Fast Quantum State Tomography in the Nitrogen Vacancy Center of Diamond

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Quantum state tomography (QST) is the procedure for reconstructing
unknown quantum states from a series of measurements of different
observables. Depending on the physical system, different sets of observables have been used for this procedure. In the case of spin-qubits, the most common procedure is to measure the transverse magnetization of the system as a function of time. Here, we present a different scheme that relies on time-independent observables and therefore does not require measurements at different evolution times, thereby greatly reducing the overall measurement time. To recover the full density matrix, we use a set of unitary operations that transform the density operator elements into the directly measurable observable. We demonstrate the performance of this scheme in the electron-nuclear spin system of the nitrogen vacancy center in diamond [1].

References

[1] [1]Jingfu Zhang, Swathi S. Hegde and Dieter Suter, PHYSICAL REVIEW LETTERS 130, 090801 (2023).