Nirmalya Ghosh, J Laser Opt Photonics 2022, Volume 09

Spin Orbit interaction of light in plasmonic metamaterials

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Coupling and mutual influence of the spin, orbital angular momentum and linear momentum of light has led to the discovery of a number of fundamental photonic spin-orbit interaction (SOI) effects, which have opened up new paradigm of spin-orbit photonic devices. Experimental methods to controllably enhance and desirably tailor the SOI effects in nanostructured metamaterials and to gain new insights on the various intertwined SOI effects are highly sought after in this regard. We have recently studied SOI of light and observed a number of intricate and intriguing spin (polarization)-orbit optical effects in various processes involving light-matter interactions. Specifically, we have demonstrated controlled enhancement of SOI and the resulting spin Hall effect of light in plasmonic metamaterials exhibiting surface plasmon resonance, giant photonic spin Hall effect in spatially tailored inhomogeneous anisotropic medium, intriguing spin-selective scattering modes in a disordered anisotropic optical medium, demonstrated optimized weak measurements on photonic spin Hall effect, resonant enhancement of some of the rather illusive fundamental entities of light, namely, the helicity-independent transverse spin angular momentum and the polarization-dependent transverse momentum (the so-called Belinfante's spin momentum) in spatially tailored plasmonic nanostructures, and so forth [1-7]. We have also developed new spin-orbit photonic device concepts such as geometric phase polarimeter, weak value polarimeter, geometric phase gradient metasurface for control and manipulation of light at nanometer length scale [5,6]. This talk will cover some of the aforementioned recent work in the area on spin orbit interaction of light in spatially tailored plasmonic systems and other hybridized metamaterials. In this regard, this new field of spin orbit photonics will be introduced and fundamental issues related to different SOI effects originating from various light-matter interactions will be discussed. The practical implications of the observed effects and the prospect of development of spin-orbit nanophotonics meta-devices and their numerous potential applications will be highlighted.

Biography

Nirmalya Ghosh is a physicist with specialization in optical physics and photonics. He is currently a Professor in the Department of Physical Sciences and Centre of Excellence in Space sciences India (CESSI), IISER Kolkata, India. At IISER Kolkata, Ghosh developed and runs biooptics & Nano-photonics (bioNap), an optics and photonics research laboratory with a particular focus of research on spin polarization optics, nano-optics and biophotonics. He has received the G. G. Stokes Award in Optical Polarization 2021 given by SPIE. He is Fellow of Indian Academy of Sciences. He has authored over hundred papers in peer-reviewed international journals, which have received over four thousand citations with h-index of thirty-six. He has also written several invited reviews, book chapters and a text book in the area of optics and photonics.