INT Symposium on "Advanced Photonic Imaging in Neuroscience"

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Martin Oheim (*1970) studied physics in Duisburg (B.Sci.), Cambridge (M.Sci.) and Göttingen (PhD). Following postdoctoral fellowships in Göttingen (Max Planck) and Paris (ESPCI), he was an assistant professor and junior group leader at the Ecole Supérieure de Physique et Chimie Industrielle (ESPCI) in Paris. Recruited as a CNRS staff researcher, he has been a PI since 2001 and CNRS director of research since 2009. The Oheim lab is interested understanding the interaction of neurons and astrocytes in the rodent brain, using a combination of electrophysiology, advanced imaging and pharmacogenetics as well as ontogenetic techniques. The lab combines expertise in instrument development, notably in super-resolution and 2-photon microscopy and biological and biophysical research at the synaptic and sub-cellular scale. Martin Oheim is the founding director of the all-new CNRS Saints-Pères Paris Institute for the Neurosciences.

S3-L1 '*On-Axis 2-Photon Virtual Light-Sheet Generation for 3-D Imaging*'

We will present a new scheme for planar 2-photon microscopy inspired by the Nipkov-Petran spinning disk microscope. With this microscope, we retained the inline geometry of the classical microscope, boosted its speed more than an order of magnitude and we provide a significantly better z-resolution than a light-sheet microscope. We completely rethought the geometry of the optical path to remove problems associated with non-linear excitation of the conventional Yokogawa dual-disk scanner. Instead, we use a single, patented disk that combines micro lenses, dichroic and pinholes all-in-one.

In my talk, I will present and characterize this novel 2-photon microscope for 3-D imaging of live tissue with diffraction-limited resolution. Its optical sectioning capabilities, large field-of-view, high speed and low photodamage are achieved by using spatially and temporally multiplexed 2P excitation to create a virtual light sheet. Fluorescence is near-confocally imaged through the same objective onto a fast sCMOS camera. The concept will be validated by imaging a number of test and biological samples, ranging from 3-D cultures, brain slices, to the intact mouse, in vivo.