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Optimizing Quantum Subchannel Discrimination: One-Way Communication and Device-Independent Security

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Steerable states provide a quantum advantage in subchannel discrimination tasks. In this work, we experimentally demonstrate a discrimination task with high-dimensional entanglement and show how local filtering operations can enhance its success probability. By distilling the steerable states, we boost the discrimination probability close to 100%. Our work also confirm the generality of this approach, which is valid across any dimension with appropriately chosen filters. This study establishes subchannel discrimination as a practical application of partially untrusted devices, deepening our understanding of their operational significance.

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