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Quantum Compressed Sensing Using 2-Designs YI-KAI LIU, NIST, SHELBY KIMMEL, University of Maryland — We develop a method for quantum process tomography that combines the efficiency of compressed sensing with the robustness of randomized benchmarking. Our method is robust to state preparation and measurement errors, and it achieves a quadratic speedup over conventional tomography when the unknown process is a generic unitary evolution. Our method is based on PhaseLift, a convex programming technique for phase retrieval. We show that this method achieves approximate recovery of almost all signals, using measurements sampled from spherical or unitary 2-designs. This is the first positive result on PhaseLift using 2-designs. We also show that exact recovery of all signals is possible using measurements sampled from unitary 4-designs. Previous positive results for PhaseLift required spherical 4-designs, while PhaseLift was known to fail in certain cases when using spherical 2-designs.

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