

Intuitive Quantum Networking



How to share secret information using qubits. Students run BB84 by hand with their own Qubis and try to eavesdrop on each other. Concludes with what actually carries a qubit down a fiber, and why governments are already migrating.

DURATION

2 hours

WITH BREAK

2h 10m

FORMAT

Fully hands-on

AUDIENCE

Grades 10 to 12+

GROUP SIZE

2 per Qubi pair

PREREQ

Fundamentals

0:00 PART 1 BB84

45 min

- 0:00 ○ Framing: sharing a secret with a stranger
- 0:08 ● Bases, hands-on
- 0:18 ● Exercise · Send a key, no eavesdropper
- 0:30 ● Exercise · Introduce Eve
- 0:40 ○ Reconciliation and the error rate

0:45 PART 2 Ekert91

15 min

- 0:45 ○ Entangled pairs as the key source
- 0:50 ○ Exercise · Shake, decode, shout the animal

Break · 10 minutes

1:10 PART 3 The hardware

30 min

- 1:10 ○ What actually carries a qubit
- 1:18 ● Fiber, free space, and loss
- 1:28 ○ Repeaters, and why they are hard

1:40 PART 4 Why it matters now

30 min

- 1:40 ○ Harvest now, decrypt later
- 1:50 ● Post-quantum cryptography versus QKD
- 2:00 ○ Where this is deployed today

WHAT PARTICIPANTS LEAVE WITH

BB84 end to end

Run by hand, including sifting and error estimation.

Why eavesdropping shows

Measurement disturbs, and disturbance is measurable.

The physical layer

What a qubit rides on, and why distance is the limit.

The real timeline

Harvest-now-decrypt-later, and what migration involves.

Quantum Machine Learning

Where quantum computing meets machine learning, and which parts of that claim survive contact with real hardware.

DURATION

2h 20m

WITH BREAK

2h 30m

FORMAT

Worked examples

AUDIENCE

Gr 11+ / undergrad

MATERIALS

No Qubis required

PREREQ

Fundamentals

0:00 PART 1 Introduction to quantum algorithms

60 min

- 0:00 ○ State of quantum computing
- 0:20 ● The problem with noise
- 0:40 ○ Overview of quantum algorithms

Break · 10 minutes

1:10 PART 2 Introduction to QML

45 min

- 1:10 ○ Encoding data
- 1:19 ● Feature transforms
- 1:28 ● Linear algebra
- 1:37 ● Topological data analysis
- 1:46 ○ Quantum neural networks

1:55 PART 3 Use case exploration

35 min

- 1:55 ○ Use case discussion
- 2:04 ● Techniques discussion
- 2:13 ● Implementation walkthrough
- 2:22 ○ Discussion and implications

WHAT PARTICIPANTS LEAVE WITH

Where the hardware stands

What today's machines can do, and what noise costs.

Getting data in

Why encoding is the bottleneck, not the algorithm.

The linear-algebra core

What QML actually accelerates, and under what assumptions.

A worked use case

End to end, from problem statement through implications.