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Achieving Heisenberg scaling with maximally entangled states: an analytic upper bound for the attainable root mean square error

Wednesday, 30 September 2020 14:00 (15 minutes)

In this talk we explore the possibility of performing Heisenberg limited quantum metrology of a phase, without any prior, by employing only maximally entangled states. Starting from the estimator introduced by Higgins et al. in New J. Phys. 11, 073023 (2009), the main result discussed in the talk is an analytical upper bound on the associated Mean Squared Error which is monotonically decreasing as a function of the square of the number of quantum probes used in the process. The analyzed protocol is non-adaptive and requires in principle (for distinguishable probes) only separable measurements. From the practical point of view, at difference with the previous works, where it was required the states sizes to grow as the powers of two, we are often able to extract Heisenberg Scaling from an arbitrary sequence of entangled states sizes, possibly realizable in a laboratory. We also explore how the strategy changes in presence of probe loss or fluctuations of the phase.

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