Characterization of birefringence with elliptic eigenmodes in a wave biplate composed of two quarter-wave plates

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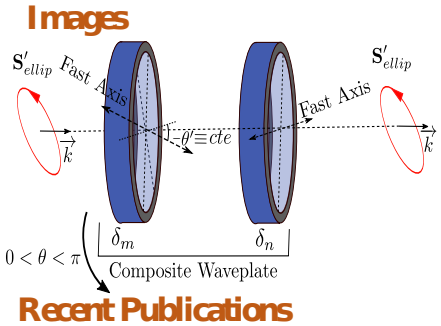
Abstract

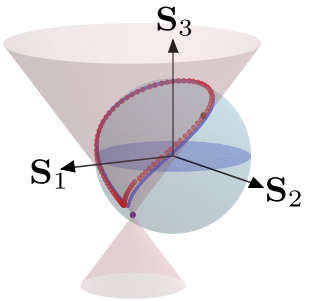
Characterizing the transformation of polarization states as it passes through materials offers the opportunity to control and manipulate the polarization of light. Allowing the development of various applications. Where, these properties that modulate the polarization present a characteristic behavior on the Poincaré sphere. As in the case of passing a polarized state in a birefringent medium, rotating said medium generates a characteristic curve, and it varies depending on the eigenmodes and the phase delay of the birefringent medium. Being the case of a birefringent with rotating linear eigenmodes previously geometrically characterized as the curve generated by the cut between a cone that intersects the Poincaré sphere, the angle of the cone being the birefringence of the material, this is the law of birefringents with linear eigenmodes [1].

On the other hand, when several birefringent wave plates (Composite Waveplate) with linear eigenmodes are superimposed, it varies their eigenmodes. These CWs have been characterized as birefringent with elliptic eigenmodes [2], however their characteristic behavior on the Poincaré sphere is unknown. Therefore, in this work, we presented a theoretical-experimental characterization of the state curve generated by passing a polarized beam through a rotating wave biplate generated by two QWPs.

Using this curve, the biplate was characterized as a variable elliptical birefringent with eigenmodes and modulating birefringence in terms of the difference angle between its fast axes. In addition, it was found that its curve can be described by a rotated vertex cone, due to the action of an additional rotary power, in this way the birefringence of different eigenmodes was characterized under the same geometric law , being their equations consistent with describing linear birefringence as a particular case of elliptic birefringence. Achieving a general geometric description of the birefringent media on the Poincaré sphere.

Images





Recent Publications

J. Pabón, K. Salazar, and R. Torres, “Characterization method of the effective phase retardation in linear birefringent thin sheets,” Appl. Opt.60, 4251–4258

Biography : Jhon Pabón

Physicist, focused on experimental physics in the field of Optics, with emphasis on the field of polarized light. Currently, I am a master's student in applied mathematics, interested in the study of polarization transformations caused by birefringent media, in the formalisms of geometric algebras; of quaternions and Pauli vectors. With knowledge of data science using Python.

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References:

[1] K. Salazar-Ariza and R. Torres, “Trajectories on the poincaré sphere of polarization states of a beam passing through a rotating linear retarder,” J. Opt. Soc. Am. A 35, 65–72 (2018).

[2] C.-J. Yu, “Fully variable elliptical phase retarder composed of two linear phase retarders,” Rev. Sci. Instruments 87, 035106 (2016).