DEPARTMENT OF PHYSICS
THE UNIVERSITY OF HONG KONG

Physics Colloquium

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Optical Metasurfaces: Physics and Applications

May 28, 2025 (Wednesday)

3:30 p.m.

MWT4, 1/F, Meng Wah Complex, Main Campus, HKU

Prof. Patrice GENEVET

Colorado School of Mines

Abstract:

Metasurfaces are artificial optical interfaces designed to control the phase, the amplitude, and the polarization of an optical wavefront. They use physical mechanisms that rely on the coherent scattering of light by nano-scatterers of various shapes and material compositions. After introducing our recent fundamental works on the poles and zeros of scattering parameters to design metasurfaces [1], I will present several on-chip integrations of metasurfaces, including lasers, LiDAR and detector arrays, and discuss how these innovative functionalities push the frontiers of optoelectronic systems beyond conventional devices.

I will briefly review our work on the realization of directional light emission and collimation of VCSEL arrays and the spin-controlled laser emission [2]. I will then present new imaging capabilities provided by 3D LiDAR metasystem, emphasizing the unprecedented performances achieved, in terms of frame rate, field of view and the simultaneous acquisition of multiple fields of views [3].

Finally, i will present our results on 3D insect-inspired directional imaging devices. We show that mimicking the peripheral vision of insects using planar metalens arrays, we could measure simultaneously the light coming from several directions to reconstruct 3D images.

I will conclude this seminar by drawing perspectives on active metasurfaces, highlighting the opportunities that this technology still has to offer, both from fundamental and application points of view.

[1] Science, 373, 1133-1137 (2021); Laser & Photonics Reviews 2200976 (2023); Optica 10(10) 1287-1294 (2023); PRL in review (2025)
[2] Nat. Nanotechnol. 15, 125–130 (2020); Nat Commun 13, 7795 (2022); submitted(2025).
[3] Nat Commun 13, 5724 (2022); Advanced Photonics, 5, 046005 (2023), npj nanophotonics 1 (1), 18 (2024)

Biography:

Patrice Genevet is a Professor of Physics at the Colorado School of Mines. He received his Ph.D. degree at the université Côte d'Azur, France in 2009 on localized spatial solitons in semiconductor lasers and amplifiers. He did five years as a research fellow (2009-2014) in the Capasso group (SEAS, Harvard University) in collaboration with Prof. M.O. Scully (Texas A&M University) where he developed the concept of v-shaped plasmonics Metasurfaces. In 2014, he obtained the position of senior research scientist at ASTAR, Singapore. In 2015, He joined CNRS as 'Chargé de Recherche'. He is the recipient of several awards, including the ERC Starting Grant 2015, the 2017 Aimé-Cotton Price from the French Physical Society, the 2019 ERC proof of Concept, and the 2021 Fabry-De Gramont Price from the French Optical Society. Since 2018, he has been named annually among the Top 1% Highly Cited Researchers by Clarivate. P. Genevet research activities concern the development of optical metamaterials, passive and active metasurfaces, and their applications and integration in optoelectronic devices. He owns 8 patents, more than 125 publications, H factor of 57 and more than 30 000 citations(Google Scholar).

Anyone interested is welcome to attend.

Enquiries:
Tel: 2859 2360 Fax: 2559 9152 Email: physdept@hku.hk