Distributed Quantum Sensing with Squeezed-Vacuum Light in a Configurable Network of Mach-Zehnder Interferometers

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Mach-Zehnder interferometry using squeezed-vacuum light is an archetype of quantum-enhanced single-phase sensing. Here we propose and study a direct generalization for the estimation of an arbitrary number of phase shifts in $d \geq 1$ distributed Mach-Zehnder interferometers (MZIs). In this case, the squeezed-vacuum is split between the d modes of a linear (splitting) network, each output of the network being one sensing mode of a MZI, the other input being a coherent state. We predict *i*) the linear combination of phase shifts that can be estimated with optimal sensitivity, given a specific splitting network; and *ii*) the splitting network that allows the estimation of a specific linear combination of phase shifts with optimal sensitivity. Sub-shot-noise sensitivity up to the Heisenberg limit is discussed, the multiphase estimation only requiring local photocounting. We show that the distributed entangled state provides a better scaling of precision with respect to separable strategies.