INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Název projektu: Mezinárodní centrum pro informaci a neurčitost

Registrační číslo: CZ.1.07/2.3.00/20.0060

Zpráva z účasti na konferenci

Název konference: 11th Intl. Conference on Quantum Communication, Measurement and Computing (QCMC)
Datum konání: 30.7. - 3. 8. 2012
Místo: Vídeň, Rakousko
Účastník konference: Mgr. Vladyslav Usenko Ph.D.

Stručný popis konference:
Intl. Conference on Quantum Communication, Measurement and Computing is one of the most representative meetings in the field of Quantum Information Science which is being held once per 2 years. It covers all aspects of information processing, storage, transmission and retrieval from the quantum states, most of all in their optical implementation. This year the conference was organized by and held in the Vienna University of Technology.

Základní údaje:

Počet účastníků:	357
Počet přednášek:	65
Počet posterů:	292

Zajímavé přednášky

R. Renner: ***Reliable Quantum State Tomography***
The presentation of Dr. Renner from Institute for Theoretical Physics, ETH Zurich, Switzerland was dedicated to quantum state tomography taking into account the finite amount of data obtained in the experiment. The authors proposed a method for obtaining reliable estimates from finite tomographic data [1]. Specifically, the method allows the derivation of confidence regions, i.e., subsets of the state space in which the unknown state is contained with probability almost one. Further, using the quantum de Finetti's theorem [2], the assumption that an identical unknown state is generated in each run of the experiment can be relaxed to the assumption that the actual runs of the experiment are chosen at random from an (in principle) infinitely long sequence of runs.

Literatura:
[1] M. Christandl and R. Renner, arXiv:1108.5329 (2011).
[2] M. Christandl, R. Konig, G. Mitchison, and R. Renner, Comm. Math. Phys., 273, 473 (2007).

Jian-Wei Pan: ***Recent Experiments on Quantum Manipulation with Photons and Atoms***
Prof. Pan from the University of Science and Technology of China made a review of the recent experiments on Quantum Manipulation with photonic and atomic states performed in China, including eight-photon entanglement, topological quantum error-correction, quantum repeater and efficient and long-lived quantum memory [1], and entanglement distribution and quantum teleportation over 100km-scale free-space quantum channels [2]. These experiments show the promising future possibility towards scalable quantum information processing with photons and atoms.

Literatura:
[1] Xiao-Hui Bao et al., Nature Physics 8, 517-521 (2012)
[2] Juan Yin et al., arXiv:1205.2024

Nicolas Gisin: ***Quantum Cryptography and Quantum Repeaters***
Prof. Gisin from the University of Geneva made a comprehensive review of the current achievements and challenges in quantum key distribution (QKD), especially concerning the quantum repeaters aimed at increase of the applicable distance of the quantum communication protocols. He presented the recent results on solid state multimode quantum memories [1], including quantum memories for photonic polarization qubits [2]. Then the preliminary results on a qubit amplifier were presented. This should be a central component for Device Independent QKD.

Literatura:

[1] Christoph Clausen, Imam Usmani, Felix Bussieres, Nicolas Sangouard, Mikael Afzelius, Hugues de Riedmatten and Nicolas Gisin, Nature 469, 508-511 (2011)
[2] Clara I. Osorio, Natalia Bruno, Nicolas Sangouard, Hugo Zbinden, Nicolas Gisin and Robert T. Thew, quant-ph/1203.3396

Vlastní prezentace

V. Usenko et al., *Continuous Variable Quantum Key Distribution With Optimally Modulated Entangled States.*

The poster presentation was given at the conference and covered the recent results obtained in collaboration with the quantum information group at Danish Technical Universty. In the work we proposed and experimentally addressed a CV QKD protocol which uses entangled states optimally combined with a large coherent modulation. The protocol is based on the preparation of the two-mode entangled state, by coupling two orthogonally squeezed states, and application of the optimized correlated Gaussian displacement on its modes. Trusted parties are then performing homodyne measurements
on their modes and are supposed to process the data in the reverse reconciliation scenario.
Following the Gaussian security proofs we show that additional modulation of entangled states greatly enhances the robustness of the protocol to channel noise and, accordingly,

increases the applicable distance of the protocol. The peculiarity of our protocol is that due to the optimal modulation the trusted parties are gaining from any amount of nonclassicality, which is present in the source.
The experimental data obtained on the modulated entangled states well confirm the theoretical security predictions and show possibility to fully implement the proposed protocol. We also shown that the improvement by optimal coherent modulation is preserved upon limited post-processing efficienc . Thus, our scheme represents a very promising method for extending the applicability of the practical CV QKD.
The presentation was followed by the discussions with Dr. Marquardt from MPI Erlangen, Prof. Lütkenhaus from the University of Waterloo, Dr. Furrer from Leibnitz University in Hannover and others.

Mezinárodní vědecká spolupráce

The visit to the conference was effectively used to enforce and broadnen the scientific collaboration with the leading groups in quantum information and quantum optics.

The running projects were discussed with Dr. Lassen from DTU Lyngby as well as with Dr. Marquardt from MPI Erlangen.

The discussion on the finite size effects in the continuous-variable quantum key distribution was carried out with Furrer from Leibnitz University in Hannover and may lead to the future collaboration.

During the conference the participants were informed on the project of International Center for Information and Uncertainty, supported by the OP VK program.

Fotografická dokumentace

Dr. Usenko (left) during discussions at QCMC'2012.