HW

Han Woerdman

Lecture I: Optical Beam Shifts and OAM.

Consider a light ray hitting a planar interface, either dielectric or metallic; this ray is reflected according to the specular reflection law of geometrical optics. Of course, in wave optics a light ray does not exist; however it can be approximated by a pencil-type physical light beam, such as a laser beam. Notably, one has to pay a prize, when one tries to apply the laws of geometrical optics to such a pencil beam, in the sense that these laws have to be slightly modified by diffractive corrections. For instance, a reflected pencil beam may suffer a shift in the longitudinal and/or in the transverse direction, relative to the geometrical-optics prediction. The longitudinal shift goes by the name Goos/Hänchen and the transverse shift by the name Imbert/Fedorov. These shifts can vary from much smaller to much larger than a wavelength. Moreover, there are not only positional beam shifts, both longitudinal and transverse, but also angular ones. Some of the shifts are mutually exclusive but others can appear in a mixed fashion. Intimately related to these shifts are the Spin Hall Effect of Light and Orbital Hall Effect of Light, where the terminology is borrowed from a condensed-matter analogy. All these shifts generally depend on the polarization of the incoming beam, that is on the Spin Angular Momentum of the input photons. Recently it has become clear that the role of the Orbital Angular Momentum is as important as that of Spin Angular Momentum and this is where our emphasis will be.