

PhotonHub Demo Centre

Course 01

Quantum Communication applications

Course Provider

National Research Council – National Institute of Optics (CNR-INO),
Headquarters of Arcetri (Florence),
Italy

Course Overview

The Demo Centre on Quantum Communication applications will be focused on the application perspectives of QKD in cybersecurity. It will be divided in four main parts:

- 1) Interactive introduction to the basic concepts of Quantum Communication;
- 2) Quantum Key Distribution (QKD) and infield implementations, including a practical demonstration of QKD in collaboration with Quantum Telecommunication Italy (QTI);
- 3) Ground to space interfaces (in collaboration with the Italian Space Agency (ASI)).
- 4) Cybersecurity industrial application examples in collaboration with Quantum Telecommunication Italy (QTI)



Target Audience

The course targets a broad audience and mainly producers oriented to produce/exploit novel photonic technologies for security and communication.

Basic knowledge of quantum mechanics will not be required but knowing in advance the attendees' background will help us to opportunely adapt the course.

Expected Outcomes

- 1) Understanding the basic concepts of Quantum Communication and QKD (interactive activity);
- 2) Demonstration of QKD over a few-hundred-meters fiber link (hands-on activity);
- 3) Demonstration of QKD over a free-space link(hands-on activity);
- 4) Understanding of ground-to-space applications for communication;
- 5) Understanding of QKD Applications

Course Schedule

Time	Demo Activity
09:00 – 9:30	Welcome Reception & Course and trainers' presentation
9:30 – 10:10	Introductory Tutorial to Quantum Communication
10:10 – 11:10	Practical Quantum Communication training (interactive)
11:10 – 11:30	Coffee Break
11:30 – 12:00	Tutorial on QKD
12:00 – 13:00	Demo 1: QKD over fibre link and lab tour (hands-on)
13:00 – 14:30	Lunch break
14:30 – 15:20	Tutorial on Ground to Space communication
15:20 – 16:40	Demo 2: QKD over free-space link and lab tour (hands-on)
16:40 – 17:00	Coffee Break
17:00 – 18:30	QC&QKD Applications Open Discussion and Closing

Course Trainers

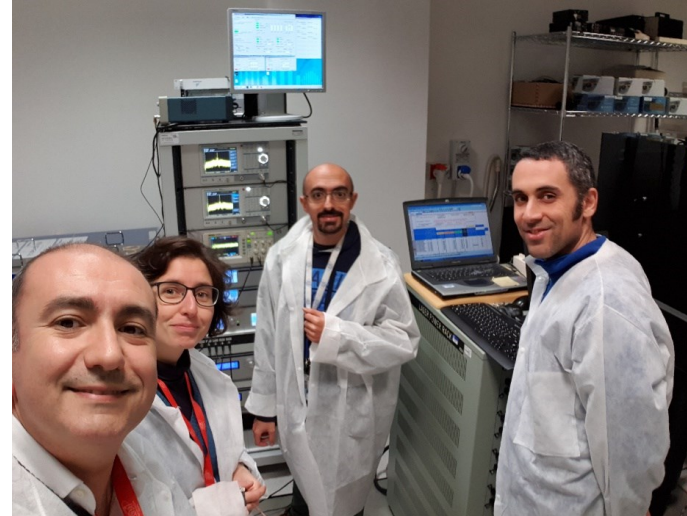
Course Director: Dr. Natalia Bruno
Course Manager: Daniela Selisca



**Quantum
Communication:**
Tecla Gabrielli,
Tommaso Occhipinti
Natalia Bruno

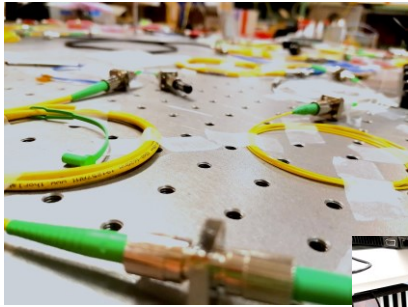


QKD
Demo 1
Demo 2:
Domenico Ribezzo
Saverio Francesconi

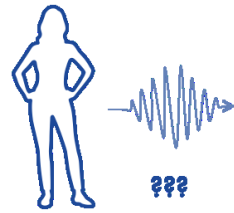


**Ground to Space
communication: Dr.**
Mario Siciliani de Cumis
(collaboration with ASI)

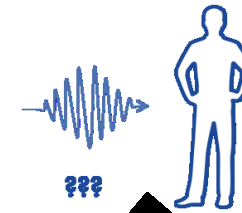
Course Demonstrators



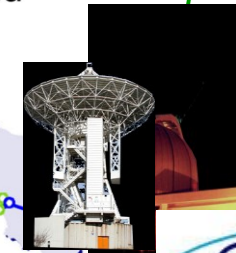
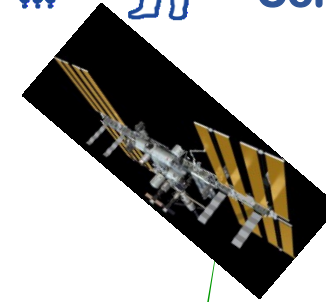
QKD
Demo 1:
Fibre based



$$\frac{1}{\sqrt{2}}|0\rangle|1\rangle + \frac{1}{\sqrt{2}}|1\rangle|0\rangle$$



Quantum
Communication



Ground to Space
communication



QKD
Demo 2:
Free-Space



Course Location, Schedule & Cost



CNR-INO Headquarters of Arcetri
Largo Fermi 6, 50125 – Firenze



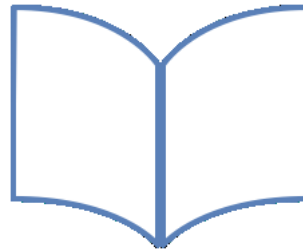
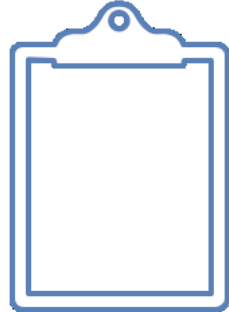
- Course Schedule (January, May, October – exact dates to be confirmed)
- Number of people (Groups of 5-10 people per course)
- Course Cost (250 Euros per person, including catering for lunch and coffee break and project consumables, e.g. course material, material for virtual lab-tour in case of travel restrictions)

Further Information

- Natalia.Bruno@ino.cnr.it
- www.quantumcommunications.ino.cnr.it
- www.ino.it

Course Material (technical hand-outs)

- Course slides provided in pdf on complimentary USB flash drive
- Course notes provided in pdf on complimentary USB flash drive
- Course bibliography



Keywords

Quantum Communication, Quantum Network, Cryptography, Photonics, Photon source, Lasers Entanglement, Secure Communication, Quantum Key Distribution, Communication, Ground to Space Communication, Space, Security

Technology & application areas

Applications: Information & Communications, Smart Cities & Smart Living

“Digital Infrastructure” (Visible Light Communication systems, Quantum Key Distribution systems, Single photon sources for Quantum Communication, Quantum Key Distribution systems (fibre & free-space), Entangled-photon sources for quantum enhanced technologies, Single photon sources for Quantum Communication) and **“Safety, security, space and defence”** (Entanglement-assisted communication systems)

Technologies: Free-Space Photonic Components & Systems, Glass & Polymer Specialty Fiber & Fiber Devices