Q 38: Quanteninformation (Konzepte I)

Zeit: Mittwoch 12:00–13:00 Raum: 5L

Q 38.1 Mi 12:00 5L

Quantum simulations under translational symmetry — •Christina Kraus, Michael Wolf, and Ignacio Cirac — Max-Planck-Institut für Quantenoptik, Garching

We investigate the power of quantum systems for the simulation of Hamiltonian time evolutions on a cubic lattice under the constraint of translational invariance. Given a set of translationally invariant local Hamiltonians and short range interactions we determine time evolutions which can and those that can not be simulated. Whereas for general spin systems no finite universal set of generating interactions is shown to exist, universality turns out to be generic for quadratic bosonic and fermionic nearest-neighbor interactions when supplemented by all translationally invariant on-site Hamiltonians.

Q 38.2 Mi 12:15 5L

General strategy for optimal Unambiguous State Discrimination of two mixed states — •Hermann Kampermann[1], Matthias Kleinmann[1], Philippe Raynal[2], and Dagmar Bruss[1] — [1]Theoretische Physik III, Universität Düsseldorf, Universitätsstraße 1, 40225 Düsseldorf — [2]Universität Erlangen-Nürnberg, Staudtstr. 7, 91058 Erlangen

We consider the problem of unambiguous state discrimination (USD), i.e. measurements which never give the wrong answer, but may led to a nonzero probability of an inconclusive result. The optimal success probability for USD of two mixed states is only known for special situations. In this work we review partial solutions and present a general strategy to reduce/solve this problem. Conditions for USD measurements by Eldar et al. [1] are used to test optimality of upper and lower bounds on the USD success probability [2 – 4]. The discussion is closed with generic examples showing the performance and optimality of these bounds.

[1] Y.C. Eldar, M. Stojnic, and B. Hassibi, Phys. Rev. A 69, 062318 (2004)
[2] P. Raynal and N. Luetkenhaus, Phys. Rev. A 72, 022342 (2005)
[3] X.F. Zhou, Y.S. Zhang, and G.C. Guo, quant-ph/0611095
[4] T. Rudolph, and R.W. Spekkens, and P.S. Turner, Phys. Rev. A 68, 010301(R) (2003)

Q 38.3 Mi 12:30 5L

Entanglement in three-qubit mixtures from GHZ and W states — Robert Lohmayer[1], Andreas Osterloh[2], •Jens Siewert[1], and Armin Uhlmann[3] — [1]Institut für Theoretische Physik, Universität Regensburg, 93040 Regensburg — [2]Institut für Theoretische Physik, Universität Hannover, 30167 Hannover — [3]Institut für Theoretische Physik, Universität Leipzig, 04009 Leipzig

We provide a complete analysis of mixed three-qubit states composed of a GHZ state and a W state orthogonal to the former. We present optimal decompositions and convex roofs for the three-tangle. These results highlight intriguing differences compared to the properties of two-qubit mixed states, and may serve as a quantitative reference for future studies of entanglement in multipartite mixed states.
From our studies we derive an analytical method to decide whether or not an arbitrary rank-2 state of three qubits has vanishing three-tangle. This result can be generalized for N-tangles of rank-2 N-qubit states ($N \geq 3$).

Reference:

R. Lohmayer, A. Osterloh, J. Siewert, A. Uhlmann, e-print quant-ph/0606071 (2006), accepted for publication in Physical Review Letters.

Q 38.4 Mi 12:45 5L

Utilizing the pure state case for the unambiguous discrimination of two mixed states — •Matthias Kleinmann[1], Hermann Kampermann[1], Philippe Raynal[2], and Dagmar Bruss[1] — [1]Heinrich-Heine-Universität Düsseldorf, Institut für Theoretische Physik III, Universitätsstraße 1, 40225 Düsseldorf, Germany — [2]Institut für Optik, Information und Photonik, Universität Erlangen-Nürnberg, Staudtstrasse 7, 91058 Erlangen, Germany

The optimal solution for the unambiguous discrimination of two pure states is known since 1995 [JS], while the mixed state case in general is still an open problem. We provide an operable criterion to test whether a given discrimination task for mixed states can be naturally decomposed into a collection of pure state tasks. Indeed, most problems in the literature prove to be of this particular structure. We furthermore investigate the optimality of measurements, which are blockwise composed from pure state measurements, as suggested in [RST]. The analysis of such measurements provides us with a new class of optimal solutions.

[JS] Phys. Lett. A 197, 83 (1995), [RST] Phys. Rev. A 68, 010301(R) (2003)