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PRESS RELEASE

2. Prize Berthold Leibinger Innovationspreis 2006

Prof. Ian A. Walmsley
University of Oxford
Oxford, Great Britain

A “Spider” for Ultra-Short Laser Pulses

A major leap in laser physics during the past 30 years has been the ability to create very short laser pulses. But for a long time, the exact shape of the pulses were unkown. Professor Ian Walmsley’s “SPIDER” measurement technique now does characterize these ultra-short femto- and picosecond laser pulses. Light travels a distance less than a thousands part of a millimeter within a femtosecond, which lasts only a billionth of a millionth of a second. During this hardly imaginable short time the invention of Ian Walmsley gathers all the light flashs’ information needed to utilize it.

SPIDER stands for “Spectral Phase Interferometry for Direct Electric Field Reconstruction” and describes a method to completely measure ultra-short laser pulses. Until this technique was developed, traditional methods were based on autocorrelation techniques. Walmsley’s process, however, uses spectral interferometry. Though initial experiments for measuring pulse durations were conducted in the early 1970s. But it was Prof. Walmsley’s work that first laid down the general principles of this type of metrology and showed how to apply spectral interferometry for the measurement of ultra-short pulses. Specifically, he was able to produce the necessary precisely defined reference pulse. And he was able to realize and to economically implement a completely new process in SPIDER. The companies APE in Berlin, Germany and DelMar Photonics in San Diego, California, USA, use licenses of this patented technology for their products. The success of these companies with SPIDER is based not least on the fact that, by creating SPIDER, Walmsley was able to convert a measuring technique for inconceivably short pulses in an easy-to-use, robust and consistently accurate process.

The process is primarily used in areas where ultra-fast processes are studied using pulses in the femtosecond range. Such applications include, for example, coherent excitation of semiconductors, the behavior of superconductors or numerous elementary chemical and physical processes. Apart from basic research interesting applications are also in the fields of telecommunication and

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microscopic analysis of biological probes. The necessary effects cannot be realized with the lower power of “longer” laser pulses. SPIDER delivers the phase information of each pulse and thus describes it completely. Pulses of extremely high intensity (> 1021 W/cm²) can also be measured by using a fraction of the original pulse.

SPIDER has quite decisively revolutionized ultrafast physics, improved the understanding of associated techniques and not least enabled improved designs of laser sources.

Title of Work:
Methods for Complete Measurement of Ultra-Short Pulses

Digital pictures of the prize winners and the awarded work are available at www.leibinger-stiftung.de.