



HARVARD UNIVERSITY
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Mathematical Picture Language Seminar



Wednesday, June 3

3:00 p.m. Boston time

Jefferson 368

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Quantum Advantage in Resource Estimation

Abstract: When will quantum computers be useful? Resource estimation - the process of determining how many qubits and operations are needed to run an algorithm - is central to answering this question. Quantum algorithms frequently rely on operations that must be approximated using quantum circuits, such as the time evolution generated by a Hamiltonian. Compiling algorithms into logical qubit and gate requirements necessitates accurately bounding these simulation errors; tighter bounds directly yield more efficient constructions. Numerical resource estimates are typically produced using classical algorithms that conservatively upper-bound simulation errors, leading to suboptimal resource estimates. In this talk, I will argue that accurate resource estimates can be produced using quantum algorithms that require few quantum resources. I will detail a specific protocol to efficiently compute the Trotter error, and show how this significantly reduces resource estimates for Trotter-based Quantum Phase Estimation. We will conclude by exploring how resource estimation serves as a useful, near-term application for quantum devices.

This talk will be posted two days after the seminar at
<https://mathpicture.fas.harvard.edu/seminar> and
<https://www.youtube.com/@mathematicalpicturelanguag2715/videos>