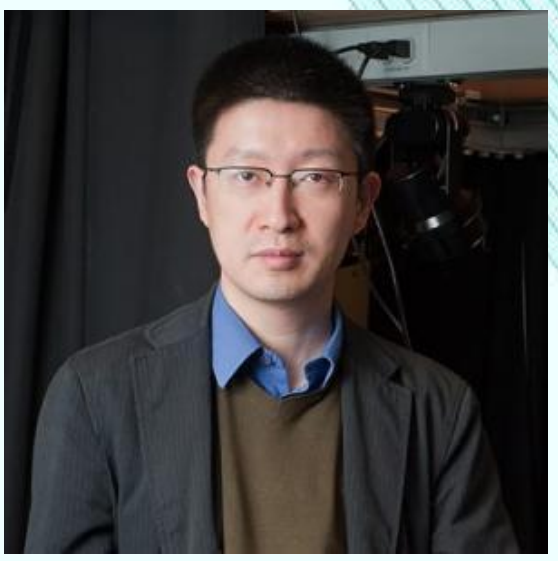
Physics Colloquium

Department of Physics
THE UNIVERSITY OF HONG KONG

Acoustic Metamaterials with Broadband Tunable Impedance Matching

Date: September 15, 2021 (Wednesday)
Time: 10:00 a.m.
Zoom Online Lecture:
https://bit.ly/2X87OXW
Meeting ID: 919 2987 9531
Password: 2859



Professor Nicholas Xuanlai Fang
Department of Mechanical Engineering,
Massachusetts Institute of Technology

Abstract:
Recent development of acoustic metamaterials opens a door to an unprecedented large design space for acoustic properties such as negative bulk modulus, negative density, and refractive index. Such novel concept paves the way for the design of a new class of acoustic materials and devices with great promise for diverse applications, such as broadband noise insulation, sub-wavelength imaging and acoustic cloak from sonar detection.
In this talk, I will present our research progress on advanced design and micro/nanofabrication techniques, to enable exploration and rapid prototyping of architectured metastructures for acoustic waves. These structures show promise on focusing and rerouting ultrasound through broadband metamaterials. As an example, we report a class of impedance transformers to overcome the fundamental limit of narrowband transmission. We experimentally show that the transformer device offers efficient implementation in broadband underwater ultrasound detection with the benefit of being soft and tunable. The broadband impedance matched nonreflecting acoustic metamaterial can also robustly prohibit reflection and reverberation of airborne sound waves over a wide range of incident angles. I will also discuss the acoustic labyrinthine metamaterials which can exhibit extreme constitutive parameters and an exceptional ability to control the phase of sound at deep-subwavelength scale.

Biography:
Nicholas X. Fang received his BS and MS in physics from Nanjing University, and his PhD in mechanical engineering from University of California Los Angeles. He is currently Professor of Mechanical Engineering. Prior to MIT, he worked as an assistant professor at the University of Illinois Urbana-Champaign until 2010. Professor Fang's areas of research look at nanophotonics and nanofabrication. His research on nanoarchitectured metamaterials was highlighted among the top 10 Emerging breakthrough technologies of the year 2015. His recognitions also include the OSA Fellow (2021); ASME Chao and Trigger Young Manufacturing Engineer Award (2013); the ICO prize from the International Commission of Optics (2011); the NSF CAREER Award (2009) and MIT Technology Review Magazine's 35 Young Innovators Award (2008).

Anyone interested is welcome to attend!

Phone: 28592360 Fax: 25599152