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Quantum state reconstruction on a quantum computer

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Quantum state tomography is an essential technique for characterizing quantum systems. It involves performing projective measurements and computationally reconstructing the density matrix from the measurement data by solving a system of linear equations. The discovery of the HHL algorithm has sparked significant interest in leveraging quantum computers to solve these equations, promising a quantum advantage. However, current quantum computers are limited by noise and constrained qubit counts—which restricts effective error correction—rendering the HHL algorithm impractical in the near term. In this work, we propose a hybrid classical-quantum approach using variational quantum eigensolvers (VQEs) for efficient state reconstruction.

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