Q 63 Quanteninformation V

Zeit: Donnerstag 14:00–16:00 Raum: HVI

Q 63.1 Do 14:00 HVI

Fitting channels to tomography data — •Michael Reimpell and Reinhard F. Werner — Institut für Mathematische Physik, TU Braunschweig, Mendelssohnstraße 3, 38106 Braunschweig

Quantum channel tomography yields a sequence of measuring results for the preparations and measurements given by the tomography strategy. These results are subject to errors and therefore may be contradictory or unphysical. We show that a quantum channel, which is close to the tomography data in a least squares sense, can efficiently be found via conic programming. For incomplete tomography, the result may not be unique. In this case, we compute the best and worst case fidelity with respect to a given unitary channel.

Q 63.2 Do 14:15 HVI

Optimal jump operators for monitoring entanglement — •Olivier Brodier, M. Busse, C. Viviescas, A. R. R. de Carvalho, and A. Buchleitner — M.P.I.P.K.S. Nothnitzer Str. 38 D-01187 DRESDEN GERMANY

We present a simple procedure which gives analytically the short time behaviour of entanglement of an initially pure state coupled to a Markovian bath.

The derivation exhibits an optimal choice of jump operators which unravel the evolution of the reduced density operator.

The method is straightforward for a bipartite 2 levels system, and can be extended approximately to multipartite cases.

Q 63.3 Do 14:30 HVI

Unterscheidung beliebiger Quantenzustände — •Stefan T. Probst-Schendzielorz[1], Alexander Wolf[1], Matthias Freyberger[1], Igor Jex[2] und Janos Bergou[3] — [1]Abteilung Quantenphysik, Universität Ulm, 89069 Ulm — [2]Department of Physics, FNSPE, Czech Technical University Prague, Brehova 7, 11519 Praha, Czech Republic — [3]Department of Physics, CUNY Hunter College, 695 Park Avenue, New York, NY 10021, USA

Die fehlerfreie Unterscheidung unbekannter quantenmechanischer Zustände ist im Allgemeinen eine schwer zu lösende Aufgabe. Für bekannte nicht-orthogonale Zustände ist das Konzept einer verallgemeinerten Messung (POVM) schon eingehend studiert. Falls Kopien der zu unterscheidenden Zustände verfügbar sind, kann man auch eine verallgemeinerte Messung anhand der Symmetriebedingungen der verschiedenen Zustände entwerfen. Wir präsentieren die grundlegenden Eigenschaften dieses POVMs und dazu ein unitäres Netzwerk für eine mögliche quantenoptische Implementierung dieser Messung.

Q 63.4 Do 14:45 HVI

Quantum Bit Commitment Revisited — the Possible and the Impossible — •Dennis Kretschmann — Institut für Mathematische Physik, Technische Universität Braunschweig, http://www.imaph.tu-bs.de — Centre for Quantum Computation, DAMTP, University of Cambridge, http://qubit.damtp.cam.ac.uk

Bit commitment is a cryptographic primitive involving two mistrustful parties, conventionally called Alice and Bob. Alice is supposed to submit an encoded bit of information to Bob in such a way that Bob has (almost) no chance to identify the bit before Alice decodes it for him, and Alice has (almost) no way of changing the value of the bit after she has submitted it.

A famous 1996 no-go theorem by Lo, Chau, and Mayers rules out *unconditionally secure* bit commitment protocols, in which — very much in parallel to quantum key distribution — the security of the protocol is guaranteed by the laws of quantum physics alone. In this contribution we substantially strengthen the impossibility proof to incorporate protocols with unknown parameters or anonymous states. The proof applies to deterministic and probabilistic protocols with any number of rounds and is based on the continuity of Stinespring's representation. Our description also provides a natural classification of those protocols that fall outside the standard setting, and thus may allow secure bit commitment. These include protocols that rely on relativistic signaling constraints, communication over noisy channels, or trusted local decoherence. We present a new such protocol in which, perhaps surprisingly, decoherence in Bob's lab guarantees secure bit commitment.

Q 63.5 Do 15:00 HVI

Quantum state reconstruction of an intense polarization squeezed state — •Christoph Marquardt[1], Joel Heersink[1], Maria V. Chekhova[2], Andrei B. Klimov[3], Luis L. Sanchez-Soto[4], Ulrik L. Andersen[1], and Gerd Leuchs[1] — [1]Institute for Optics, Information and Photonics, Max-Planck Research Group, Universität Erlangen-Nürnberg, Günther-Scharowsky-Str. 1 / Bau 24, 91058 Erlangen — [2]Department of Physics, Moscow M.V. Lomonosov State University, 119992 Moscow, Russia — [3]Departamento de Física, Universidad de Guadalajara,*Revolución 1500, 44420 Guadalajara, Jalisco, Mexico — [4]Departamento de Optica, Facultad de Física, Universidad Complutense, 28040 Madrid, Spain

By reconstructing the density matrix or Wigner function, one gains full information about a given quantum state. Such reconstructions have been shown for various quantum systems[1]. We use a source of intense polarization squeezed fs-pulses which are generated inside an optical fiber exploiting the nonlinear Kerr effect[2]. For these states Stokes measurements for various angles of the Poincaree sphere were performed. To reconstruct the Wigner function one has to take into account the algebraic properties of the quantum Stokes operators. We report on the reconstruction of such a Wigner function from experimental data.

