Light-matter interaction in micro/nanostructures: hybrid perovskite polaritons and giant luminescent downshifting meta-structure.

By
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Host: Dr Carole Diederichs

Abstract

Over the past few years, hybrid organic-inorganic perovskite has emerged as an outstanding class of material for photovoltaics and opto-electronics. In the first part of my presentation, I will provide a review of our recent research on perovskite polaritons - quasiparticles arising from the strong coupling regime of 2D perovskite exciton and photons in micro cavity at room temperature. The demonstration of both 2D and 0D perovskite polaritons will be highlighted. Finally, new approach to obtain perovskite polaritons with novel photonic crystal design will be presented. This promises a new platform for cavity polaritons based on emerging 2D materials such as hybrid perovskite and monolayers of transition metal dichalcogenides.

In the second part of the talk, I will present our work on emission enhancement of phosphor materials having low absorption cross-section, making use of nanophotonics concepts. In particular, I will present the demonstration of a luminescent downshifting meta-structure comprising a thin film of rare-earth doped layer beneath a passive transparent 2D photonic crystal. Thanks to the photonic crystal backbone, the conversion efficiency of integrated emission is enhanced by 77 times. Moreover, the emission is almost unidirectional and the enhancement factor corresponds to the principal emission direction is 697 times – a new record for rare-earth doped material. This giant enhancement is due to simultaneous improvements of absorption, extraction and emission mechanisms.

Short Biography

Dr Hai Son NGUYEN obtained his PhD at the Université Pierre-et-Marie-Curie (Paris VI) Pierre Aigrain Laboratory, Ecole Normale Supérieure de Paris in 2011 with a thesis entitled “Optical control of resonant emission of semiconductor single quantum dots”. He was supervised by Guillaume Cassabois and Carole Diederichs. He joined Ecole Centrale de Lyon, Institut des Nanotechnologies de Lyon (INL-CNRS, France) as Associate Professor Since September 2014. His main research topics are light-matter interaction in the context of quantum optics and photonics in nanostructures.