Compressed Sensing of Twisted Photons

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In past years, we witnessed the emerging phenomena of quantum technologies for quantum computing, quantum algorithms, quantum key distribution, etc. The orbital angular momentum (OAM) states of a single photon are recognized as a preeminent platform for such applications. Although the generation of photons with OAM is relatively simple, the full characterization of a quantum state in the OAM Hilbert space still stands as a challenging task. Even though there exist methods based on projective measurements, they work well only in determining pure OAM states. The case of a mixed state requires full state tomography and so projections on arbitrary superpositions of two or more OAM eigenstates, which is still challenging. Our approach [1] incorporates the idea of compressed sensing, originally introduced in the context of quantum state tomography in work [2] applied on a convenient measurement consisting of a few scans with intensified CCD camera Figure . In other words, one can use a very simple setup for characterization of a quantum state, which is robust to noise and informationally complete among low-rank quantum states.

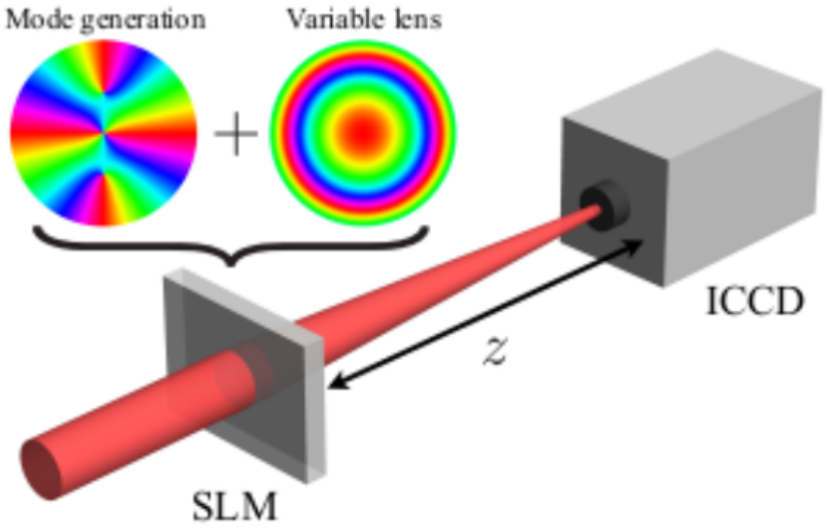

Figure 1: Schematic of the experiment. The photonic state preparation and measurement are performed using an SLM and ICCD camera. The ICCD camera has a fixed position and records intensity scans. Inset shows the state and lens phase patterns, $[0, 2\pi)$, in a hue color.

References

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