



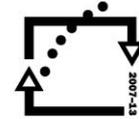
evropský  
sociální  
fond v ČR



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 stáži

Datum konání stáže: 25.06.2012 – 13.07.2012  
Navštívené pracoviště: CNRS-LPQM, ENS Cachan, Paříž, Francie  
Zahraniční garant: doc. Frederic Grosshans  
Účastník stáže: Vladyslav Usenko, Ph.D.

#### **Stručný popis navštíveného pracoviště**

The Ecole normale supérieure de Cachan (ENS Cachan) founded in 1912 is a prestigious public institution of higher education; it is one of the four major French Grandes Écoles, which are considered as the top higher education institutions in France. The research part of the ENS Cachan consists of 12 laboratories and 2 interdisciplinary research institutes, which makes Cachan a very active research center. Quantum and Molecular Photonics Laboratory (le Laboratoire de photonique quantique et moléculaire, LPQM) is the main physical laboratory in ENS Cachan and is also the part of the CNRS (Centre National de la Recherche Scientifique, National Center for Scientific Research), which is the largest governmental research organization in France and the largest fundamental science agency in Europe. The co-founder of the LPQM laboratory is also France Telecom R&D, which is the research and development division of France Télécom (the main telecommunications company in France, the third-largest in Europe). The directions of research of the LPQM laboratory cover quantum, nonlinear and biological nanophotonics as well as development of components for photonic technologies and studies of hybrid nanostructures. The LPQM staff consists of 15 permanent members (professors, associate professors and post-docs) and over 20 post-graduate students and engineers. The research of the laboratory is supported by several French and European grants (in particular, NanoSci-ERANET "NEDQIT" and IST STREP FP6 "EQUIND").

The theoretical group of Assoc. Prof. F. Grosshans is dealing with the fundamental tests and quantum information and is especially active in quantum cryptography. Besides doc. Grosshans it consists of Dr. Fabio Grazioso (post-doc) and Christina Giarmatzi (Ph.D. student). In the tight collaboration with the leading experimentalists in LPQM as well as within CNRS (in particular, group of Prof. Philippe Grangier at CNRS Institut d'Optique), group of doc. Grosshans achieved the outstanding results in the field of quantum information,

e.g., developed the first Gaussian continuous-variable quantum key distribution protocol on the basis of coherent states and shown optimality of Gaussian collective attacks.

### **Průběh stáže**

The visit was dedicated to the further development of the Gaussian continuous-variable quantum key distribution (CV QKD) protocol based on the single modulation of coherent states. Such protocols waives requirement of the channels estimation in the complementary quadrature, which makes its implementation simple compared to the symmetrical protocols. At the same time this is achieved by cost of the sensitivity to the channel loss and noise. The protocol was deeply investigated during the visit with some new results obtained. In particular, the analytical expression for the key rate in the general case was obtained and simplified using certain approximations. The case of symmetrical quantum channels, most likely to occur in the real-life communication scenario, was deeply investigated.

### **Publikace rozpracované během stáže**

The scientific discussions during the stay resulted in the further improvements to the manuscript draft with the working title “Continuous variable quantum key distribution with single quadrature modulation” which is currently under preparation to publication and is to be submitted in the second half of the year 2012.

### **Navázání kontaktů**

The visit resulted in the intensification of the scientific collaboration with the group of doc. Frederic Grosshans. The possible future joint international projects between the Palacky University and CNRS were also preliminarily discussed. Further directions of research were also addressed and established.

### **Shrnutí stáže**

The visit indeed achieved its goals, the scientific collaboration with one of the leading European institutions in the field of quantum optics and quantum information was successfully established and intensified. The new knowledge on the current research trends in the mentioned field was obtained and will be further disseminated to the target group within the scientific seminars.

