Interpreting and modeling backscattering polarimetric patterns recorded from multiply scattering systems

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Optical polarization measurements have a rich history spanning more than three centuries. Nowadays, Stokes-vector/Mueller-matrix polarimetry finds applications in a plethora of fields encompassing physical, chemical, planetary, and biological sciences. Extracting a system's physical features from polarimetric experiments constitutes a challenging task, especially in the presence of multiple scattering. This can be attributed to the difficulty in interpreting the polarimetric measurements. To understand the behavior of multiply scattering systems, we have developed: (i) a methodology that makes explicit the dependence of the polarimetric properties on the polarization state of the probing light beam; (ii) a forward analytical model based on the coherency matrix that generates backscattered polarimetric patterns. Our findings demonstrate that additionally to 'classical' polarimetric properties (diattenuation, retardance, and depolarization), the helicity flip induced by the systems should be included into the parametrization. In this talk, we will show with examples that this allows not only to reproduce the measurements, but also to discriminate between different materials. Identifying birefringent properties and structural anisotropy is made possible.

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