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Violating the Modified Helstrom Bound with Nonprojective Measurements ALEXANDER N. KOROTKOV, JUSTIN DRESSEL, University of California, Riverside, TODD A. BRUN, University of Southern California — For the task of discriminating two pure states of a qubit, we provide a rigorous bound for how much projective measurements can minimize a general cost that penalizes both incorrect and declined guesses. This cost bound interpolates between the two-outcome projective strategy of the usual Helstrom bound and the three-outcome unambiguous discrimination strategy. Nonprojective measurements can violate this cost bound to show a clear cost improvement over projective measurements. In the presence of realistic experimental noise, the cost advantage of unambiguous state discrimination is completely destroyed; however, other cost bound violations are more robust, and thus could be experimentally tested with modern superconducting qubit implementations.

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