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State Key Laboratory of Terahertz and Millimeter Waves
香港城市大學 City University of Hong Kong

Seminar On

THz Metasurfaces for Optical Logic Gates, Reconfigurable Imaging, and High-Dimensional Photodetection

Professor Ming-Yao Xia
Peking University

Date : **3 September 2025 (Wednesday)**

Time : **4:00 pm – 5:00 pm**

Venue : **Room 15-202, 15/F, State Key Laboratory of Terahertz and Millimeter Waves, Lau Ming Wai Academic Building, City University of Hong Kong**

Abstract

Design and application of electromagnetic meta-surfaces have been a research frontier in the past two decades for performance improvements of antennas, stealth, detections, sensing, imaging, and communications, etc. Here I introduce some extended applications of THz functional meta-surfaces for optical computing, reconfigurable imaging, and simultaneous photodetection of multi-dimensional wave characteristics. After a brief introduction to the research background, three meta-surfaces will be reported. The first one is a linearly distributed nano-slit array. By encoding the polarization and frequency of a single wave as the input of a two bit's system, we can obtain the seven basic logic operation results, while previous works had to employ two waves. It can also be used as an encryptor for secure information transmission. The second one is an inversely-designed multilayer diffractive deep neural network, which can realize asymmetric transmission or imaging for potential applications in all-optical encryption and information storage. The last one is a spiral nano-slit array. By using this single-device, we can achieve full characterization of intensity-polarization-frequency 3-D continuous parametric space, so that light with arbitrarily mixed polarization states across a specified frequency scope can be detected with an acceptable error. This is implemented by projecting polarimetric and spectral responses into the Orbital Angular Momentum (OAM) domain via dispersion-driven OAM multiplication. This meta-surface can also be applied to secure information transmission using the OAM-mediated information encryption. At the end, some further researches along the current directions are discussed.

Biography

Ming-Yao Xia received the master's and Ph.D. degrees in electrical engineering from the Institute of Electronics, Chinese Academy of Sciences (IECAS), Beijing, China, in 1988 and 1999, respectively. From 1988 to 2002, he was an Engineer with IECAS. From October 1995 to October 1996, he was a Visiting Scholar at the University of Oxford, Oxford, U.K. From June 1999 to August 2000, he was a Senior Research Assistant with the City University of Hong Kong, where he was a Research Fellow in 2002. He joined Peking University, Beijing, as an Associate Professor in 2002, and was promoted to Full Professorship in 2004. In 2010, he moved to the University of Electronic Science and Technology of China, Chengdu, as a Changjiang Professor nominated by the Ministry of Education of China. In 2013, he returned to Peking University after completing the appointment. He received the Foundation for Outstanding Young Investigators presented from the National Natural Science Foundation of China in 2008. He served as an Associate Editor for the IEEE Transactions on Antennas and Propagation. His current research interests include computational electromagnetics and applications, electromagnetic detection and imaging, and magnetic anomaly detection techniques.

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

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