

## **Seminar über Biomedizinische Photonik**

**Referent/in:** Dr. Willi Stepp, Laboratory of Experimental Biophysics, EPFL

**Titel:** **Imaging dynamic biological events the smart way**

When studying biological processes, the most valuable information is often to be found in their dynamics. That's why we try to capture them with high resolution in both space and time, a challenge to biologists and microscope developers alike. Super-resolution fluorescence microscopy has become an established tool to approach these tasks. However, imaging throughput, photobleaching and phototoxicity have proven to be considerable challenges that limit the type and amount of data that can be obtained.

We use a special version of structured illumination microscopy called instant SIM (iSIM) that uses analog optical processing for resolution enhancement. This gives super-resolved images without post-processing and allows for frame rates of up to 100 Hz. We also extend the field of view to 100x100  $\mu\text{m}$  by using a flat fielding module in the excitation to allow for high throughput imaging.

Even with iSIM, photobleaching and phototoxicity put restrictions on the speed, duration and quality of imaging. We therefore developed event-driven acquisition (EDA), a framework that optimizes the use of the photon budget by adapting the imaging parameters to the dynamics of specific biological events of interest. On-the-fly image processing relays the current probability for an event to the microscope controller, which increases the imaging speed to capture dynamic events with high temporal resolution, or decreases it during low activity periods. We used EDA integrated into our iSIM microscope to show the advantages of both techniques at the example of studying mitochondrial division.

Our work is only one example of how microscopes and imaging techniques are becoming 'smarter'. Especially the study of rare and dynamic events, arguably the most interesting of them all, will benefit greatly from these approaches.

**Zeit:** Mittwoch, 17. November 2021, 10:15

**Ort:** Room A97, Sidlerstrasse 5, 3012 Bern