Vortex beams: from photons to magnons

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ABSTRACT

Over recent years remarkable advances were made in the fabrication and control of spatially and temporally modulated beams of photons, electrons and neutrons [1] that were used for a variety of purposes ranging from particles trapping and charge and spin current generations to applications in quantum information. Of particular interest for us are vortex beam which carry orbital angular momentum with an amount related to the topological charge of the vortex. Such beams are routinely produced in a wide range of frequencies, intensities, and duration [1]. When traversing a sample, vortex beams can transfer their orbital angular momentum to charge, and for spin-orbit coupled systems also to spin [2,3]. This contribution presents how vortices interact with semiconductor nanostructures with Rashba spin orbit coupling generating, on an ultrafast time scale a unidirectional charge and spin turrents. Ultrafast non-linear photon-vortex-induced photogalvanic effects and spin Hall currents will be discussed. Further interesting aspects to be addressed in the talk are related to the interaction with magnons and the formation of topological magnon beams and their propagation properties.

References

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