Quantifying Quantum Metrology: Noiseless Amplification, Precision Bounds For Open Systems, and Ghost Quantum Sensing

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Quantum metrology is one of the basic pillars of quantum information, together with quantum computation, quantum simulation, and quantum communication. It concerns the estimation of parameters, for which lower bounds to the precision of estimation are derived through a rigorous theoretical framework, established by Cramér, Rao, and Fisher for classical systems and generalized to quantum physics by Helstrom and Holevo. This framework yields simple expressions for the precision when dealing with parameter-dependent unitary evolutions in closed systems. Open systems, on the other hand, require more sophisticated techniques [1-4]. This talk reviews recent results on closed and open systems: the analysis of an experiment on noiseless quantum amplification of mechanical oscillator motion [5,6], and the demonstration that, for open systems, a procedure analogous to quantum ghost imaging may increase the precision of estimation.

References

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