

Press Release: IQEC 2007

Nearly 50 years after its invention, the laser continues to spark scientific and technological developments. From the very beginning, the International Conference on Quantum Electronics (IQEC) has brought together physicists to advance fundamental research in fields ranging from laser physics to quantum optics - to the development of new optical materials. IQEC will be held alongside the European Conference on Lasers and Optoelectronics (CLEO[®]/Europe) in Munich (at the International Congress Centre, ICM) - from 17th to 22nd June 2007

Researchers will report groundbreaking results from their laboratories and discuss further applications of laser light. For instance, new kinds of microscopic sensors and information processors are based on the subtle and often unexpected behaviour of quantum mechanics. The devices may use single atoms, or single particles of light (photons) trapped between tiny mirrors, or even artificially made quantum objects such as quantum dots or microscopic tuning forks. A whole new science is being developed as we understand how to use the interactions of these quantum objects with each other to address problems of measurement, sensing and computation. These building blocks form the basis of an emerging new technology. One breakthrough is the construction of tiny atomic clocks the size of a grain of rice, which could enhance the performance of battery-operated devices such as GPS receivers and mobile phones. Participants can learn how light can be slowed down or even stopped with vapour cells or waveguides. Promising applications are presented for optical buffering, data synchronization, optical memories and optical signal processing.

The laser has emerged as probably the most precise of all measurement devices that we possess today. With so-called optical frequency combs we can now directly count the cycles of an optical wave, making optical atomic clocks possible and revolutionizing precision spectroscopy. This breakthrough, pioneered by J. L. Hall and T. W. Hänsch, was recognized with the 2005 Nobel Prize in physics. J. Hall will open the symposium on frequency combs with personal reminiscences. T. Hänsch will review the relentlessly advancing art of measuring optical frequencies in his plenary lecture. Another highlight of precision physics will be presented by G. Gabrielse with his new measurement of the electron's anomalous magnetic moment, which constitutes the best present test of quantum electrodynamics.

Optical devices are also following the quest for ever more compact, micro-structured devices. Tiny optical micro-cavities can be more stable and more sensitive than their macroscopic counterparts. The new fields of nanophotonics and metamaterials emerge when we force light to interact with nano-structures, artificial optical materials arranged at the scale of only billionths of a meter. These artificial materials promise functionalities not available with natural materials.

Needless to say, the full range of optical research topics - ranging from quantum optics to quantum information and light control of ultra-cold atoms will be presented in this show, highlighting how fundamental research in optics may potentially contribute to the advancement of physics and technology.