Transformation Optics and the control of light

By

Dr Luo Yu
Imperial College London

Date: Thursday, 16th May 2013
Time: 10am to 12pm
Venue: MAS Executive Classroom 1 (SPMS- MAS-03-06)
Host: Asst. Prof. Zhang Baile

Abstract

Transformation optics as a tool has generated much interest in recent years. It offers revolutionary ways to manipulate light (from radio frequencies to the visible) and also other forms of electromagnetic waves, such as the surface plasmons. Among the plethora of its applications, it is perhaps the demonstration of invisibility cloak that has sparked the greatest excitement. Other novel applications of Transformation optics, involves the direct manipulation of EM waves, and these include the flatten Luneburg lens, super-scatterers, field rotators, just to name a few. The application of Transformation optics in plasmonics has also generated new developments, such as surface plasmon guiding and focusing. The possibility of manipulating surface plasmons has open up more alternative means of information transfer beyond the traditional electron transport, promising much faster data transfer rates. The ability to focus surface plasmons can also vastly improve the sensitivities of chemical detectors and enhance the efficiencies of photovoltaic devices. Indeed, this new strategy of manipulating light has posed fascinating possibilities and challenges for experimentalists and theorists, driving forward new techniques and conceptual approaches to old problems. In this talk, I will talk about the progress in the study of transformation optics, and the resolution to the challenges of realizing these ideas. The focus of the talk would be on how to simplify the required material parameters while optimizing the performance of Transformation optics devices. Specifically, I will highlight a special sub-class of transformations, i.e. linear transformations, which enables devices to be more easily implemented using natural birefringent crystals or homogeneous grating structures. As examples, I will show how to design macroscopic invisibility cloak at optical frequencies, full-parameter omni-directional cloak, broadband SPP bending structures, and abrupt SPP focusing, using these linear transformations.

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.

College of Science
Nanyang Technological University
SPMS-04-01, 21 Nanyang link, Singapore 637371
Fax: +65 6515 8229 Tel: +65 6513 8459