Estimating many properties of a quantum state via quantum reservoir processing

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Abstract

Estimating properties of a quantum state is an indispensable task in various applications of quantum information processing. To predict properties in the postprocessing stage, it is inherent to first perceive the quantum state with a measurement protocol and store the information acquired. In this seminar, I will talk about a general framework that we proposed for constructing classical approximations of arbitrary quantum states with quantum reservoirs. A key advantage of our method is that only a single local measurement setting is required for estimating arbitrary properties, while most of the previous methods need an exponentially increasing number of measurement settings. To estimate M properties simultaneously, the size of the classical approximation scales as lnM. Moreover, this estimation scheme is extendable to higher-dimensional systems and hybrid systems with nonidentical local dimensions, which makes it exceptionally generic.

Bibliography

[1] Y. Li, S. Ghosh, JS, Q. Xiong, and X. Zhang, Phys. Rev. Research **6**, 013211 (2024).