### **Fotografická dokumentace**

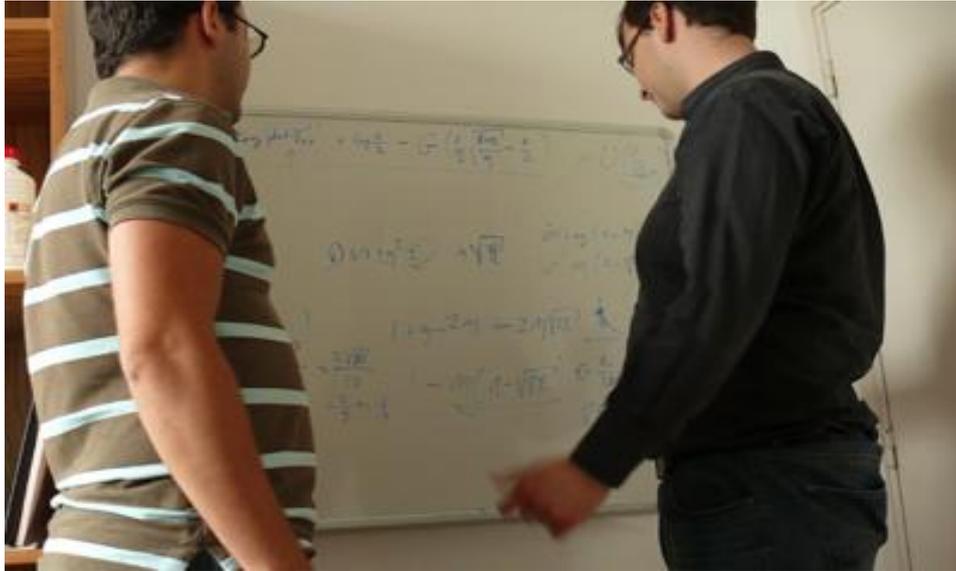
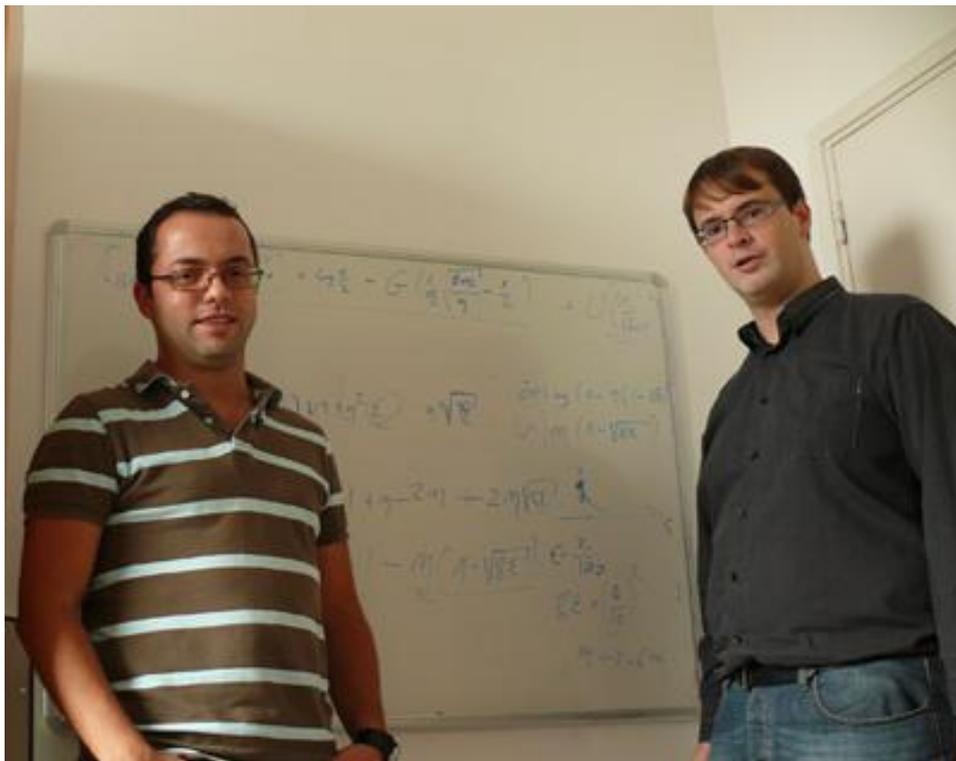


Photo taken during the scientific discussion within the stay, depicted are doc. Grosshans (right) and Dr. Usenko (left).



Doc. Grosshans (right) and Dr. Usenko (left).