Q 36: Quanteninformation (Konzepte und Methoden II)

Zeit: Donnerstag 11:00–13:00 Raum: 1B

Q 36.1 Do 11:00 1B

Disentanglement in qubit-qutrit systems — •Mazhar Ali[1], Gernot Alber[1], Kedar Ranade[1], and A. R. P. Rau[2] — [1]Institut für Angewandte Physik, Technische Universität Darmstadt, D-64289, Germany — [2]Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803, USA

The interaction of a quantum system with an environment leads to decoherence. This decoherence gradually degrades quantum entanglement. In particular, there are situations in which entanglement can vanish after some finite time. This phenomenon has been named entanglement sudden death. We examine this phenomenon induced by local spontaneous emission for 2×3-dimensional systems [1]. Similar to 2×2-dimensional systems, the negativity of quantum states can vanish in finite time. It is possible to hasten, delay or even avert this sudden death phenomenon [2].

[1] Mazhar Ali, A. R. P. Rau and K. Ranade, arXiv:quant-ph/0710.2238.
[2] A. R. P. Rau, Mazhar Ali and G. Alber, arXiv:quant-ph/0711.0317.

Q 36.2 Do 11:15 1B

2D Multipartite Valence Bond States in Quantum Anti-ferromagnets — Enrique Rico[1], •Robert Hübener[1], and Hans Briegel[1,2] — [1]Institut für Quantenoptik und Quanteninformation Innsbruck, Technikerstraße 21a, A-6020 Innsbruck, Austria — [2]Institut für Theoretische Physik, Universität Innsbruck, Technikerstraße 25, A-6020 Innsbruck, Austria

A quantum anti-ferromagnetic spin-model on a lattice is characterized via projections of the Hilbert space of a spin-1/2-model on a 2D lattice into suitable subspaces. We implement the following requirements to the resulting state space: a) the states are homogeneous, translationally and rotationally invariant; b) the states are real singlet states (non-chiral); c) the states have a local spin-1 representation. We investigate the properties (e.g., decay of correlations) of this class of states, which is a set of ground states of certain Heisenberg-like Hamiltonians, and then relax the requirements to obtain more general models. Ref.: arXiv:0710.2349v1

Q 36.3 Do 11:30 1B

The structure and properties of symmetric and antisymmetric maximally entangled multidimensional bipartite states — •Denis Sych — Institute of Optics, Information and Photonics, University of Erlangen-Nuremberg, Germany

A multidimensional generalization of the Bell states and the Pauli matrices is considered. It is shown that in the case when the dimension of the Hilbert space is equal to a power of 2, a basis of multidimensional maximally entangled bipartite states can be chosen similarly to the Bell states and constructed of only symmetric and antisymmetric states. It preserves all basic properties of the standard Bell states. An iterative method for its construction is presented and its properties are discussed. Antisymmetric states turn out to be analogous to the singlet Bell state, namely they deliver perfect anticorrelations while being rotationally invariant. The latter property is shown to be tightly connected with antisymmetry. The generalized Bell states are used to show the upper bounds of possible correlations between two quantum systems and to prove the "no-copying" principle, which is a stronger version of the "no-cloning" principle.

Q 36.4 Do 11:45 1B

Discussion of generalized monogamy relations for multipartite entanglement — •Andreas Osterloh[1], Christopher Eltschka[2], and Jens Siewert[2] — [1]Institut für Theoretische Physik, Universität Hannover, D-30167 Hannover, Germany — [2]Institut für Theoretische Physik, Universität Regensburg, D-93040 Regensburg, Germany

The analytic convex roof expression for the entanglement of pairs of qubits marked a major breakthrough in the quantification of entanglement. An equally remarkable "momogamy" relation limits the way of distibuting such pairwise qubit entanglement over a multi-qubit system and gave rise to the definition of a tri-partite entanglement measure. Already for this reason would it be desirable to have an extension of this monogamy relation in order to include multipartite entanglement beyond pairs. We discuss possible extensions of the monogamy relation for pairwise qubit entanglement. Based on recent advances for mixed state threetangle and known invariants for four qubits we systematically analyze pure states of four qubits. Though a class of states exists for which the manogamy relation can be extended in some form, we give a family of counterexamples where no monogamy equality does exist including the three- and/or some four-tangle.

