THE UNIVERSITY OF HONG KONG

DEPARTMENT OF MECHANICAL ENGINEERING
AND
MEDICAL ENGINEERING PROGRAMME

SEMINAR

Title: **Surface Acoustic Wave Microfluidics: Novel Phenomena and Applications for Biotechnology**

Speaker: **Professor Leslie Yeo**
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RMIT University, Melbourne, Australia

Date: **18 August, 2015 (Tuesday)**

Time: **2:00 p.m.**

Venue: **Room C, Chow Yei Ching Building, HKU**

Abstract:
Surface acoustic waves are nanometer amplitude analogues of earthquakes that propagate along the substrate of a piezoelectric material. The transmission of acoustic energy into a liquid as a result of the intricate fluid-structural coupling from the substrate vibration gives rise to bulk fluid motion known as acoustic streaming. Our recent work attempts to uncover the multiscale facet of these flows and how the complex nonlinear hydrodynamics arising from such sound wave interactions give rise to novel wetting and colloidal phenomena. These include a recently discovered acoustowetting phenomenon that exhibits unique flow reversal, fingering instability and soliton-like wave pulse propagation, as well as rich and peculiar complex pattern formation dynamics in which colloidal islands assemble and evolve along the interface of a sessile drop due to the coupled action between the acoustic force and capillary wave vibration on the colloidal particles. Additionally, we show that the capillary wave dynamics induced by high frequency (>10 MHz) SAW excitation curiously exhibits a marked departure from the classical Faraday parametric excitation theory and offer insight into why such an anomaly might arise. Beyond merely elucidating the underlying fundamental mechanisms governing the complex physicochemical hydrodynamics associated with SAW microscale and nanoscale flows, we further demonstrate the powerful potential for exploiting these flows to drive a broad range of chip-scale functions for drug delivery, point-of-care

diagnostics, biosensing, biomaterials synthesis and tissue engineering. As an example, we show the possibility for inducing a rapid microcentrifugation effect for micromixing and bioparticle concentration/separation, as well as for rapidly spinning millimetre diameter discs on which an assortment of microarchitectures can be fabricated to carry out a variety of microfluidic operations—the so called *Lab-on-a-Disc*. In addition, we demonstrate the capability of the SAW for the generation of slender jets and aerosol droplets, and the encapsulation of drugs within, which can be exploited for drug and gene delivery, polyelectrolyte multilayer nanoparticle synthesis, and template-free polymer array patterning.

Brief Bio:
Leslie Yeo is currently an Australian Research Council Future Fellow and Professor of Chemical Engineering at RMIT University, Australia. He received his PhD from Imperial College London in 2002, for which he was awarded the Dudley Newitt prize for a computational/theoretical thesis of outstanding merit. Prior to joining RMIT University, he was a postdoctoral research associate in the Department of Chemical & Biomolecular Engineering at the University of Notre Dame, USA, after which he held a faculty position at Monash University. Dr Yeo was the recipient of the 2007 Young Tall Poppy Science Award from the Australian Institute for Policy & Science 'in recognition of the achievements of outstanding young researchers in the sciences including physical, biomedical, applied sciences, engineering and technology', and both the Dean and Vice-Chancellor's awards for excellence in early career research at Monash University. Dr Yeo is co-author of the book *Electrokinetically Driven Microfluidics & Nanofluidics* (Cambridge University Press), and the author of over 170 research publications and 20 patent applications. He is also the Editor of the American Institute of Physics journal Biomicrofluidics, editorial board member of *Interfacial Phenomena & Heat Transferand Scientific Reports*, and an Adjunct Senior Research Fellow in the Department of Physiology at Monash University.

ALL INTERESTED ARE WELCOME.

For further information, please contact Dr. A. Shum at 2859 7904.