IBS Center for Molecular Spectroscopy and Dynamics

SEMINAR

■ SPEAKER

Dan Rodawig (Phi Optics, Inc.)

■ TITLE

Spatial Light Interference Microscopy (SLIM)

■ ABSTRACT

Spatial Light Interference Microscopy (SLIM) is a non-invasive phase imaging technology that quantifies the optical path length differences in a biospecimen and converts them into thickness, dry mass area density and refractive index maps. Figure a) illustrates the principle of the technology. A live cell in culture medium is imaged with the phase contrast modality of the microscope: the light passing through the object (scattered beam) and the light passing through the medium (reference beam) combine through interference in the image plane. The optical path length differences between the beams (i.e. the phase shift) in each point of the image plane are measured. The measured phase shift is proportional to the optical density at each point in space. In other words, optically denser areas of the cell (e.g. nucleus) introduce a larger phase shift.

The SLIM module relays the image plane with minimal aberrations (diffraction limited) at a 1:1 ratio to a camera sitting at its exit port. The active element at the heart of the SLIM module is a liquid crystal spatial light modulator (SLM). The SLM is conjugated with the back focal plane of the microscope objective, and it modulates the reference beam like a phase plate with variable thickness. To create a quantitative phase image the SLM works as a tunable phase ring and shifts the phase of the reference beam by a fixed amount (0, 0.5pi, pi, 1.5pi) and the camera captures the resulting frame (Figure b). The CellVista software module combines the four frames by solving the field interference equations in each point of the frame – the result (Figure c) is a quantitative-phase (SLIM) image that is uniquely determined.

SLIM is a wide field quantitative imaging method thus it can measure simultaneously large populations of cells at full camera resolution (e.g. 2 mm FOV for 10X objective at 4.2 MP camera resolution). Wide field optical sectioning (e.g. 850 nm Z-resolution for 100X/1.4NA objective) enables 3D tomography. All microscope output is acquired with the same camera which enables seamless overlay of SLIM images with fluorescence channels.

■ DATE AND VENUE

Sep. 30, 2016 (Friday, 11:00-12:00)
Seminar room 116, R&D Center