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Finite amount of entanglement can be insufficient for a small size quantum game

We define the notion of coherent state exchange and provide a solution for any number of parties. We obtain the following applications: (1) The set of entanglement-assisted local operations is shown not to be a closed set. (2) There exists a game in which two provers who cannot communicate with one another cannot implement an optimal winning strategy with finite amount of shared entanglement. The game consists of only one quantum message of low dimension from a referee to each of the provers and vice versa. Consequently, there is no general bound in the entanglement required in quantum multi-party interactive proof system. (3) A simple proof that any multi-prover quantum interactive proof system can be efficiently transformed to have near-perfect completeness. Joint work with Ben Toner and John Watrous.