Q 36.5 Do 12:00 1B

Unambiguous discrimination of many mixed states — •Matthias Kleinmann, Hermann Kampermann, and Dagmar Bruss — Heinrich-Heine-Universität Düsseldorf, Institut für Theoretische Physik III, Universitätsstraße 1, 40225 Düsseldorf

While the optimal unambiguous discrimination of two mixed states has already attracted considerable attention, only a few results [1,2] are known for the optimal case of more than two mixed states. We show that many concepts and some classes of optimal solutions known from the two-state case [3] can be generalized to the many-state case.

[1] Y.C. Eldar, M. Stojnic, and B. Hassibi, Phys. Rev. A 69, 062318 (2004), [2] Y. Feng, R. Duan, and M. Ying, Phys. Rev. A 70, 012308 (2004), [3] M. Kleinmann, H. Kampermann, and D. Bruß (in preparation)

Q 36.6 Do 12:15 1B

Characterization of superposition states via STIRAP-type back transfer — •Ruth Garcia-Fernandez[1,2], Frank Vewinger[1,3], David Dzsotjan[1], and Klaas Bergmann[1] — [1]FB Physik, TU Kaiserslautern, Kaiserslautern — [2]Current address: Institut für Physik, Johannes-Gutenberg Universität, Mainz — [3]Current address: Institut für Angewandte Physik, Universität Bonn, Bonn

We present results of an experimental technique for the characterization of coherent superposition states between magnetic sublevels. The technique is based on a multistate variant of the stimulated Raman adiabatic passage (STIRAP) method [1]. The determination of the parameters of the superposition (phases and amplitudes) is achieved using the reverse process, i.e., the transfer of the population in the superposition state back to the initial state by means of a second interaction zone with the laser beams. The experiments are carried out in a collimated supersonic beam of Neon atoms. The superposition states involves two or more degenerate levels in the $J = 2$ metastable state. The population in the initial state $J = 0$ is monitored as a function of the phase. The parameters of the unknown initial superposition state are determined from the properties of the laser radiation which lead to a maximum flow of atoms in $J = 0$.

[1] F. Vewinger et al., Phys. Rev. A 75, 043407, 2007.

Q 36.7 Do 12:30 1B

Experimental Demonstration of near-Optimal Discrimination of Optical Coherent States — •Christoffer Wittmann[1], Katiuscia N. Cassemiro[2], Masahiro Takeoka[3], Masahide Sasaki[3], Ulrik L. Andersen[1], and Gerd Leuchs[1] — [1]Institut für Optik, Information und Photonik, Max-Planck Forschungsgruppe, Universität Erlangen-Nürnberg, — [2]Instituto de Fìsica, Universidade de São Paulo, Caixa Postal 66318, — [3]National Institute of Information and Communications Technology, 4-2-1 Nukui-kitamachi, Koganei, Tokyo 184-8795, Japan

Optimal discrimination of non-orthogonal quantum states is one of the fundamental tasks in quantum detection theory. For weak coherent states, the standard detection schemes, namely homodyne detection and the Kennedy receiver, are not able to achieve error free sensitivity in principle. Both schemes do not even reach the optimal bound for the minimum average error.

We propose and experimentally realize a novel detection strategy for the discrimination of two optical coherent states. We present the experimental comparison of the new strategy with standard detection schemes and demonstrate, that the new receiver surpasses both standard approaches for any signal amplitude.

Q 36.8 Do 12:45 1B

Quantum evolution from a snapshot — •Michael Wolf[1], Jens Eisert[2], Toby Cubitt[3], and Ignacio Cirac[1] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str.1, 85748 Garching

— [2]Institute for Mathematical Sciences, Imperial College London — [3]Department of Mathematics, University of Bristol

We investigate what a snapshot of a quantum evolution - a quantum channel reflecting open system dynamics - reveals about the underlying continuous time evolution. Remarkably, from such a snapshot, and without imposing additional assumptions, it is possible to decide whether or not a channel is consistent with a time (in)dependent Markovian evolution, for which we provide computable necessary and sufficient criteria. Based on these, a computable measure of 'Markovianity' is introduced which quantifies the Markovian part of a quantum channel. We discuss the consistency with Markovian dynamics as encountered in quantum process tomography for physical non-Markovian processes. The results clarify the geometry of the set of quantum channels with respect to being solutions of time (in)dependent master equations or (in)divisible channels.