



The Chinese University of Hong Kong



Department of Biomedical Engineering

Time: 1:30pm, 6 March 2023 (Monday)

Venue: Room 1122, William M. W. Mong Engineering Building

Electromotility: Fast Nanometer-scale Cellular Deformation as a Non-invasive Biomarker for Functional Neuroimaging



Professor Tong Ling

Nanyang Assistant Professor

School of Chemistry

Chemical Engineering and Biotechnology

Nanyang Technological University

Abstract

Functional neuroimaging is a powerful tool for neurodegenerative/neurological disease diagnosis, and it often relies on detecting macroscopic responses in electric fields or hemodynamics. In this talk, I will introduce a new aspect of functional imaging at the cellular scale by tracking the fast nanometer-scale neuronal deformation using high-speed interferometric imaging techniques. I will describe electromotility, the electromechanical coupling in the cell membrane, and how it can lead to an all-optical non-invasive electrophysiology. I will show how this new approach can be demonstrated in vitro to image propagating action potentials using a common-path interferometric microscope, and in vivo to map the light-induced electrical responses of photoreceptors using high-speed phase-resolved optical coherence tomography. These findings provide a new perspective for designing novel imaging tools for the study, diagnosis, and treatment-monitoring of human retinal diseases, and may lead to the next-generation all-optical brain-machine interface.

Biography

Dr. Tong Ling joined Nanyang Technological University in January 2021 and was subsequently awarded the Singapore NRF Fellowship (Class of 2022). Before that, he was a postdoctoral fellow in the Department of Ophthalmology and Hansen Experimental Physics Laboratory at Stanford University. He received his Ph.D. in 2016 and B.Eng. in 2011 from Zhejiang University. He develops interferometric imaging techniques for a wide range of applications across multiple fields, including biomedical imaging, optical metrology, and applied physics. He invented the randomly encoded hybrid grating for versatile quadriwave lateral shearing interferometry, which was nominated for 2015 China's Top 10 Optical Breakthroughs by the Chinese Journal of Lasers. He also received the Wang Daheng Optics Award by the Chinese Optical Society, the top award for young researchers in optics and photonics in China. Recently, his research in full-field interferometric imaging of action potentials demonstrated a new approach to functional neuroimaging using optical phase signals, opening the door to all-optical non-fluorescent techniques for functional imaging in the retina and the brain.

***** ALL ARE WELCOME *****

For enquiries, please contact Ms. Joyce Chan, Department of Biomedical Engineering at 3943 8278