

## Optimal control strategies for parameter estimation of quantum systems

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Optimal control theory is an effective tool to improve parameter estimation of quantum systems. Different methods can be employed for the design of the control protocol. They can be based either on Quantum Fisher Information (QFI) maximization or selective control processes. In this talk, I propose to introduce some basic notions concerning these optimization schemes, to describe their similarities, their differences, and their respective advantages. The discussion will be illustrated with the estimation of the parameters of a spin- $1/2$  system coupled to a bosonic bath. Mathematical and numerical investigations show that the control mechanisms are generally equivalent, except when the decoherence is not negligible or when the experimental setup is not adapted to the QFI. In this latter case, the precision achieved with selective controls can be several orders of magnitude better than that given by the QFI. This presentation is based on [1].

- [1] Q. Ansel, E. Dionis, D. Sugny. *Optimal control strategies for parameter estimation of quantum systems*. SciPost Phys., **16**, 013, 2024. doi :10.21468/SciPostPhys.16.1.013.

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