革新的な量子情報処理技術基盤の創出
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実績報告書

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Numerical Methods for Studying Real-World Quantum Devices

§1. 研究成果の概要

During the 2019 fiscal year I began my investigation into the effect of noise in quantum information processing. Noise and imperfection in experimental devices is a fundamental obstacle in the development of practical quantum information processing. I explored how we can combat the effect of certain types of noise using a process called quantum error correction. In particular, I looked at how error correction can be adapted to protect against noise that is *biased*, meaning that certain types of errors happen much more frequently than others. For instance, this happens often in superconducting qubit architectures, where phase-damping errors occur much more frequently than energy relaxation errors.

I published a paper with colleagues in Australia and the USA showing how very simple changes to the error correction procedure can drastically improve the protection provided by quantum error correction when the noise is biased. I have also started looking at how certain experimental architectures can be adapted to make use of this large performance improvement. Finally, I have also started work looking more generally at how noise characterization can be used to improve the performance of error correcting schemes.