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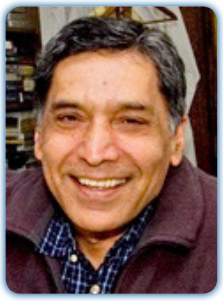

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Review of surface plasmon polaritons in metamaterial and quantum dots hybrid nanomaterials

We study surface plasmon polaritons in metamaterial waveguides which are made by sandwiching a metamaterial between two dielectric material layers. Recently there is considerable interest in the study of the physical properties of artificial materials such as metamaterials. Optical waveguides play an important role in many fundamental studies of optical physics at nanoscale. An ensemble of non-interacting quantum dots are doped at the waveguide interfaces. Surface plasmon polaritons are found at interfaces of metamaterial waveguides. The effect of surface plasmon polaritons on the absorption coefficient of quantum dots in metamaterial waveguides is studied. It is found that when the thickness of the waveguide is many times larger than the wavelength of the interaction light, we found a surface Plasmon polariton resonance energy. On the other hand, when the thickness of the waveguide is of the order of the wavelength of the interaction light; the surface plasmon polariton resonance energy splits into two energy state. Excitons of the quantum dot are interacting with surface plasmon polaritons of the waveguide, where metamaterial waveguide is acting as reservoir. It is observed that when the exciton resonance frequency lies near the surface plasmon polariton frequencies of the waveguide the absorption spectrum peak splits into peaks and a minimum. This is due to the strong coupling between excitons and surface plasmon polaritons. The minimum corresponds to the transparent state of the system. However, when the excitons energy do not lie near the surface plasmon polariton frequencies, the transparent state disappears due to weak coupling. The splitting of the peak can be controlled by applying an external laser field. The present study can be used to make new types of optical devices for sensing and imaging applications based on metamaterials.

Biography

Mahi R Singh received PhD (1976) degrees from Banaras Hindu University, Varanasi in Condensed Matter Physics. After that he was awarded an Alenxander von Humbold Fellow in Stuttgart University, Germany from 1979 to 1981. Currently he is Professor in this university. He was a visiting Professor at University of Houston and also worked as a Chief Researcher at CRL HITACHI, Tokyo and he was a visiting Professor and Royal Society Professor at University of Oxford, UK. He was the Director of the Centre of Chemical Physics and theoretical physics program at Western. He has worked on various fields of science and technology such as nanoscience, nanotechnology, nanophotonics, optoelectronics, semiconductor structures, high temperature superconductors, nanophotonics, plasmonics, polarotonics and nanoscience and technology.

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