

■ Invited speaker

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Next-generation attosecond metrology

Abstract

Born around the turn of the new millennium, attosecond metrology has permitted the observation of atomic-scale electron dynamics in real time. Until recently, this capability has relied on attosecond extreme ultraviolet pulses, generated and measured in complex vacuum systems. Attosecond metrology 2.0 is now about to change this state of matters profoundly. Sub-femtosecond current injection into wide-gap materials can directly probe ultrafast electron phenomena in condensed matter systems and also be used for sampling the electric field of light up to ultraviolet frequencies. Petahertz field sampling draws on a robust solid-state circuitry and routine few-cycle laser technology, opening the door for complete characterization of classical fields all the way from the far infrared to the vacuum ultraviolet. These fields, with accurately measured temporal evolution, serve as unique probe for the dynamic (polarization) response of matter. Field-resolved spectroscopy will access (valence) electronic as well as nuclear motions in all forms of matter and constitutes a generalization of pump-probe approaches. Its implementation with a solid-state instrumentation opens the door for real-world applications, such as early cancer detection by measuring miniscule changes of the molecular composition of blood (liquid biopsy) via field-resolved vibrational molecular fingerprinting.

About the Author

Ferenc Krausz (*1962 in Mór/Hungary) earned his degree in Electrical Engineering at the Technical University Budapest (1985). He completed his doctorate in Laser Physics at the Technische Universität (TU) Vienna (1991) where he habilitated in the same research field in 1993, took up assistant professorship in 1998 and full professorship in 1999.

In 2003 Ferenc Krausz was appointed Director of the Max-Planck-Institute of Quantum Optics (MPQ) in Garching. In October 2004 he became professor at the Faculty of Physics of Ludwig-Maximilians-Universität (LMU) Munich and since then holds the Chair of Experimental Physics - Laser Physics.

In a series of experiments performed between 2001 and 2004 Ferenc Krausz and his team succeeded in producing, measuring and using attosecond light pulses for tracing atomic-scale electronic motions. Since then Ferenc Krausz is considered to be - together with Paul Corkum - founder of the field of Attosecond Physics, a field devoted to real-time observation and control of electron phenomena, as also acknowledged by their selection as 2015 Thomson Reuters Citation Laureates.