Analyzing the Effect of Mid-Circuit Measurement (MCM) on Spectator Qubits

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Mid-Circuit Measurements (MCMs) are a key component in many quantum information algorithms. As such, ways to characterize their performance are of great interest. Specifically, it is important to determine what impact MCM has on nearby, unmeasured, spectator qubits. Here, I present a novel benchmarking method consisting of a variation of the Interleaved Randomized Benchmarking Technique. I then use this method to evaluate MCM-induced spectator qubit error on various qubits inside IBM's quantum computer "ibm_nairobi". I then examine the effect of qubit position on this error, test if IBM's widely-used quantum simulators account for this error, and analyze potential causes of this error. This project has far reaching implications as it sheds light on a never before seen type of quantum error and discovers a major deficiency in current quantum simulators.

Awards Won:

Lawrence Technological University: STEM Scholar Award, a tuition scholarship of $19,650 per year, renewable for up to four years and applicable to any major

First Award of $5,000

National Security Agency Research Directorate : Third Place Award "Principles of Security and Privacy"