Quantum Imaging of High-Dimensional Hilbert Spaces with Radon Transform

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High-dimensional Hilbert spaces possess large information encoding and transmission capabilities. Characterizing exactly the real potential of high-dimensional entangled systems is a cornerstone of tomography and quantum imaging. The accuracy of the measurement apparatus and devices used in quantum imaging is physically limited, which allows no further improvements to be made. To extend the possibilities, we introduce a post-processing method for quantum imaging that is based on the Radon transform and the projection-slice theorem. The proposed solution leads to an enhanced precision and a deeper parameterization of the information conveying capabilities of high-dimensional Hilbert spaces. We demonstrate the method for the analysis of high-dimensional position-momentum photonic entanglement. We show that the entropic separability bound in terms of standard deviations is violated considerably more strongly in comparison to the standard setting and current data processing. The results indicate that the possibilities of the quantum imaging of high-dimensional Hilbert spaces can be extended by applying appropriate calculations in the post-processing phase.