



Conference collection

Eleventh International Conference on Quantum Communication, Measurement and Computation (QCMC)

Vienna, Austria

30 July–3 August 2012

Editors

Hannes-Jörg Schmiedmayer

Vienna University of Technology, Vienna, Austria

Philip Walther

University of Vienna, Vienna, Austria

Sponsoring Organizations

City of Vienna, for the general support and sponsoring the Heurigen event

EU Integrating Project SOLID

EU Integrating Project Q-ESSENCE

EU Integrating Project AQUTE

McCormick Northwestern Engineering University

Quantum Information Theory Group

Research Laboratory of Electronics at MIT

Austrian Institute of Technology

Pfeiffer Vacuum Austria GmbH

Topica Photonics

Springer-Verlag

Thorlabs GmbH

Coherent GmbH

Single Quantum BV

Europhysics Letters

Radiant Dyes Laser & Accessoires GmbH

ID QUANTIQUE SA

All papers have been peer reviewed.



Melville, New York, 2014
AIP Proceedings

Volume 1633

To learn more about AIP Proceedings visit <http://proceedings.aip.org>

Editors

Hannes-Jörg Schmiedmayer

Vienna University of Technology
Atominstitut – Institute of Atomic and Subatomic Physics
Stadionallee 2
A-1020 Vienna
Austria

E-mail: jschmied@ati.ac.at

Philip Walther

University of Vienna
Quantum Optics, Quantum Nanophysics and Quantum Information
Boltzmanngasse 5
A-1090 Vienna
Austria

E-mail: Philip.Walther@univie.ac.at

Authorization to photocopy items for internal or personal use, beyond the free copying permitted under the 1978 U.S. Copyright Law (see statement below), is granted by the AIP Publishing LLC for users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$30.00 per copy is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923, USA: <http://www.copyright.com>. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Services is: 978-0-7354-1272-9/14/\$30.00



© 2014 AIP Publishing LLC

No claim is made to original U.S. Government works.

Permission is granted to quote from the AIP Conference Proceedings with the customary acknowledgment of the source. Republication of an article or portions thereof (e.g., extensive excerpts, figures, tables, etc.) in original form or in translation, as well as other types of reuse (e.g., in course packs) require formal permission from AIP Publishing and may be subject to fees. As a courtesy, the author of the original proceedings article should be informed of any request for republication/reuse. Permission may be obtained online using RightsLink. Locate the article online at <http://proceedings.aip.org>, then simply click on the RightsLink icon/"Permissions/Reprints" link found in the article abstract. You may also address requests to: AIP Publishing Office of Rights and Permissions, Suite 1N01, 2 Huntington Quadrangle, Melville, NY 11747-4502, USA; Fax: 516-576-2450; Tel.: 516-576-2268; E-mail: rights@aip.org.

ISBN 978-0-7354-1272-9
ISSN 0094-243X
Printed in the United States of America

AIP Conference Proceedings, Volume 1633
**Eleventh International Conference on Quantum Communication,
Measurement and Computation (QCMC)**

Table of Contents

Preface: Quantum Communication, Measurement and Computing (QCMC) Jörg Schmiedmayer and Philip Walther	1
Committees	3
Acknowledgments	5
Awards	6
Conference Photographs	7
FOUNDATION OF QUANTUM PHYSICS	
Studying non-equilibrium many-body dynamics using one-dimensional Bose gases Tim Langen, Michael Gring, Maximilian Kuhnert, Bernhard Rauer, Remi Geiger, Igor Mazets, David Adu Smith, Takuya Kitagawa, Eugene Demler, and Jörg Schmiedmayer	11
Tripartite entanglement in single-neutron interferometer experiments Daniel Erdösi, Marcus Huber, Beatrix C. Hiesmayr, and Yuji Hasegawa	16
Optimal strategies for tests of EPR-Steering with no detection loophole David A. Evans and Howard M. Wiseman	19

