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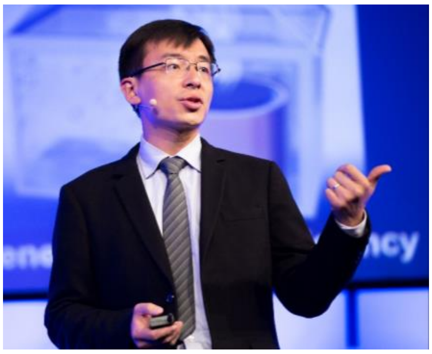
Manipulating the flow of light & heat at nanoscale (onsite and online)

Seminar organized by the Department of Mechanical Engineering



Date: 20 June, 2023 (Tuesday)
Time: 2:00 p.m. (Hong Kong Time)
Venue: Tam Wing Fan Innovation Wing Two
G/F, Run Run Shaw Building, HKU

Speaker: Professor Jia Zhu
College of Engineering and Applied Sciences
Nanjing University

Zoom Online Lecture: https://tinyurl.com/4388jkv4

Meeting ID: 999 1728 1377
Passcode: 302040

Abstract:

Light and heat are the two most common and widely used energy in society. Nanostructures with carefully tailored properties can be used to manipulate the flow of light and heat, to enable novel devices and functionalities in an unconventional manner. In this talk, I will present three examples.

The first example is passive cooling. Radiative cooling which sends heat to space through an atmospheric transparency window without any energy consumption, is attracting significant attention. For radiative cooling to achieve high cooling performance, it is ideal to have a selective emitter, with an emissivity dominant in the atmospheric transparency window. However, so far scalable production of radiative cooling materials with selective emissivity has not been realized. Here I will present a hierarchical design for a selective thermal emitter to achieve high performing all-day radiative cooling. Moreover, it is revealed that this hierarchically designed selective thermal emitter shows significant advantage if applied to alleviate Global Warming or to regulate temperature of the Earth-like planet.

The second example is interfacial solar evaporation. We report that efficient and broad-band plasmonic absorbers can be fabricated through a three-dimensional self-assembly process. Because of its efficient light absorption and strong field enhancement, it can enable very efficient (>90%) solar vapor generations. Inspired by the transpiration process in plants, we report an artificial transpiration device with a unique design of two-dimensional water path. The energy transfer efficiency of this artificial transpiration device is independent of water quantity and can be achieved without extra optical or thermal supporting systems, therefore significantly improving the scalability and feasibility of this technology. At the end, we would like to demonstrate that this type of interfacial solar vapor generation can have direct implications in various fields such as solar desalination, zero liquid discharge, sterilization, and power generation.

The third example is about alkali metal plasmonics. Plasmonics combining the advantages of the speed of light and the size of electron, has long been pursued as promising candidates for integrated photonics. However, the loss of plasmonic materials has long been the primary road blocker for its widespread implementations. Here I report the first experimental demonstration of alkali metal as high performing plasmonic materials. Because of low loss property, a room temperature sodium-based plasmonic nanolaser with a record low threshold is demonstrated. In addition, as alkali metal also possesses unique electrochemical properties, alkali metal plasmonics at the intersection of plasmonics and electrochemistry, open up tremendous opportunities for both information and energy storage.

Biography:

Prof. Zhu Jia is a professor at Nanjing University, fellow of Optica and fellow of Royal Society of Chemistry. His research focuses on manipulating light and heat at nanoscale. As a Highly Cited Researcher of Clarivate, he has published over 100 papers, with over 20,000 citations, on prestigious journals such as Nature, Nature Photonics, Nature Nanotechnology, Nature Sustainability, Nature Water, National Science Review, Joule, Advanced Materials. He also serves as the executive editor of Nanophotonics and the editorial board member of Advanced Photonics. Recent honors include: The Xplorer Prize, NSFC Young Investigator Award, OSA Young Investigator Award, Tan Kah Kee Young Scientist Award, MIT Technology Review Innovators Under 35.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Nicholas Fang at 3917 2639.