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Rigidity for Monogamy-of-Entanglement Games

In a monogamy-of-entanglement (MoE) game, two players who do not communicate try to simultaneously guess a referee's measurement outcome on a shared quantum state they prepared. We study the prototypical example of a game where the referee measures in either the computational or Hadamard basis and informs the players of her choice.

We show that this game satisfies a rigidity property similar to what is known for some nonlocal games. That is, in order to win optimally, the players' strategy must be of a specific form, namely a convex combination of four unentangled optimal strategies generated by the Breidbart state. To show this, we appeal to a positivity argument via a sum-of-squares decomposition satisfied by the game polynomial. We extend this result to show that strategies that win near-optimally must also be near an optimal state of this form. We also show rigidity for multiple copies of the game played in parallel.

As an application, we show that this can be used to achieve bit commitment in a model where it is impossible classically.