1139-68-301 **Anand Natarajan*** (anandn@mit.edu) and **Thomas Vidick** (vidick@cms.caltech.edu).

Low-degree testing for quantum states.

For any integer $n \geq 2$ we construct a one-round two-player game G_n, with communication that scales poly-logarithmically with n, having the following properties. First, there exists an entangled strategy that wins with probability 1 and in which the players perform generalized Pauli measurements on their respective share of an n-qudit maximally entangled state, with local dimension $q = \operatorname{poly}\log(n)$. Second, any strategy that succeeds with probability at least $1-\varepsilon$ must be within distance $O((\log n)^c \varepsilon^{1/d})$, for universal constants $c, d \geq 1$, of the perfect strategy, up to local isometries. This is an exponential improvement on the size of any previously known game certifying $\Omega(n)$ qudits of entanglement with comparable robustness guarantees. The construction of the game G_n is based on the classical test for low-degree polynomials of Raz and Safra, which we extend to the quantum regime. We further obtain several consequences for complexity theory, most notably that it is QMA-hard, under randomized reductions, to approximate up to a constant factor the maximum acceptance probability of a multiround, multiplayer entangled game with $\operatorname{poly}\log(n)$ bits of classical communication. (Received February 14, 2018)