Ultrafast experts win Wolf Prize

Three pioneers of attosecond physics share the 2022 Wolf Prize in Physics.

The 2022 Wolf Prize in Physics has been awarded to Paul Corkum, Anne L'Huillier and Ferenc Krausz. The three academics share the prestigious award for their pioneering contributions to the fields of ultrafast laser science and attosecond physics, and for demonstrating time-resolved imaging of electron motion in atoms, molecules, and solids.

The highly coveted Wolf Prize is awarded almost every year by the Wolf Foundation in Israel to scientists and artists for "achievements in the interest of mankind and friendly relations among people, regardless of race, gender, religion or political views". The prize is typically awarded in six categories, among which Physics is regarded as one of the most prestigious recognitions, often considered second only to the Nobel Prize. Indeed, former recipients include names of the calibre of Stephen Hawking, Roger Penrose, Dan Shechtman and Peter Higgs. In the past, the prize has recognized major breakthroughs such as the realization of the first operating laser, the testing of the Bell inequalities in quantum physics and the discovery of the first extrasolar planet orbiting a Sun-like star. Many recipients went on to receive the Nobel Prize, including last year's Giorgio Parisi.

It is therefore with pleasure that we welcome this year's award, which pays tribute to the growth that attosecond science has experienced in the last decades. In this issue of *Nature Photonics*, we celebrate the award with interviews with the three prize winners, who share their views on the development of the research field, the unanswered questions and the exciting opportunities laying ahead.

Each of the awardees made crucial contributions to various aspects of attosecond physics and the development of ultrafast lasers and their applications. Their pioneering research initially led to the understanding and realization of high harmonic generation, the process that underlies the formation of attosecond pulses. Anne L'Huillier, Professor of Atomic Physics at Lund University, pioneered the experimental demonstration of high harmonic generation in the late 80s. A few years later, Paul Corkum, now Professor of Physics at the University of Ottawa and Director of the Joint Attosecond Science Laboratory, proposed the semiclassical re-collision model that explains the formation of the pulses. Ferenc Krausz, now Director of the Max Planck Institute of Quantum Optics and Professor of Experimental Physics at the Ludwig Maximilian University of Munich, experimentally produced and measured the first isolated attosecond pulses in the early 2000s.

And experimental endeavours began to thrive. Owing to their incredibly short duration, which matches the timescale of light–matter interaction, attosecond pulses gave access to an unprecedented control over electronic processes at extreme timescales. Indeed, these pulses enabled real-time observation and time-domain control of atomic-scale electron dynamics and probed extremely short-lived phenomena such as photoionization, electron tunnelling through Coulomb barriers, charge migration in biomolecules and inner-shell electron decay dynamics, among others.

Now, although fundamental and technical challenges still need to be overcome, fascinating opportunities and exciting applications of attosecond science abound. On the one hand, probing such short timescales will further push our fundamental understanding of light–matter interaction. We may have only started to scratch the surface of such an ultrafast realm of physics, as many understudied systems are left to explore, including complex molecules and condensed matter. These will enable us to ask question about the most fundamental aspects of electronic interactions and correlations, such as the formation and break-up of chemical bonds and the limits of electron-based information exchange and processing. On the other hand, practical applications of attosecond pulses are also on the horizon, with the promise of broadband, coherent sources of high appeal for ultraprecise metrology, imaging and disease detection. The Wolf Prize certainly recognizes the significant effort in what has been achieved so far, while, we would like to think, acknowledging the potential of ultrafast lasers to open up new frontiers in science and technology. ❐

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