The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

Winter College on Optics:

Advances in Nano-Optics and Plasmonics

(6-17 February 2012 - SMR2328)

LAMP Seminars
session II

ABSTRACTS

(Thursday, 9 February 2012)

Preference: oral

Modelling of near field effects for nanowaveguide applications

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Abstract

Plasmon resonance in near-field-coupled two-dimensional (2D) particle arrays is especially interesting due to the possibility to obtain high field enhancement over large areas. Special attention has been paid to metallic nanocylinders, [1,2,3,4] and very recently nanoshell cylinders [5,6,7] have gained particular interest. For the core-shell structures, the interaction between the surface charge distributions at the inner and outer surfaces of the core-shell structure result in the large variation of the plasmon resonance wavelength for the core-shell nanocylinder [1].The triangular system is intriguing due to the broken linear symmetry of the dimer and provides an intuitive means of exploring novel plasmonic properties.
We have investigated the near field optical responses of triangular system of nanoshell cylinder array interacting with incident electro-magnetic wave using finite diference time domain method (FDTD) and finite element method (FEM). The sensitivity of silver nanoshell cylinders to the refractive index of the environment and refractive index of the core was analyzed. The dependence on interparticle distance and size dependent surface plasmon resonance of nanoshell cylinders was also investigated. The efficient coupling between nanoshell cylinders makes it possible to design photonic-plasmonic routing devices, which are essential for incorporating low- loss silver nanocylinder waveguides as practical components into high-capacity photonic circuits.

Acknowledgement
The authors thank the Department of Science and Technology, Government of India for the financial support through a research grant (No. SR/S2/CMP- 0012/2009).

Preference: oral

Antenna-Integrated Terahertz Photodiodes For Optical Microwave-To-Terahertz Generation

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Abstract

Photonic techniques are used for microwave-to-terahertz generation due their superior characteristics in comparison to more conventional electronic techniques. In addition, the use of low-loss optical fibers enables to distribute the high-frequency RF signals over very long distances. Fiber-coupled photonic microwave-to-terahertz transmitter and receiver are thus key components for many applications, e.g. in the fields of wireless communications, radio-astronomy or spectroscopy. The presentation will also include a new concept of a small-scale integrated photonic THz transmitter employing a log-periodic-toothed antenna (LPT) integrated with a passive waveguide-coupled p-i-n photodiode.

Preference: oral

Multiparametric Surface Plasmons Resonance Imaging: Experiment and modeling

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Abstract

We present a new home made multiparametric surface plasmons resonance imaging instrument able to measure the reflectivity map depending bothon wavelength and angle,R(theta, lambda). We can also measure separately angular plasmons at fixed wavelength, spectral plasmon at fixed angle and, as in conventional systems, reflectivity variation (kinetic reaction) at fixed wavelength and angle. The polarization of incident light is computer controlled and switched between TE and TM. The temperature of the reaction cell is driven by heater module within a fraction of a degree.We used this instrument to measure multiple biomolecular interactions at the surface of dedicated biochips, getting extra spectral information.

We also fabricated nanostructure in form of ribbon grating on the surface, thus modifying the modes of surface plasmon propagation wave. In particular, to demonstrate the spectral capability of this instrument, we integrated a dielectric grating of 250 nm on the metallic surface. The experiment at angulo-spectral coupling showed the observation of plasmon bandgap.

We used also a RCWA program to simulate the reflectivity of the theoretical response of such 1D metallic or dielectric nanostructures integrated on the surface and correlated with the experimental data.

Preference: oral

FDTD analysis of photonic crystals with square and hexagonal symmetry

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Abstract

Photonic crystals offer the opportunity of building a wide class of efficient optoelectronic devices given their special property of forbidding the electromagnetic field propagation in all directions for a specific frequency range. We investigate the properties of two-dimensional photonic crystal devices and circuits using computer simulations. We used air as basic element ($\varepsilon 1=1$) and different designs to build periodic structures with square and hexagonal symmetry. These devices and circuits were studied for a testing incident radiation wave having 1.55 μm wavelength. As a first step, a square lattice having an area of 16x26 μm^2uwas built. The lattice constant was chosen to be 1 μm and the radius of all elements was fixed to r = 0.3a = 0.3μm. This structure leads to three photonic band gaps. The next step was to introduce several types of defects into the structure, altering its periodic character by removing a row and creating a coupled cavity in the photonic crystal. Also the case of a periodic hexagonal structure was considered. It was built with 15x21 μm22 area and the same radius for all the elements r = 0.3a = 0.3μm. We observed that the forbidden band increased in this case. Using a similar approach as in the square lattice case, we removed some of the cells and this generated a splitter (guide ramification). Their properties in guiding the radiation were highlighted.