

The Femtosecond Optical Frequency Comb and its applications

Dr. Ronald Holzwarth

Besides founding Menlo Systems and acting as managing director, he is still very active in the research field. He is author or co-author on 97 papers and holds 10 patents. Dr. Holzwarth has accumulated for his work over 8700 citations and had an h-factor of 42. Many of these papers have been landmark papers being highly cited.

In 2001, Dr. Holzwarth founded together with co-workers Menlo Systems GmbH to commercialize the optical frequency comb technology. Since that time it has been his main task to build up the company, promote the optical frequency comb technology and develop new products. At the same time, Dr. Holzwarth has conducted advanced research on frequency combs at the MPQ as well as at Menlo and served as Ph.D. advisor for several students. The research direction is on the one hand side targeted towards more user-friendly frequency combs, to spread their application. This notably includes work on micro resonator frequency combs together with Dr. T.J. Kippenberg. On the other hand, it is important to expand the accessible wavelength range into the UV and infrared part of the spectrum. Other topics of his research include fundamental limits of frequency combs and the use of frequency combs for the distribution of optical frequencies through optical fiber networks.

Another topic under investigation with collaboration partners from Astronomy, most notably the European Southern Observatory (ESO), is the precise calibration of astronomical spectrographs by frequency combs. Dr. Holzwarth is also coordinating a number of projects with the German and the European Space Agency (DLR and ESA) to bring frequency combs to space. Another side of the comb research is the use of combs for low phase noise microwave generation. Here the superior properties of optical references are leveraged to achieve world record performance in the RF domain. Already during Dr. Holzwarth's work towards a Ph.D. degree at the Max-Planck-Institute for Quantum Optics the frequency comb technology has been developed, guided by the ideas of his Ph.D. advisor T.W. Hänsch. Starting in late 1997 with initial experiments to assure equal mode spacing and overall feasibility, in 1998 the fs laser has been used to measure optical frequency differences. The first absolute optical frequency measurement with a fs frequency comb has been conducted one year later in 1999. With the availability of photonic crystal fibers, the apparatus used for these measurements underwent rapid miniaturisation until it fitted on a 60 x 80 cm breadboard at the end of 2000. Many papers and invited talks presented at international conferences confirm the importance of the frequency comb technology to the community.