Seminarvortrag **Fachgebiet Mikrotechnik**

Mittwoch, den 14. Oktober 2009 **16:15 - 17:45 Uhr**

Ort: Neues Physikgebäude 1. Etage Westflügel Raum EW 115 A

Femtosecond laser pulses: Generation and applications

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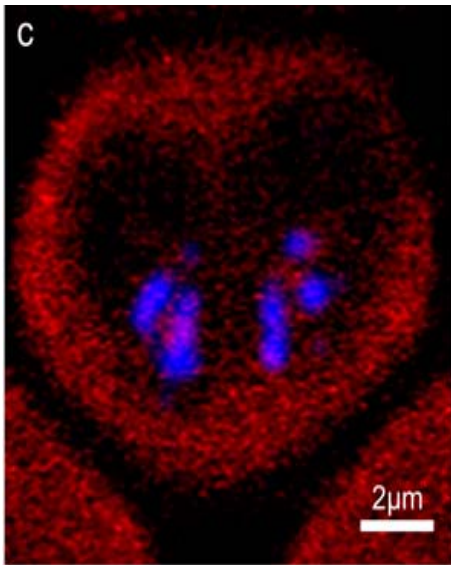
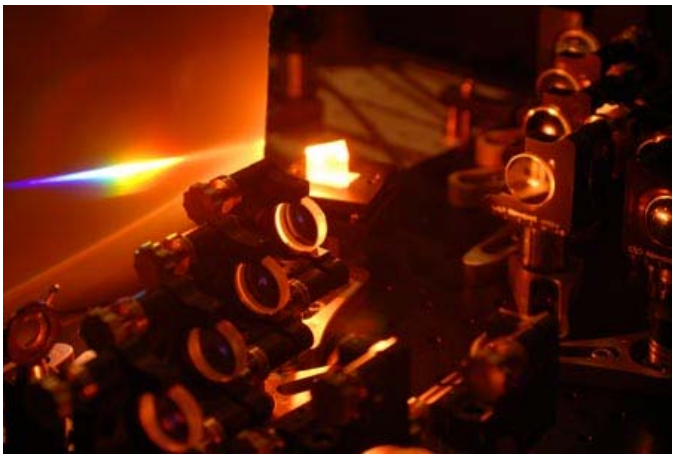
Ultrafast lasers, which generate optical pulses in the picosecond and femtosecond range, offer great potential for innovations and applications. Because the laser output energy can be concentrated both spatially and temporally, such lasers have permitted the development of minimal-invasive surgical procedures, high-resolution microscopy, micromachining, data storage and optical communications.

In chemistry, femtosecond pulses are now routinely used to investigate ultrashort processes with extremely high temporal resolution. In particular the dissociation dynamics of molecules and more complex chemical reaction dynamics have been measured, and this work was rewarded with a Nobel Prize in chemistry for A. H. Zewail in 1999. At the Max Planck Institute of Quantum Optics the interaction of light and matter under extreme conditions is being explored using ultrafast laser systems.



Blood cell infected by the malaria parasite (blue). Image obtained using third-harmonic generation microscopy with a femtosecond laser



A femtosecond pulse passes through a prism, revealing its full spectrum from the blue to the infrared

Mode-locking is a technique that can generate ultrashort pulses from lasers. It was actually demonstrated shortly after the realisation of the first ruby laser in 1960. However these lasers were originally difficult to handle, impeding their development until the emergence of new technologies in the early 90's. Since then, mode-locked lasers have progressed from complex laboratory systems to compact reliable instruments accelerating their implementation in the industry.

In this talk, the principles of lasers will be reviewed with emphasis on the pulse formation and shaping mechanisms in the mode-locking process. Some examples of industrial and scientific applications of ultrafast lasers will be finally presented to illustrate their versatility.