research was mostly unpaid, that has not been her experience.

“I felt like all along I’ve always been paid the same and treated the same. I’ve always been treated as an equal... So things have changed and hopefully keep changing for the better.”

SHOOT FOR THE STARS

Canada’s new Nobel **laureate** is an important role model for female physicists, says her daughter Hannah Dykaar, a graduate student in astrophysics at the University of Toronto. Her mother’s Nobel win inspires and encourages young researchers.

“Seeing women celebrated definitely can help more people see that it’s possible for them, too,” she says. ★

DEFINITIONS

SUEZ CRISIS: an international conflict over control of the Suez Canal, one of the world’s busiest shipping lanes. This artificial shortcut connecting the North Atlantic to the Indian Ocean was once controlled by Britain. When Egypt nationalized the canal in 1956, Israel, Britain, and France invaded.

LAUREATE: a person who is honoured with an award for outstanding creative or intellectual achievement.



ON THE LINES

Answer the following in complete sentences:

1. What is the significance of a **Nobel Prize**?

2. How many categories of Nobel prizes are there? How often are these awards given out?

3. Which Canadian scientist recently won the Nobel Prize for Physics?

4. Where does this scientist currently work?

5. What problem did this scientist help solve when she worked at Rochester University?

6. Describe the breakthrough that this scientist made in the mid-1980s.

7. Describe the impact of this breakthrough.

8. What are the four STEM subjects?

9. Explain why women have rarely won the Nobel Prize for Physics.



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BETWEEN THE LINES

Making an inference: An *inference* is a conclusion drawn from evidence. A plausible inference is supported by evidence in the article and is consistent with known facts outside of the article.

What inference(s) can you draw from the fact that Canadian Donna Strickland won the 2018 Nobel Prize for Physics?

JUST TALK ABOUT IT

1. You've just travelled into the future and have arrived at your own Nobel Prize ceremony. Congratulations! Based on your current interests and passions, which award do you think you are receiving? What is your achievement? Explain.
2. It has been fifty years since a new category has been added to the Nobel ceremonies. If you were tasked with adding a seventh prize, what would the category be? Explain your choice.
3. Imagine that you were just given the impossible task of eliminating three of the Nobel Prize categories. Which would you keep, which would you discard, and why?
4. As you see it, what is the significance of the Nobel Prizes? Explain.

ONLINE

Note: The links below are listed at www.lesplan.com/en/links for easy access.

1. Find out more about Dr. Donna Strickland and her work at <https://uwaterloo.ca/physics-astronomy/people-profiles/donna-strickland>
2. Explore Nobel Prize winners, ceremonies, histories, and even educational games at <https://www.nobelprize.org/>
3. Watch “Donna Strickland on being the 1st Canadian woman to win the Nobel Prize for Physics” at https://www.youtube.com/watch?v=r7pgPo8_6XI [19:15].
4. Watch “Donna Strickland Nobel Prize Congratulations” at <https://www.youtube.com/watch?v=FTiZqooNmkU> [2:38]. Now, consider: What congratulatory message would you like to send Professor Strickland? ★