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Time-dependent Hamiltonian reconstruction using continuous weak measurements

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Reconstructing the Hamiltonian of a quantum system is an essential task for characterizing and certifying quantum processors and simulators. Existing techniques either rely on projective measurements of the system before and after coherent time evolution and do not explicitly reconstruct the full time-dependent Hamiltonian or interrupt evolution for tomography. In this talk, I will introduce continuous weak measurements on quantum systems, coupled dispersively to microwave cavity and read using phase preserving or phase sensitive amplifiers. I will then describe an algorithm which recovers the Hamiltonian and density matrix from an incomplete set of continuous measurements, and demonstrate that it reliably extracts amplitudes of a variety of single-qubit and entangling two-qubit Hamiltonians. It will be further demonstrated how this technique reveals deviations from a theoretical control Hamiltonian, which would otherwise be missed by conventional techniques. Additionally, in contrast to previous work, this technique does not require interruptions, which would distort the recovered Hamiltonian.

Title

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