Interferometric Weak Value Polarimeter

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The weak value amplification concept, introduced by Aharonov, Albert, and Vaidman, has proven to be fundamentally important and extremely useful for numerous metrological applications. This quantum mechanical concept can be understood using the wave interference phenomena and can therefore be realized in classical optical settings also. We shall illustrate how the WVA concept can be formulated within the realm of the classical electromagnetic theory of light. In this regard, our recent experimental work on the realization of the weak value of polarization observable by introducing a weak coupling between the path degree of freedom of an interferometer and the polarization degree of freedom of light will be presented. Real and imaginary weak-value amplifications of different polarization anisotropy effects are manifested as characteristic changes in the relevant Stokes vector elements at the exit port of the interferometer, which follow orthogonal trajectories in the Poincaré sphere. The proof-of-concept experiment demonstrates that by using this scheme, one can faithfully extract and quantify an anisotropy parameter that is smaller than the typical sensitivity of measurement of a given Stokes parameter of a traditional polarimeter by a large weak-value amplification factor.