

SEMINAR: A necessary and sufficient condition for super additivity of the Fisher information in fully Gaussian quantum metrology

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Seminar Room

Famously, the quantum Fisher information--the maximum Fisher information over all physical measurements--is additive for independent copies of a system and the optimal measurement acts locally. We are left to wonder: does the same hold when the set of accessible measurements is constrained? Such constraints are necessary to account for realistic experimental restrictions. Here, we consider a fully Gaussian scenario focusing on only Gaussian measurements. We prove that the optimal Gaussian measurement protocol remains local, if the information is encoded in either the displacement or the covariance matrix. However, when the information is imprinted on both, this no longer holds true: we provide with a necessary and sufficient condition for super additivity of the Gaussian Fisher information, and when the condition is met we construct a simple global Gaussian measurement where the Fisher information becomes super additive. These results can improve parameter estimation tasks via feasible tools. Namely, in quantum optical platforms our proposed global operation requires only passive global operations and single mode Gaussian measurements. We demonstrate this in two examples where we estimate squeezing and losses. While in the former case there is a significant gap between the Fisher information of the optimal Gaussian measurement and the quantum Fisher information for a single copy, this gap can be reduced with joint Gaussian measurements and closed in the asymptotic limit of many copies.

Hosted by: Prof. Dr. Antonio Acin