National Institute of
Information and Communications Technology

Tokyo
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Master Thesis: GPU Implementation of Reconciliation Protocols for Quantum Key Distribution Systems

We are currently offering a Master Thesis project on GPU implementation of reconciliation protocols for continuous variable quantum key distribution.

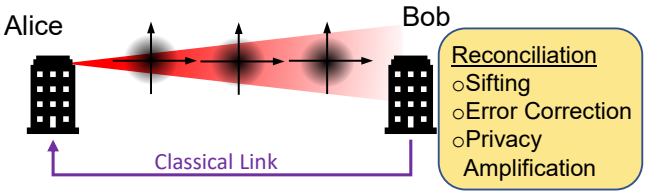
Master Thesis Proposal

The modern society relies heavily on communication and most of our daily activities involves transmission of data through the Internet. We assume that such communication can be done securely, e.g, when we purchase something online. Imagine your daily life were suddenly you could no longer trust the security of such communication. This is the threat of the forthcoming quantum computer. All encryption techniques today rely on computationally hard problems such as factoring of prime numbers. However, algorithms already exist that can easily break the security of todays encryption schemes when a quantum computer is available.

Unlike todays encryption methods, quantum cryptography relies on the laws of quantum mechanics and can be proven to offer unconditionally secure communication between two remote parties. The two main techniques distributes a random key between two parties using either single photon transmission or weak coherent Gaussian laser states. This Master Thesis project concerns the later technique which can be implemented with standard telecommunication equipment and is a major candidate for commercial systems. One of the key challenges of quantum key distribution is the implementation of forward error correction (FEC) in the very low signal-to-noise ratio regime compared to conventional communication systems. In this Master Thesis project, FEC decoding will be implemented in quasi real-time on graphics processing units (GPUs). Different decoding methods will be studied trying to maximize the secret key rate respect to the quantum channel and the finite computational capacity of the GPUs. The final goal is to apply the technology in an experimental demonstration over both the Tokyo QKD network and the Tokyo Free-space optical test bed.

Quantum ICT Advanced Research Center - NICT

The National Institute of Information and Communications Technology (NICT) is Japans sole public research institute specializing in the field of information and communications technology (ICT). The Quantum ICT Advanced Research Center is developing quantum



photonics networks, including quantum key distribution over fiber and free-space links. Fundamental research on quantum optics is also carried out with the goal to develop new functionality in future quantum communication networks.

Our group collaborates with many industrial partners such as NEC, Toshiba, and Mitsubishi, as well as academic partners such as Gakushuin University, University of Tokyo, University of Electro-Communications and Hokkaido University. Throughout this project you will have the possibility to collaborate with these companies and institutes. Further, we are also working closely with the space communication lab at NICT to realize secure free space optical links. During this project, you will have a chance to learn about forward error correction implementation which is a skill that can be employed in any communication field. You will also get practical experience with quantum key distribution. Expertize in these two fields is of high demand in both industrial and and academic positions.

Suitable Background

This project should be carried out as a Master Thesis and you need to be enrolled at a University. Prior knowledge on forward error correction is necessary. Experience in quantum optics, encryption and/or optical communication is a plus, as well as experience in GPU programming.

Info and Contact

NICT cannot offer any financial support. However, housing can be arranged during the internship (subject to availability).

Please send your application to:

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