McMaster University ENGINEERING

FALL 2017

ENGINEERING PHYSICS SEMINAR SERIES

Venue:
John Hodgins Engineering Building (JHE A102)
Wednesday, September 13th, from 1:30 - 2:20 PM

Department of Engineering Physics in the Faculty of Engineering at McMaster University, Canada.

Biqin Dong

Postdoctoral Fellow
at Northwestern University

WEDNESDAY 13 SEPTEMBER 2017

Probing Sound Waves with Light - From Nanophotonics to Biomedical Optical Imaging Applications:

The emerging field of nanophotonics offers promising potentials in controlling electromagnetic waves with nanometer-scale photonic structures. My research on advanced optical biomedical imaging focuses on translating novel nanophotonic concepts and discoveries into innovative optical imaging capabilities, aiming to offer unprecedented clarity and investigative power for biomedical research and clinical diagnostic. In this seminar, I will present our work centered on developing a nanophotonic ultrasonic sensor to overcome the main technical barriers for high-resolution functional photoacoustic microscopy (PAM). This miniaturized optical sensor consists of a polymeric micro-ring resonator (MRR) fabricated on an optically transparent substrate using a newly developed highly reproducible soft nanoimprinting lithography process. In comparison with traditional piezoelectric based ultrasonic detection, the MRR ultrasonic sensor offers many unique advantages, such as extremely high sensitivity (noise equivalent pressure < 10 Pa), ultra-broad bandwidth (> 300 MHz), and wider angular sensitivity (7o @ 200 MHz), by detecting and amplifying ultrasonic waves with its integrated light-sound interaction and underlying optical resonance. These unique properties enable high acoustic imaging resolution (< 2.2 µm) which sets the foundation for realizing three-dimensional (3D) isotropic resolution PAM and quantitative assessments of physiological properties in highly absorbing tissues. Finally, I will discuss the integration of MRR sensors with various imaging modalities for practical biomedical applications, including 1) simultaneous multi-contrast microscopy for ophthalmic research, 2) a compact all-optical probe for 3D photoacoustic endoscopy, and 3) disposable head-mounted imaging devices for long-term in vivo brain angiography on live animals.