What the complex joint probabilities observed in weak measurements can tell us about quantum physics	22
Holger F. Hofmann	
Single spontaneous photon as a coherent beamsplitter for an atomic matter-wave	25
Jiří Tomkovič, Michael Schreiber, Joachim Welte, Martin Kiffner, Markus K. Oberthaler, and Jörg Schmiedmayer	
Time reversibility in the quantum frame	29
Fátima Masot-Conde	
Entanglement of phase-random states	32
Yoshifumi Nakata, Peter Turner, and Mio Murao	
Genuine four tangle for four qubit states	35
S. Shelly Sharma and N. K. Sharma	
Playing a quantum game with a qutrit	38
Urbasi Sinha, Piotr Kolenderski, Li Youning, Tong Zhao, Matthew Volpini, Adan Cabello, Raymond Laflamme, and Thomas Jennewein	
Tests of alternative quantum theories with neutrons	41
S. Sponar, J. Klepp, C. Schmitzter, H. Bartosik, K. Durstberger-Rennhofer, G. Badurek, and Y. Hasegawa	
Experimental demonstration of Leggett-Garg inequality violations by measurements with high resolution and back-action	44
Yutaro Suzuki, Masataka Iinuma, and Holger F. Hofmann	
Generalized mutual information and Tsirelson's bound	47
Eyuri Wakakuwa and Mio Murao	

Symmetric states: Their nonlocality and entanglement Zizhu Wang and Damian Markham	50
QUANTUM MEASUREMENTS AND METROLOGY	
Noise in phase-preserving linear amplifiers Shashank Pandey, Zhang Jiang, Joshua Combes, and Carlton M. Caves	53
Cavity optomechanics with a nonlinear photonic-crystal nanomembrane Kevin Makles, Thomas Antoni, Rémy Braive, Aurélien Kuhn, Tristan Briant, Pierre-François Cohadon, Isabelle Sagnes, Isabelle Robert-Philip, and Antoine Heidmann	59
Quantum displacement receiver for M-ary phase-shift-keyed coherent states Shuro Izumi, Masahiro Takeoka, Mikio Fujiwara, Nicola Dalla Pozza, Antonio Assalini, Kazuhiro Ema, and Masahide Sasaki	62
Observation of a single spin by transferring its coherence to a high level macroscopic pure state Minaru Kawamura	65
A micropillar for cavity optomechanics Aurélien Kuhn, Leonhard Neuhaus, Emmanuel Van Brackel, Claude Chartier, Olivier Ducloux, Olivier Le Traon, Christophe Michel, Laurent Pinard, Raffaele Flaminio, Samuel Deléglise, Tristan Briant, Pierre-François Cohadon, and Antoine Heidmann	68
Quantum limits on optical phase estimation accuracy from classical rate-distortion theory Ranjith Nair	71
A generalized Dolinar receiver with inconclusive results K. Nakahira and T. S. Usuda	74

Photon-number statistics of twin beams: Self-consistent measurement, reconstruction, and properties Jan Peřina Jr., Ondřej Haderka, and Václav Michálek	77
How to make optimal use of maximal multipartite entanglement in clock synchronization Changliang Ren and Holger F. Hofmann	81
On signal amplification via weak measurement Yutaka Shikano	84
Understanding boundary effects in quantum state tomography – One qubit case Takanori Sugiyama, Peter S. Turner, and Mio Murao	87
Extremely high Q-factor mechanical modes in quartz bulk acoustic wave resonators at millikelvin temperature M. Goryachev, D. L. Creedon, E. N. Ivanov, S. Galliou, R. Bourquin, and M. E. Tobar	90
Optimal driving of Bose-Einstein condensates in optical cavities T. Caneva, T. Calarco, and S. Montangero	93
Hybrid quantum information processing Akira Furusawa	100
Coherent manipulation of an NV center and one carbon nuclear spin Burkhard Scharfenberger, William J. Munro, and Kae Nemoto	106
QUANTUM COMMUNICATION AND CRYPTOGRAPHY	
The Holy Grail of quantum optical communication Raúl García-Patrón, Carlos Navarrete-Benlloch, Seth Lloyd, Jeffrey H. Shapiro, and Nicolas J. Cerf	109

