

Gérard Mourou

Physicist

Date of birth: June 22, 1944

Place of birth: Albertville, France

Also known as: Gérard Albert Mourou

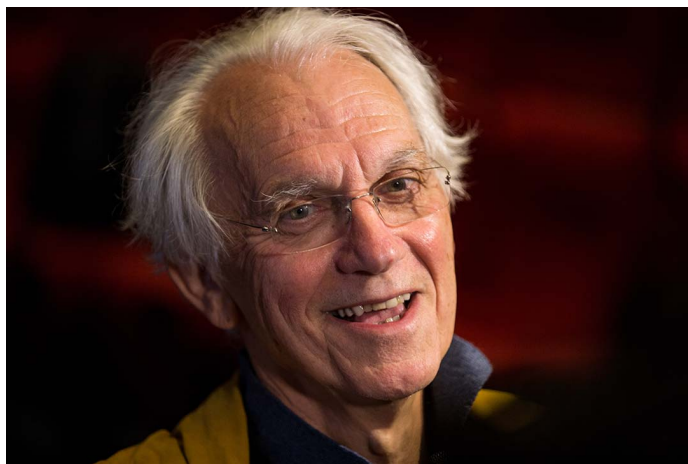
Education: University of Grenoble; University of Orsay; University of Paris VI (now Sorbonne University)

Significance: Gérard Mourou is one of the world's leading scientists in ultrafast laser technology. His groundbreaking co-invention of chirped pulse amplification (CPA) and subsequent development of its applications led to the advancement of the fields of ultrafast lasers, sub-wavelength machining, and femtosecond ophthalmology.

Background

Gérard Mourou was born on June 22, 1944, in Albertville, France. He attended schools in Beaurepaire and Voiron before obtaining a bachelor's degree in physics from the University of Grenoble in 1967. He then earned a master's degree in physics from the University of Orsay in 1970, before entering the doctoral program at the University of Paris VI (now Sorbonne University). During that time, he conducted research for his doctoral thesis at Laval University in Quebec City, Quebec, Canada. He completed his PhD in physics in 1973.

Gérard Mourou in 2018.



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After completing his education, Mourou worked as a postdoctoral fellow at the University of California at San Diego. From 1974 to 1977 he was on staff at the École Polytechnique in Paris.

Physics Career

Mourou moved to the United States and joined the electrical engineering and applied physics faculty at the University of Rochester in New York in the late 1970s. He became the group leader of the ultrafast science group in the Laboratory for Laser Energetics (LLE) in 1978, overseeing research that led to the discovery and development of techniques that became standard tools in ultrafast science and technology research. Among them were electro-optic sampling, THz generation, jitter-free synchronization, picosecond electron diffraction, and chirped pulse amplification (CPA).

The CPA was co-invented by Mourou and graduate student Donna Strickland in 1985. For several years, researchers in the LLE ultrafast science group had been attempting to amplify ultrashort pulses of lasers and store the energy, which would increase the peak power of a laser pulse beyond its current limited capabilities. They were stymied, however, by the laser destroying the mediums, such as glass, used to store the pulses. Mourou theorized that lasers could be stretched, amplified, and compressed to increase their peak power and allow for safe usage. He devised an experiment to test his theory, and graduate student Strickland conducted the experiment as her doctoral research. Using a tabletop terawatt laser, she discovered a way to stretch

a pulse to reduce its energy to its lowest level, safely amplify the pulse, and then compress it and amplify it even more. This resulted in ultrashort, super high-energy laser pulses that could be used without damaging materials.

In 1988, Mourou moved to the University of Michigan at Ann Arbor, where he and his team of researchers, many of whom had been part of his group at LLE, worked to advance the CPA technology and develop applications for it. In 1990, he founded the Center for Ultrafast Optical Science (CUOS) at the university and became its director, a position he held through 2001. The CUOS soon became a leading laboratory for ultrafast optics research. In the early 1990s, Mourou and engineer Ted Norris used CPA to invent two ultrafast titanium-sapphire amplifiers: the ultrafast high-repetition-rate Ti:sapphire amplifier and the 250-kHz Ti:sapphire regenerative amplifier. Both became standard tools in laboratories around the world. In 1994, Mourou and his team discovered femtosecond laser micromachining, which decreased laser pulses to less than ten picoseconds and allowed for ultraprecise laser cutting with little damage to surrounding areas. Mourou and other CUOS researchers also developed a bladeless method of LASIK eye surgery using an ultraprecise laser. In 1997, Mourou cofounded the start-up company IntraLase (acquired by Advanced Medical Optics in 2007) to commercialize the technique. CUOS fostered innovation and Mourou assisted several scientists in their efforts by allowing them to use the laboratory's space and equipment for their initial product development.

In 1994, Mourou retired from the University of Michigan but retained his role as the A. D. Moore Distinguished University Professor Emeritus. He returned to France in 2005, where he became a professor at Haut College at the École Polytechnique. From 2005 to 2008, he also served as the director of the Applied Optics Laboratory, a joint laboratory between the École Polytechnique, the French National Centre for Scientific Research, and ENSTA ParisTech. His achievements there included the proposal and coordination of the preparatory phase of the Extreme Light Infrastructure, a collaborative European project to construct three facilities in Romania, Hungary, and the Czech Republic to house the world's most powerful laser systems. He also initiated the development of the Apollon laser facility, which contains an extreme intensity laser with the highest known power of petawatts and which is being developed to reach a power 1 of 10 petawatts.

Following his retirement from the Applied Optics Laboratory, Mourou cofounded the International Center for Zetta-Exawatt Science and Technology (IZEST) in 2011 and became its director. A multinational collaborative research laboratory, IZEST aims to advance the next generation of laser-based high-energy research.

Impact

Gérard Mourou's discoveries revolutionized the field of ultrafast optical science and led to significant applications in research, medicine, national security, and electronics, including the creation of the field of femtosecond ophthalmology.

Chirped pulse amplification, the technique he co-invented with Strickland, was adopted by research laboratories worldwide for use in multiple fields. It has made possible advances in the ultrahigh-intensity laser field and astrophysics research, and has shaped research for future developments of even more powerful lasers. In recognition of the significance of this contribution to science, Mourou and Strickland were awarded one-half the 2018 Nobel Prize in Physics. They shared the prize with Arthur Ashkin.

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Barb Lightner