Physics > Optics

Generalized shifts and weak values for polarization components of reflected light beams

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The simple reflection of a light beam of finite transverse extent from a homogenous interface gives rise to a surprisingly large number of subtle shifts and deflections which can be seen as diffractive corrections to the laws of geometrical optics [Goos-H\"anchen shifts] and manifestations of optical spin-orbit coupling [Imbert-Fedorov shifts], related to the spin Hall effect of light. We develop a unified linear algebra approach to dielectric reflection which allows for a simple calculation of all of these effects and lends itself to an interpretation of beam shifts as weak values in a classical analogue to a quantum weak measurement. We present a systematic study of the shifts for the whole beam and its polarization components, finding symmetries between input and output polarizations and predicting the existence of material independent shifts.

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