Improving the maximum transmission distance of continuous-variable quantum key distribution using a noiseless amplifier Rémi Blandino, Anthony Leverrier, Marco Barbieri, Jean Etesse, Rosa Tualle-Brouri, and Philippe Grangier	113
Discord as a quantum resource for bi-partite communication Helen M. Chrzanowski, Mile Gu, Syed M. Assad, Thomas Symul, Kavan Modi, Timothy C. Ralph, Vlatko Vedral, and Ping Koy Lam	116
Field transmission test of 2.5 Gb/s Y-00 cipher in 160-km (40 km × 4 spans) installed optical fiber for secure optical fiber communications Fumio Futami and Osamu Hirota	119
Long-distance quantum key distribution with imperfect devices Nicoló Lo Piparo and Mohsen Razavi	122
Coherent pulse position modulation quantum cipher Masaki Sohma and Osamu Hirota	125
Turbulent single-photon propagation in the Canary optical link Ivan Capraro, Andrea Tomello, Alberto Dall'Arche, Francesca Gerlin, Thomas Herbst, Rupert Ursin, Giuseppe Vallone, and Paolo Villoresi	128
QUANTUM INFORMATION AND COMMUNICATION THEORY	
Compressed quantum simulation B. Kraus	131
Quantum money with classical verification Dmitry Gavinsky	135
Implementability of two-qubit unitary operations over the butterfly network and the ladder network with free classical communication Seiseki Akibue and Mio Murao	141

Average iterations of accessible nonlinear witnesses Juan Miguel Arrazola, Oleg Gittsovich, and Norbert Lütkenhaus	144
Characterization of the CGLMP₄ polytope Yu Cai, Jean-Daniel Bancal, and Valerio Scarani	147
How much a quantum measurement is informative? Michele Dall'Arno, Giacomo Mauro D'Ariano, and Massimiliano F. Sacchi	150
Fault-tolerant quantum computation and communication on a distributed 2D array of small local systems K. Fujii, T. Yamamoto, M. Koashi, and N. Imoto	153
Key rate for calibration robust entanglement based BB84 quantum key distribution protocol O. Gittsovich and T. Moroder	156
Polaractivation for classical zero-error capacity of qudit channels Laszlo Gyongyosi and Sandor Imre	159
Quasi-superactivation for the classical capacity of quantum channels Laszlo Gyongyosi and Sandor Imre	162
Reliable quantum communication over a quantum relay channel Laszlo Gyongyosi and Sandor Imre	165
Evaluation of multipartite entanglement in graph states Michal Hajdušek and Mio Murao	168
Randomizing quantum states to Shatten p-norm for all $p \geq 1$ Kabgyun Jeong	171

Minimax discrimination of quasi-Bell states Kentaro Kato	174
Quantum walk computation Viv Kendon	177
Implementing controlled-unitary operations over the butterfly network Akihito Soeda, Yoshiyuki Kinjo, Peter S. Turner, and Mio Murao	180
Universal construction of controlled-unitary gates using dynamical decoupling and the quantum Zeno effect Shojun Nakayama, Akihito Soeda, and Mio Murao	183
Dissipative quantum computing with open quantum walks Ilya Sinayskiy and Francesco Petruccione	186
Superadditivity of classical capacity revisited Oleg V. Pilyavets, Evgeni A. Karpov, and Joachim Schäfer	189
Information transmission in bosonic memory channels using Gaussian matrix-product states as near-optimal symbols Joachim Schäfer, Evgeni Karpov, and Nicolas J. Cerf	192
Microscopic derivation of open quantum walks Ilya Sinayskiy and Francesco Petruccione	195
Thresholds of surface codes on the general lattice structures suffering biased error and loss Yuuki Tokunaga and Keisuke Fujii	198

