



evropský
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EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání
pro konkurenceschopnost

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: 21st International Laser Physics Workshop
Datum konání: 23.7. - 27. 7. 2012
Místo: Calgary, Kanada
Účastník konference: Mgr. Vladyslav Usenko Ph.D.

Stručný popis konference:

International Laser Physics Workshop is the large annual conference covering all aspects of optics and laser physics. 21st conference in 2012 was organized by A.M. Prokhorov General Physics Institute, Russian Academy of Sciences (RAS), Moscow, Russia; University of Calgary, Calgary, Canada; International Journal of Laser Physics; International Journal Laser Physics Letters; International Laser Center, Moscow State University, Moscow, Russia; National Research Nuclear University MEPhI, Moscow, Russia. It brought together more than 500 participants from all over the world. It took place in the premises of University of Calgary, Canada. The conference was divided into several seminars of which seminar 7 covered quantum optics and quantum information.

Základní údaje:

Počet účastníků: 522
Počet přednášek: 472
Počet posterů: cca 50

Zajímavé přednášky

L. Davidovich et al: *Ultimate precision limit for measurement of forces on noisy harmonic oscillators*

The presentation of Prof. Davidovich from the University of Rio de Janeiro was dedicated to measurement precision limit in quantum metrology. Within the recently proposed general framework [1] the authors were able to derive the exact tight bounds for the estimation of weak forces acting on a noisy harmonic oscillator. They considered a resonant force, and determined, for a given average energy of the oscillator, the best possible precision, as well as the corresponding best initial state and best measurement procedure [2].

Literatura:

- [1] B. M. Escher, R. L. de Matos Filho, L. Davidovich, *Nature Physics* 7, 406-411 (2011)
- [2] C. L. Latune, B. M. Escher, R. L. De Matos Filho, and L. Davidovich, submitted for publication.

Marco Barbieri et al.: *Multiparameter Quantum Metrology*

Dr. Barbieri from the University of Oxford made a talk on quantum metrology with the multiparameter estimation. The challenging issue of such measurement consists in the fact that estimating one parameter with quantum-limited precision inexorably leads to a reduced precision of the other. Unlike single-parameter estimation, it is impossible to design a strategy saturating the quantum Cramér-Rao bound for loss and phase estimation in a single setup simultaneously. The authors presented the optimal quantum states achieving the best possible simultaneous precisions. Their results reveal general features about concurrently estimating Hamiltonian and dissipative parameters, and can be applied to sophisticated sensing scenarios such as quantum imaging.

Literatura:

- [1] Philip J. D. Crowley, Animesh Datta, Marco Barbieri, and Ian A. Walmsley, preprint: arXiv:1206.0043v1 (2012)

Fabio Sciarrino: *Complete Experimental Toolbox for Alignment-Free Quantum Communication*

Presentation of Dr. Sciarrino from La Sapienza University of Rome was dedicated to the recently experimental platform aimed at implementation of the quantum communication independent on the alignment. The purpose of such system is first of all the quantum communication between the moving and rotating objects, e.g. satellites. To achieve the goal the group of Dr. Sciarrino used the information encoding into orbital angular momentum photonic states, which are rotationally invariant [1]. By developing a complete toolbox for the efficient encoding and decoding of quantum information in such photonic qubits, they demonstrated the feasibility of alignment-free quantum key-distribution, and performed a proof-of-principle alignment-free entanglement distribution and violation of a Bell inequality.

Literatura:

- [1] Vincenzo D'Ambrosio, Eleonora Nagali, Carlos H. Monken, Sergei Slussarenko, Lorenzo Marrucci, Fabio Sciarrino, preprint: arXiv:1109.6747; Eleonora Nagali, Fabio Sciarrino, *Optics Express* 18, 18243 (2010)

Vlastní prezentace

V. Usenko et al., *Gaussian Continuous-Variable Quantum Key Distribution Enforced By Squeezing*.

The invited talk was given at the conference and the recent results on the secure quantum communication with the use of squeezed nonclassical states of light were presented. The proof-of-principle experimental test of improvement of an entangled-resource by additional coherent modulation in the Gaussian quantum key distribution protocol were reported. The presented results show the possibility to outperform the coherent-state protocol with an arbitrarily strong modulation, using a moderate feasible squeezing. Alternatively, when the

post-processing is limited, it was shown how squeezing combined with reduced modulation is able to provide security in the noisy channels when optimally modulated coherent states fail. The presentation was followed by the questions and scientific discussion with Prof. Ulrik Andersen (Danish Technical University), Dr. Fabio Sciarrino (Univ. La Sapienza), Dmitry Strekalov (California Institute of Technology) and others.

Mezinárodní vědecká spolupráce

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

The running projects were discussed with Prof. Andersen from DTU Lyngby as well as with Dr. Marquardt and Dr. Chekhova from MPI Erlangen.

The discussion on the properties of nonclassical states and the possibility to use them in quantum information processing was carried out with Dr. Barbieri from the Oxford University 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

Unfortunately, the lighting conditions in the presentation hall did not allow photographing.