Quantum Induced Coherence Light Detection and Ranging

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Quantum illumination has been proposed and demonstrated to improve the signal-to-noise ratio (SNR) in light detection and ranging (LiDAR). When relying on coincidence detection, such a quantum LiDAR is limited by the response time of the detector and suffers from jamming noise. Inspired by the Zou-Wang-Mandel experiment, we design, construct and validate a quantum induced coherence (QuIC) LiDAR which is inherently immune to ambient and jamming noises. In traditional LiDAR the direct detection of the reflected probe photons suffers from deteriorating SNR for increasing background noise. In QuIC LiDAR we circumvent this obstacle by only detecting the entangled reference photons, whose single-photon interference fringes are used to obtain the distance of the object, while the reflected probe photons are used to erase path information of the reference photons. In consequence, the noise accompanying the reflected probe light has no effect on the detected signal. We demonstrate such noise resilience with both LED and laser light to mimic the background noise and jamming attack. The proposed method paves a new way of battling noise in precise quantum electromagnetic sensing and ranging.

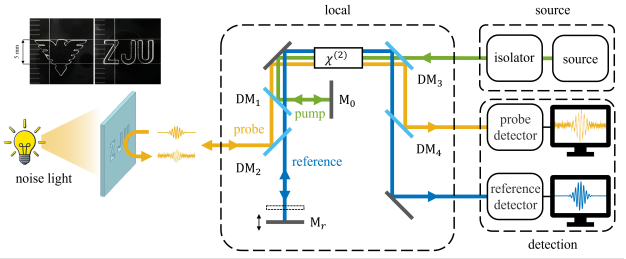

Figure 1: Experimental setup for QuIC LiDAR