Title:	Experiments on quantum ghost imaging of transparent patterns.
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Abstract:	Single photon experiments are at the forefront for testing the foundations of quantum mechan- ics and implementation of quantum technologies. The eld of quantum optics is immensely powerful in the context of the counter-intuitive process of light and their immediate applica- tions for quantum technologies. One of the most striking discoveries of quantum mechanics is quantum entanglement wherein the non-classical correlations can exist between particles, even when separated by large distances. When two or more particles become quantum entangled, the quantum state of one particle instantaneously in uences the quantum state of the other(s), regardless of the physical separation between them. In addition, quantum information process- ing and quantum computation mainly rely on quantum entanglement. This thesis is focused on the foundational experiments on quantum ghost imaging carried out using hyper-entangled photons generated via the type-II spontaneous parametric down conversion process (SPDC) in Beta Barium Borate crystals. The primary objective of this thesis is the experimental study of quantum ghost imaging of polarization-sensitive phase patterns. The hyper-entangled photons possess Einstein-Podolsky-Rosen (EPR) and polarization entanglement in the form of a hyper- entangled state. Quantum ghost imaging experiments for the transparent objects have not been performed prior to this experiment. In the experiment, a single photon interacts with the pattern and it is detected by a stationary detector, while a non-interacting photon is imaged with a coin- cidence camera. The EPR entanglement manifests the spatial correlations between the pattern and the ghost image, whereas polarization entanglement detects a polarization-dependent phase shift exhibited by the pattern. A quantum ghost image is created by measuring correlations between the polarization-momentum measurements of the interacting photon and polarization- position measurements of the non-interacting photon. In experiment, the transparent patterns of a few millimeters extension are quantum mechanically imaged from a distance 19.16 m. The viviii experiment demonstrates the non-local behavior of a two-photon quantum entangled system.
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