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Quantum Nonlocal Boxes Exhibit Stronger Distillability JIBRAN RASHID, PETER HOYER, University of Calgary — Given the apparent limited distillability of nonlocal boxes (NLBs), we initiate a study of the distillation of correlations for NLBs that output quantum states rather than classical bits. We propose a new non-adaptive protocol for nonlocality distillation which asymptotically distills correlated quantum nonlocal boxes to the value 3.098, whereas in contrast, the optimal non-adaptive parity protocol for classical NLBs asymptotically distills to the value 3.0. The protocol is also proven to be an optimal non-adaptive protocol for 1, 2 and 3 copies by formulating nonlocality distillation as a semi-definite programming optimization problem. Even if we restrict out attention to non-adaptive protocols, qNLBs offer improved distillation over NLBs. A generalization of our SDP approach that allows for adaptive protocols may reveal a similar improvement in general. This may imply distillability for nonlocal correlations that are currently not known to be distillable. As a consequence of the work on nonlocality distillation we provide numerical evidence that correlations with non-trivial marginals which are not known to satisfy the macroscopic locality principle may be distillable even when corresponding correlations with trivial marginals are not.

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