Contribution ID : **44** Type : **Short communications**

Analytical determination and single-photon validation of QHQ wave-plate settings for prescribed polarization transformations

We present an analytical method for determining the quarter-half-quarter (QHQ) wave-plate settings required to implement a prescribed $\mathrm{U}(2)$ polarization transformation, up to a physically irrelevant global phase. The method addresses the inverse problem in which the desired operation is specified as a unitary matrix rather than by Euler angles or optical-element orientations. By explicitly removing the global phase, extracting the corresponding $\mathrm{SU}(2)$ component, and determining the Euler parameters directly from the matrix elements, the prescription provides an analytical mapping from a target polarization transformation to experimentally accessible QHQ angles, without numerical optimization or iterative solution of nonlinear equations. We validate the method using heralded single photons generated by spontaneous parametric down-conversion. Polarization state tomography and direct reconstruction of the implemented transformations show high output-state fidelities and transformation infidelities on the order of 10^{-3} for a representative set of polarization operations. We further demonstrate the implementation of prescribed polarization evolutions by reconstructing fixed-axis and varying-axis trajectories on the Poincaré sphere. These results establish the proposed analytical prescription as a practical tool for implementing matrix-defined polarization transformations in classical and quantum optical experiments.

Primary author(s) : Mr LARIOS GOETENDIA , Diego Alfredo (Pontificia Universidad Católica del Perú)

Co-author(s) : Mr OBREGÓN HILARIO, Wilber André (Pontificia Universidad Católica del Perú); Dr ORTIZ CABELLO, Omar Hernán (Universidad de Ingeniería y Tecnología)

Presenter(s) : Mr LARIOS GOETENDIA , Diego Alfredo (Pontificia Universidad Católica del Perú)

Session Classification : Física Aplicada y Computacional