A class of group covariant signal sets and its necessary and sufficient condition Tsuyoshi Sasaki Usuda, Yoshihiro Ishikawa, and Keisuke Shiromoto	201
QUANTUM INFORMATION AND COMMUNICATION IMPLEMENTATION	
Simulations of two-particle interactions with 2D quantum walks in time A. Schreiber, A. Gábris, P. P. Rohde, K. Laiho, M. Štefaňák, V. Potoček, C. Hamilton, I. Jex, and C. Silberhorn	204
Arbitrary unitary transformations on optical states using a quantum memory	
Geoff T. Campbell, Olivier Pinel, Mahdi Hosseini, Ben C. Buchler, and Ping Koy Lam	210
Relaxation dynamics in correlated quantum dots	
S. Andergassen, D. Schuricht, M. Pletyukhov, and H. Schoeller	213
Deterministic and cascadable conditional phase gate for photonic qubits	
Christopher Chudzicki, Isaac Chuang, and Jeffrey H. Shapiro	216
Quantum reading of unitary optical devices	
Michele Dall'Arno, Alessandro Bisio, and Giacomo Mauro D'Ariano	219
Heralded processes on continuous-variable spaces as quantum maps	
Franck Ferreyrol, Nicolò Spagnolo, Rémi Blandino, Marco Barbieri, and Rosa Tualle-Brouri	222
Optimal discrimination of M coherent states with a small quantum computer	
Marcus P. da Silva, Saikat Guha, and Zachary Dutton	225
Qubus ancilla-driven quantum computation	
Katherine Louise Brown, Suvabrata De, Viv Kendon, and Bill Munro	228

Time-bin state transfer to electron spin coherence in solids Hideo Kosaka, Takahiro Inagaki, Ryuta Hitomi, Fumishige Izawa, Yoshiaki Rikitake, Hiroshi Imamura, Yasuyoshi Mitsumori, and Keiichi Edamatsu	231
Integrated optics for coupled-cavity QED G. Lepert and E. A. Hinds	234
Light pulse analysis with a multi-state atom interferometer I. Herrera, J. Petrovic, P. Lombardi, F. Schäfer, and F. S. Cataliotti	237
Control of Wannier orbitals for generating tunable Ising interactions of ultracold atoms in an optical lattice Kensuke Inaba, Yuuki Tokunaga, Kiyoshi Tamaki, Kazuhiro Igeta, and Makoto Yamashita	240
Coherence and entanglement in a nano-mechanical cavity Li-hui Sun, Gao-xiang Li, and Zbigniew Ficek	243
Deterministic linear-optics quantum computing based on a hybrid approach Seung-Woo Lee and Hyunseok Jeong	246
Quantum interference of independently generated telecom-band single photons Monika Patel, Joseph B. Altepeter, Yu-Ping Huang, Neal N. Oza, and Prem Kumar	249
High-fidelity frequency down-conversion of visible entangled photon pairs with superconducting single-photon detectors Rikizo Ikuta, Hiroshi Kato, Yoshiaki Kusaka, Shigehito Miki, Taro Yamashita, Hirotaka Terai, Mikio Fujiwara, Takashi Yamamoto, Masato Koashi, Masahide Sasaki, Zhen Wang, and Nobuyuki Imoto	252

Bi-photon generation with optimized wavefront by means of adaptive optics

Mattia Minozzi, Stefano Bonora, Alexander V. Sergienko,
Giuseppe Vallone, and Paolo Villoresi

255

Hybrid quantum teleportation: A theoretical model

Shuntaro Takeda, Takahiro Mizuta, Maria Fuwa, Jun-ichi Yoshikawa,
Hidehiro Yonezawa, and Akira Furusawa

258

**Mode coupling in phase-sensitive amplifier with generalized pump mode
and spot size**

M. Annamalai, M. Vasilyev, and P. Kumar

261

Photon-photon interaction in strong-coupling cavity-atom system

Jian Yang and Paul G. Kwiat

264

Engineering a factorable photon pair source

Kevin Zielnicki and Paul Kwiat

267

**Precision spectral manipulation: A demonstration using a coherent
optical memory**

B. M. Sparkes, C. Cairns, M. Hosseini, D. Higginbottom,
G. T. Campbell, P. K. Lam, and B. C. Buchler

270