



University
of Basel

Department of
Biomedical Engineering

Seminar Series FS 2020: **Robotics, Lasers and Beyond**

Lecture Room 14.03.002, Department Biomedical Engineering, Gewerbestrasse 14, Allschwil

Tuesday 12.05.2020, 11:00 – 12:30

Holographic optical coherence tomography (OCT): How to use the phase for aberration correction, functional imaging and therapy control

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Abstract:

Optical coherence tomography (OCT) is one of the most successful modern optical imaging modalities in medicine. It uses scattered light to reconstruct cross-sectional images with a resolution down to the subcellular level. Using interferometry, OCT gives access not only to the intensity, but also the phase of the scattered light. However, in current applications sample motion and phase noise prevent us from fully taking advantage of phase information. Even worse, the phase introduces speckle noise, which degrades the image quality. New OCT technologies, like full field OCT, and the recent availability of MHz OCT are going to change this and will enable holographic imaging, i.e. imaging of phase and amplitude of the full scattered light field. This enables aberration correction, new contrast options and functional imaging.

Using full-field swept-source OCT we have achieved phase-preserving full volumetric imaging of human retina at 100 Hz imaging speed. The full phase information allowed numerical aberration correction and 3D imaging of tissue changes with nanometer precision. For the first time, we demonstrated parallel imaging of photoreceptor and neuronal cell function in the human retina.

Holographic OCT opens new avenues for functional imaging and therapy control.

Curriculum:

Gereon Hüttmann received his Master of Science degree in Physics and his Ph.D. in Physical Chemistry from the University of Göttingen, Germany. From 1992 - 2005, he was research member and scientific group leader of the Medical Laser Center in Lübeck, Germany, working in the fields of photodynamic therapy and fluorescence detection of tumors. Since 2005 he leads a research group at the Institute of Biomedical Optics, University of Lübeck. Gereon Hüttmann was member of the Supervisory Board of the Thorlabs Lübeck GmbH and Mentor of the spin-offs Optomedical Technologies GmbH and Visotec GmbH. Currently he is Member of the German Center for Lung Research and Vice-Director of the Institute of Biomedical Optics in Lübeck. His main research interests are optical coherence tomography (OCT) and intravital microscopy.