Adaptive Quantum Metrology under General Markovian Noise

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Abstract

In many branches of quantum information theory we assume some amount of resources and aim to use them most efficiently. In Quantum Metrology these are time and the number of particles. The fact that prevents arbitrarily precise estimation is the Heisenberg uncertainty principle. Our main goal is to find bounds on precision with the same fundamental origin but fine-grained to particular physical situations. The theoretical tool we use to evaluate the precision of estimation is Quantum Fisher Information.

We formalise the problem of estimation by defining a model that captures all essential parts of metrolgical experiments. In this general model the channel includes adaptive control and the time of interaction with the Hamiltonian and decoherence is the full time of the experiment $T$.

Applications

Quantum Metrology with Many-Body Interactions

Operating in the limit of short times allows us to analyze in more detail channels consisting of gates acting on small number of particles. We call the number of particles the Hamiltonian acts on the degree of the Hamiltonian. Similarly with the decoherence gates. Up till now several simple cases of non-linear schemes were considered but not as general as here [6].

References


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