Nobel-winning laser discoveries that lit up the field

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Three scientists shared the 2018 Nobel Physics Prize on Tuesday for their work that has "revolutionised" the field of laser physics.

Here is a brief explanation of their breakthroughs and how the discoveries can be applied:

Optical tweezers

American physicist Arthur Ashkin was given one half of the prestigious award for inventing "optical tweezers"—intense laser beams that can grab microscopic particles and move them about for study.

They use light to move physical objects, "an old dream of science fiction," according to the Royal Swedish Academy of Sciences.

The beams use light's natural radiation pressure, allowing scientists to examine and manipulate viruses, bacteria and other living cells—even individual atoms—without damaging them.

The Nobel prize committee said the innovation, which Ashkin developed in the 1970s and 1980s, had created "new opportunities for observing and controlling the machinery of life".

Optical pulses

The other half of Tuesday's prize pot was split between Frenchman Gerard Mourou and Donna Strickland of Canada, for their joint development of ultra-short optical pulses.

When early lasers were being developed in the 1960s, scientists encountered the problem of how to scale up the beams without also boosting their intensity to potentially dangerous levels.

Mourou and Strickland developed a technique, known as chirped-pulse amplification (CPA), which enabled researchers to boost laser power but keeping the intensity safe by having incredibly short light bursts.

CPA first stretches laser pulses over time to reduce their intensity, before amplifying them and compressing them again.

The compressed pulses saw more light packed into a shorter time, increasing the intensity of the pulse.

It enables beams to cut or drill holes in various materials, including living matter, with extreme precision.

Today the technique is used in millions of laser eye surgeries across the world and is being applied to research in several fields, including cancer care.

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