Light Harvesting: non-local and quantum tunnelling effects

By

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Host: Asst. Prof. Zhang Baile

Abstract

Metallic nanoparticles that support localized surface plasmon resonances can concentrate light into a deep-subwavelength volume, thereby achieving very large field enhancements. Many emerging nano-photonic technologies rely on the careful control of this field enhancement, including cancer therapy, improved photovoltaic devices, and optical antennas for enhanced light-matter interactions. However, at deep subwavelength scales, classical continuum electrodynamics fails to describe the optical responses of nanoparticles owing to nonlocal screening and the spill-out of electrons. Electron correlations that are driven by these effects require a new model of nonlocal transport, which is crucial in nanoscale optoelectronics. In this talk, I will present a systematic strategy, based on transformation optics, to study analytically the plasmonic interaction at subnanometer scales. Our approach incorporates radiative, nonlocal, and quantum tunnelling effects, and thus can be applied to design realistically sized plasmonic systems. As an example, I will use this method to elucidate the optimum shape of a nanoparticle that maximizes its absorption and field enhancement capabilities.

Biography

Dr. Luo Yu has received his BSc in Electronic & Information Engineering, from Zhejiang University in 2006, and his PhD in Physics, from Imperial College London in 2012. Since then he has been working as a Research associate at the Department of Physics, Imperial College London under Sir John Pendry, one of the pioneers of the field of Metamaterials. Since 2007, Luo Yu has published over 44 articles with a H-index of 17. His work on the full scattering model of invisibility cloaks and concentrators (Phys Rev B 77 125127) was listed under the top 100 most influential Chinese papers published in international journals for 2008. He is one of the co-inventors of the macroscopic visible ground cloak, which was selected as one of the top 10 breakthroughs in 2010 by IOP’s physics world. In 2012 he was won the prestigious Chinese government award for outstanding self-financed students abroad. His research interest includes applied topics such as novel antenna designs, non-linear active metamaterials, transformation media, in particular invisibility devices and surface plasmon manipulation in plasmonic. He also has interest in more academic topics such as transformation optics in computational EM, the study of non-local and tunneling effects in classical and quantum nano-plasmonics.