

PhotonHub Demo Centre

Course 01

Quantum Communication applications

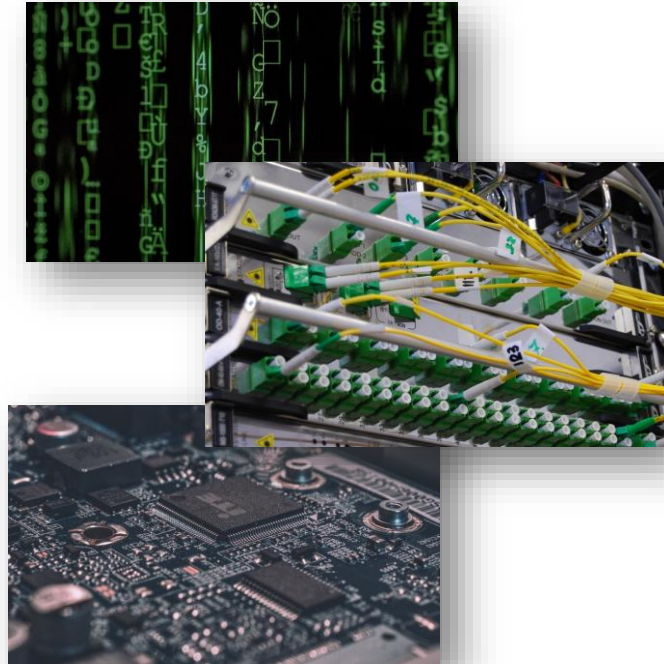
Course Provider

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) 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 QKD Applications

Course Schedule

Time	Demo Activity
9:00 – 10:00	Welcome
10:00 – 10:30	Introduction Tutorial on Quantum Communication
10:30 – 11:00	Practical Quantum Communication training
11:00 – 11:20	Coffee Break
11:20 – 12:00	Tutorial on Quantum Key Distribution
12:00 – 13:00	State of the art on Quantum Key Distribution
13:00 – 14:30	Lunch break
14:30 – 15:00	Use cases of Quantum Key Distribution
15:00 – 16:00	Quantum Key Distribution – BB84 (hands-on demo – over free-space link) (half group)
15:00 – 16:00	Remote demo QKD (fibre based Quantum Key demo) and Open Q&A (half group)
16:00 – 16:30	Coffee Break
16:30 – 17:30	Quantum Key Distribution – BB84 (hands-on demo – over free-space link) (half group)
16:30 – 17:30	Remote demo QKD (fibre based Quantum Key demo) and Open Q&A (half group)

Course Trainers

Course Director: Dr. Natalia Bruno

Course Manager: Daniela Selisca

Trainers:

Davide Bacco

Natalia Bruno

Tecla Gabbrielli

Marco Menchetti

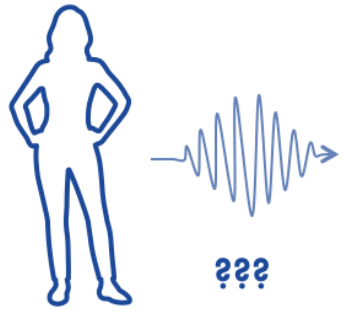
Marco Pinel

Domenico Ribezzo

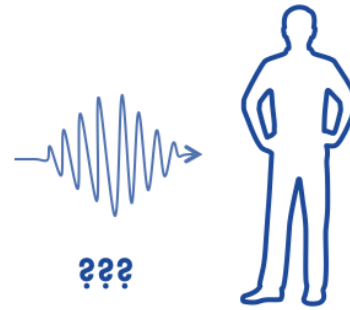
Ilaria Vagniluca



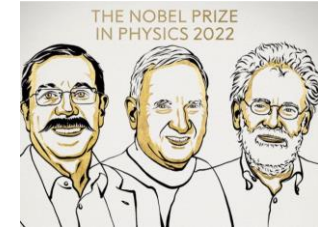
Course Demonstrators



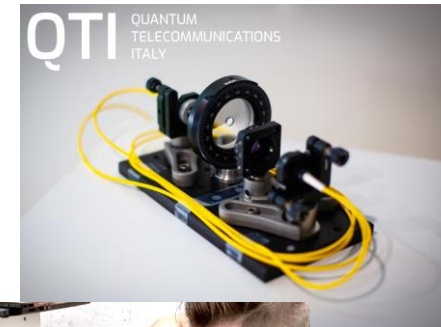
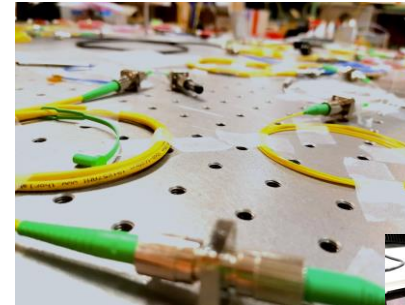
$$\frac{1}{\sqrt{2}} |0\rangle |1\rangle + \frac{1}{\sqrt{2}} |1\rangle |0\rangle$$



**Quantum
Communication**



**QKD
Demo 1:
BB84**



**QKD
Demo 1:
Fibre based QKD
system**



Course Location, Schedule & Cost



Villa 'Il Gioiello' (aka as Villa Galileo)

Via Pian dei Giullari 4 – Firenze

https://en.wikipedia.org/wiki/Villa_II_Gioiello



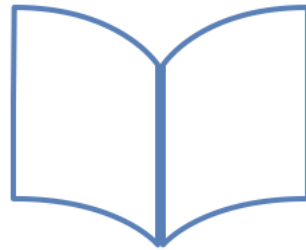
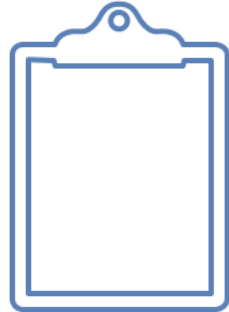
- Course Schedule (November, May – exact dates to be confirmed)
- Number of people (Groups of 5-10 people per course)
- Course Cost : 250 € per person - 150 € for early registrations
including catering for lunch and coffee breaks and project consumables, e.g. course material

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
- Course notes provided in pdf
- Course bibliography



Keywords

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