Active Plasmonics

Anatoly V Zayats

Nano-optics and Near-field Spectroscopy Laboratory, Department of Physics,
King's College London, Strand, London WC2R 2LS, United Kingdom
http://www.nano-optics.org.uk, email: a.zayats@kcl.ac.uk

Abstract

We will discuss various plasmonic approaches for controlling photonic signals on sub-wavelength scales. Plasmonic crystals, plasmonic waveguiding components as well a new plasmonic platform based on metamaterials will be presented. Particular emphasis will be given to achieving active functionalities using various control stimuli such as electronic and magnetic fields and all-optically. Amplification of plasmonic signals and dispersion management will also be addressed. Active and tuneable plasmonic components are required for development of integrated photonic circuits, in high-density data storage as well as bio- and chemo-sensing lab-on-a-chip systems, to name a few.

Recent advances in nanofabrication and subwavelength optical characterisation have led to the development of a new area of nanophotonics concerned with routing and conditioning of optical signals in scalable and integratable devices. In this context, plasmonics which is dealing with surface electromagnetic excitations in metallic structures, provides a great deal of flexibility in photonic integration in all-optical circuits since with surface plasmons the problem of light manipulation can be reduced from three to two dimensions. Surface plasmon polaritons, the electromagnetic excitations coupled to collective motion of conduction electrons near a metal surface, are emerging as a new optical information carrier that enables signal manipulation and processing on the subwavelength scale. Plasmonic metamaterials play crucial role in the development of novel paradigms such as negative refractive index engineering, superlensing and optical cloaking.

A variety of passive plasmonic elements such as mirrors, lenses, waveguides, resonators, etc. have been demonstrated. The development of active plasmonic elements capable of controlling light on the nanoscale dimensions with external electronic or optical stimuli is on the agenda.

In this talk we will discuss various plasmonic approaches for controlling photonic signals on sub-wavelength scales with particular emphasis on the active functionalities such all-optical and electro-optical modulation and amplification of plasmonic signals and dispersion management. These functionalities facilitate possible applications of plasmonics in telecommunication networks, integrated photonics and lab-on-a-chip systems. Plasmonic crystals, plasmonic waveguiding components as well a new plasmonic platform based on metamaterials will be presented. Particular emphasis will be given to achieving active functionalities using various control stimuli such as electronic and magnetic fields and all-optically. Amplification of plasmonic signals and dispersion management will also be addressed. Active and tuneable plasmonic components are required for development of integrated photonic circuits, in high-density data storage as well as bio- and chemo-sensing lab-on-a-chip systems, to name a few.

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