Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Measuring Entanglement via SICs and 2-designs[1] MATTHEW GRAYDON, University of Waterloo, Perimeter Institute for Theoretical Physics, Institute for Quantum Computing, MARCUS APPLEBY, Perimeter Institute for Theoretical Physics — We consider measuring entanglement via the classical quadratic Rényi entropy of joint probability distributions over the measurement outcomes associated with tensor products of elements of local positive operator valued measures (POVMs). We examine the case of pure $d \times d$ bipartite quantum states and identical local POVMs. In this case, we prove that if the local POVMs are rank 1, then the classical quadratic Rényi entropy of such a distribution (denoted by H) is independent of the underlying Schmidt bases if and only if the local POVMs are equivalent to spherical 2-designs. We also prove that if the local POVMs admit a cardinality equal to the composite Hilbert space dimension, then H is independent of the underlying Schmidt bases if and only if the local POVMs are symmetric informationally complete POVMs of arbitrary rank. We show that different degrees of entanglement correspond to distinct spheres within the corresponding joint probability simplexes. Furthermore, we derive a separability criterion for mixed isotropic quantum states in terms of probabilities for outcomes of generalized quantum measurements constructed from tensor products of elements of local POVMs formed from spherical 2-designs.

[1]This work was supported in part by the U. S. Office of Naval Research (Grant No. N00014-09-1-0247), by the Government of Canada through NSERC, and by the John Templeton Foundation.

Matthew Graydon
University of Waterloo, Perimeter Institute for Theoretical Physics,
Institute for Quantum Computing

Date submitted: 27 Nov 2012 Electronic form version 1.4