Femtosecond Frequency Combs and Applications

Dr. Thomas Udem, Max-Planck-Institut für Quantenoptik

Wednesday, March 17, 2010
12:00 noon – 1:00 p.m. followed by lunch
TAMUQ – LH 144/1st Floor

A femtosecond frequency comb is a simple and compact tool that allows the phase coherent connection of the radio frequency domain (below 10 GHz) with the optical domain (above 200 THz). It greatly simplified high precision optical frequency measurements and provides the long awaited clockwork mechanism for an all-optical atomic clock. In addition it allows to shape the electric field transients of femtosecond pulses including the phase between the carrier wave and the pulse envelope. The technical aspects of frequency combs their operation will be discussed along with an overview of applications.

Thomas Udem, born in 1962, studied physics at the University of Gießen/Germany and at the University of Washington in Seattle/USA. In 1997 he received his PhD from the Ludwig Maximilians University Munich. After obtaining his Habilitation (tenure track) at the same University and a Postdoc at the National Institute for Standards and Technology (NIST) at Boulder/USA he became fellow of the Max-Planck Institute for Quantum Optics in Garching/Germany. Thomas Udem is co-recipient of the 1998 Philip Morris Research Award and received a Habilitation Award of the University of Munich in 2005. For his ‘seminal contributions to the realization of optical frequency combs’ he received the Röntgen Award of the University of Gießen in 2006.

Thomas Udem has been working on precise laser spectroscopy for many years developing technologies such as frequency interval dividers and optical frequency combs. Among other applications these techniques have largely improved the experimental knowledge of the energy levels of hydrogen and allowed to construct all optical atomic clocks. Currently he is leading a group of about 15 students and postdocs. He is co-author of more than 110 publications and various book chapters. In 2010 he became a fellow of the Optical Society of America.

Thomas Udem’s research interests are ultra precise laser spectroscopy, atomic physics, quantum optics and metrology. His main aim is to improve the spectroscopic accuracy of simple atoms such as hydrogen and hydrogen-like systems to test fundamental laws. His activities cover extreme ultraviolet frequency combs for spectroscopy of trapped ions such as hydrogen like He or helium like Li as well as new calibration methods for precision astronomy.