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Unmasking phase with ghost imaging

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In ghost imaging, an object can be imaged by interrogating a photon that has not interacted with it. One of the entangled photons in a pair interacts with the object while the spatial distribution of the second photon is measured. Due to the correlations, the spatial properties of the non-interacting photon carries information about the object despite never having contact with it. An image of the object is then built up by repeatedly measuring the non-interacting photon spatial state. This has led to many advantages such as low-intensity imaging of photosensitive samples, dual-wavelength illumination and detection and improved resolution.

Traditionally, ghost imaging was used to obtain the object intensity only. This, however, excludes useful phase information which is important for objects such as biological samples. To obtain this, many methods have been proposed and demonstrated with majority relying on interference to induce changes in the spatial amplitude or observing generated diffraction patterns. Here we present phase reconstruction imaging that side-steps the need for alignment sensitive and complex setups; this, by instead exploiting correlations already isolated in many reconstruction algorithms and used in vanilla ghost imaging setups. We do so by using only two projective measurements with conventionally used spatial interrogation masks such as Hadamard or random masks. Accordingly, we show accurate phase reconstruction for complex phase-only objects. It follows that no changes to the vanilla ghost imaging setup is needed, but rather only an additional projective measurement for each spatial mask being used to build up the image.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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