**Quantum computational advantage with string order parameters of 1D symmetry-protected topological order**[1] AUSTIN DANIEL, AKIMASA MIYAKE, University of New Mexico — Nonlocal games with advantageous quantum strategies give arguably the most fundamental demonstration of the power of quantum resources over their classical counterparts. Recently, certain multiplayer generalizations of nonlocal games have been used to prove unconditional separations between small computational complexity classes of shallow-depth circuits. Here, we show advantageous strategies for these nonlocal games for generic ground states of one-dimensional symmetry-protected topological orders (SPTO), when a discrete invariant of SPTO known as a twist phase is nontrivial and -1. Our construction demonstrates that sufficiently large string order parameters of such SPTO are indicative of globally constrained correlations useful for the unconditional computational separation.

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