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Quantum Interferometry at the Heisenberg Limit LUCA PEZZE', AUGUSTO SMERZI, BEC-CNR-INFM and Dipartimento di Fisica, Universita' di Trento, I-38050 Povo, Italy — Entanglement can increase the precision of an interferometric phase measurement from the standard quantum limit up to the Heisenberg limit, which is the ultimate bound imposed by Quantum Mechanics. The quest requires two key ingredients: maximal quantum correlations engineered among the particles employed in the measurement process and a tailored phase estimation strategy. Here we present a rigorous Bayesian protocol for -unbiased- estimation of phases with confidences at the Heisenberg limit which overcomes basic difficulties present in previous approaches. We also demonstrate phase sensitivity beating the classical shot-noise limit with published experimental probabilities for Schroedinger cats up to N=6 beryllium ions. We report 0.8 db sub shot-noise implemented with an arbitrary large number of particles and maximum priori ignorance. Possible implementation of the protocol with trapped Bose-Einstein condensates will also be discussed.

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