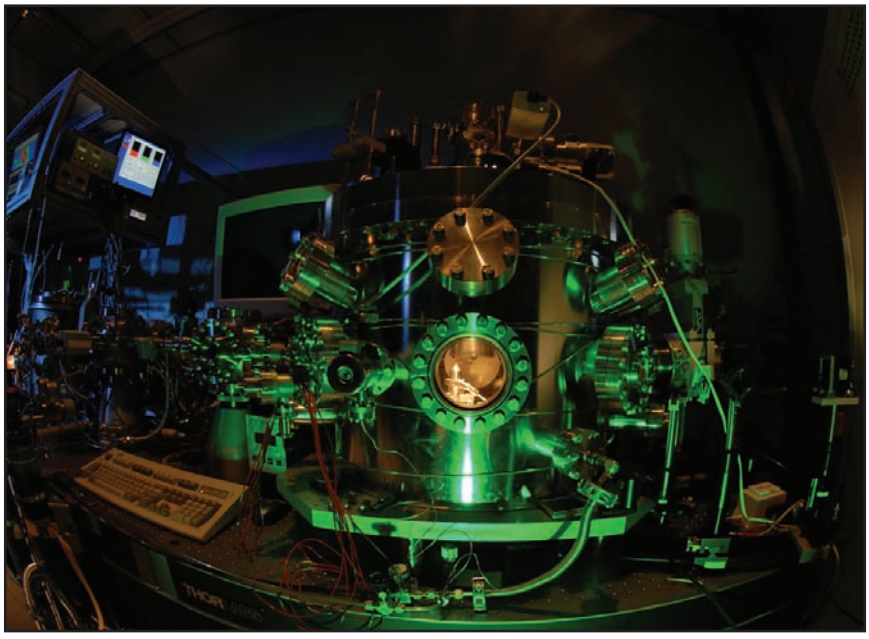
Laurin Publications
EUROPHOTONICS
european coverage of optics, lasers, imaging, fibre optics, electro-optics and photonic component manufacturing

EUROResearch

An Attosecond Atomic Probe



The laboratory setup for the attosecond atomic probe includes vacuum chambers and peripheral equipment. Photo by Thorsten Näser for MPQ Garching, Germany.

In 1965, Leonid V. Keldysh hypothesized that strong light fields from ultrashort laser pulses free the valence electrons from their atomic bonding. The theory had been unproved, however, until a team of European physicists recently achieved real-time observation of the process, whereby intense light ionizes atoms.

The scientists used 300-μJ, 5.5-fs pulses of light at 750 nm to interact nonlinearly with the bound electrons in neon gas and to produce subfemtosecond extreme ultraviolet (XUV) pulses, which can excite electrons in neon atoms. Further, XUV pulses with a variable delay from a double-mirror arrangement probe the subsequent response, allowing attosecond (10^{-18}) sampling of the electron motion. A time-of-flight spectrometer detects the ions that are created.

The attosecond technique provides a tool for probing other short-lived atomic events. The team demonstrated this by observing multielectron excitation and relaxation in xenon atoms.

The group included researchers from Max Planck Institut für Quantenoptik in Garching, from Ludwig Maximilians Universität in Munich and from Universität Bielefeld, all in Germany, from FOM Instituut voor Atoom- en Molecuulfysica in Amsterdam, the Netherlands, and from Moscow State University in Russia. □

(*Nature,* 5 April 2007, pp. 627-632)