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Scalable Heisenberg limited metrology using mixed states GENG CHEN, University of Science and Technology of China, YARON KEDEM, stockholm university — Improving the precision of measurements is a prime challenge of the scientific community. Quantum metrology provides methods to overcome the standard quantum limit (SQL) of $1/\sqrt{N}$ and to reach the fundamental Heisenberg limit (HL), $1/N$. While a lot of theoretical and experimental work has been dedicated to this task, most of the attempts focused on utilizing NOON and squeezed states, which exhibit unique quantum correlations. However, it was not yet experimentally demonstrated that schemes using these states are scalable. Here we present, and experimentally implement, a new scheme for precision measurements that enables reaching the HL. Our scheme is based on a probe with a large uncertainty, combined with a postselection, such that the Fisher information is maximized, and the Carmer-Rao bound is saturated. We performed a Heisenberg limited measurement of the Kerr non-linearity at the single photon level, and report on an unprecedented precision $\simeq 10^{-9}$ of a Kerr phase.

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