[1] A.I.Lvovsky, M.G.Raymer, quant-ph/0511044
[2] J. Heersink et al., Opt. Lett. 30, 1192 (2005)

Q 63.6 Do 15:15 HVI

Experimentelle Purifikation von gequetschten Zuständen — •Boris Hage[1], Alexander Franzen[1], Jaromir Fiurasek[2], Petr Marek[2], Radim Filip[2], Simon Chelkowski[1], Henning Vahlbruch[1], Karsten Danzmann[1] und Roman Schnabel[1] — [1]Albert-Einstein-Institut Hannover, Max-Planck-Institut für Gravitationsphysik und Institut für Gravitationsphysik der Universität Hannover — [2]Department of Optics, Palacky University, Olomouc, Czech Republic

Wir stellen ein experimentelles Schema sowie erste Ergebnisse zur Purifikation von gequetschten Zuständen vor, welche nach einer Transmission durch einen rauschbehafteten Kanal Phasenfluktutationen zeigen. Es handelt sich dabei um Quadraturamplituden-gequetschte Zustände kontinuierlicher Laserstrahlung.

Unser Vorschlag besteht darin, zwei Kopien der gestörten (gemischten) Zustände auf einem 50:50 Strahlteiler zu überlagern und einen Ausgang des Strahlteilers mit einem Homodyndetektor zu beobachten. Fällt bei dieser Detektion der Messwert unter eine bestimmte Schwelle, so dient dieses Ereignis als Trigger für die Verwertung des anderen Ausgangs für weitere Experimente. Um das Prinzip zu demonstrieren, bestehen letztere zunächst lediglich aus einem weiterem Homodyndetektor, mit welchem der Erfolg der Purifikation vermessen werden kann. Dieses Schema besticht durch seine einfache Realisierbarkeit im Vergleich zu anderen Vorschlägen, die hocheffiziente Einzelphotonendetektion voraussetzen (D. E. Browne et al., Phys. Rev. A 67, 0623208 2003).

Q 63.7 Do 15:30 HVI

Quantum states on Harmonic lattices — •Norbert Schuch, J. Ignacio Cirac, and Michael M. Wolf — Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching

We investigate bosonic Gaussian quantum states on an infinite cubic lattice in arbitrary spatial dimensions. We derive general properties of such states as ground states of quadratic Hamiltonians for both critical and non-critical cases. Tight analytic relations between the decay of the interaction and the correlation functions are proven and the dependence of the correlation length on band gap and effective mass is derived. We show that properties of critical ground states depend on the gap of the point-symmetrized rather than on that of the original Hamiltonian. For critical systems with polynomially decaying interactions logarithmic deviations from polynomially decaying correlation functions are found.

Q 63.8 Do 15:45 HVI

Optimal unambiguous state discrimination of two density matrices — •philippe raynal and Norbert Luetkenhaus — Institut für theoretische Physik I, Max-Planck-Forschungsgruppe, Universität Erlangen-Nürnberg, Staudtstr. 7/B1, 91058 Erlangen

Quantum state discrimination is a fundamental task in quantum in-

formation theory. The signals are usually nonorthogonal quantum states, which implies that they can not be perfectly distinguished. One possible discrimination strategy is the so-called Unambiguous State Discrimination where the states are successfully identified only with some probability, but without error. The optimal USD measurement has been extensively studied for pure states, especially for any pair of pure states. In the case of a pair of generic mixed states, no complete solution is known. However, the dimension of the generic problem can often be reduced [1]. Moreover bounds on the optimal success probability have been derived [2,3] and for a given pair of mixed states those bounds can be reached if and only if two explicit conditions are met [3]. We go beyond this result by providing optimal solutions for any two states ρ_0 and $\rho_1 = U\rho_0 U$, $U^2 = 1$ in dimension 4 with equal *a priori* probabilities. ρ_0 and ρ_1 are called Geometrically Uniformed states. This class of problems includes the discrimination of the basis information in the BB84 QKD protocol with coherent states.

[1] Ph. Raynal, N. Lütkenhaus, S.J. van Enk, PRA **68**, 022308 (2003)
[2] Ph. Raynal, N. Lütkenhaus, PRA **72**, 022342 (2005)
[3] U. Herzog, PRA **71**, 042314 (2005)