

Presentation of the Quantum Communications axis Eleni Diamanti, CNRS, UPMC



Quantum communications	
Eleni Diamanti	LIP6
Anthony Leverrier	INRIA
Sara Ducci	MPQ
Julien Laurat	LKB
Pascale Sennelart	C2N

24 groups in 15 laboratories

C2N, GEMaC, INRIA, IRCP, INRIA, INSP, IRIF, LAC, LCF, LIP6, LKB, LPA, LPS, LTCI, MPQ

Quantum communication is used for transferring states carrying quantum information between distant locations

This allows performing tasks impossible to achieve by classical means



Resources

Photonic sources, detectors
Quantum channels
Light-matter interfaces

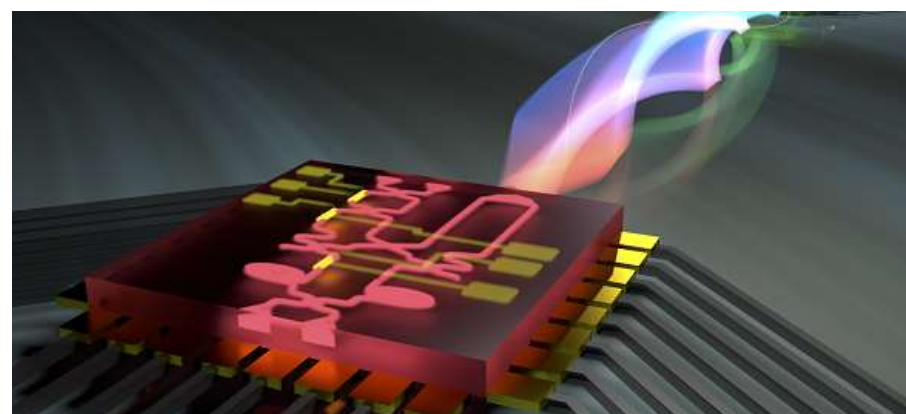
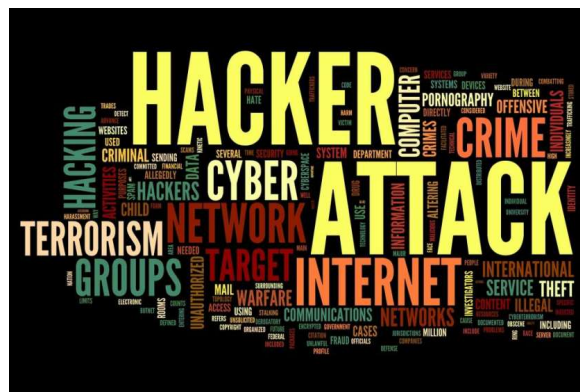
Security

Untrusted network users
and untrusted devices

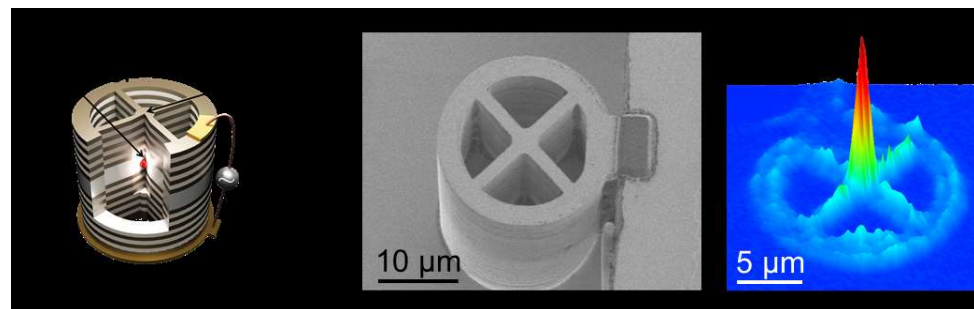
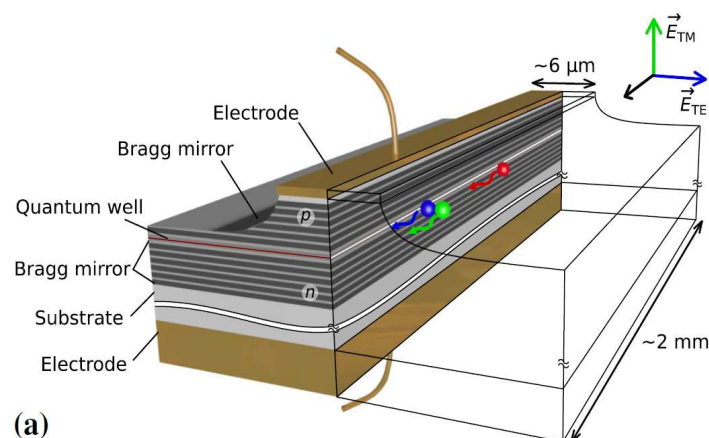
Tasks

Realistic conditions
Protocol implementations with
provable quantum advantage

High-security applications, advanced photonic technologies,
distributed computing

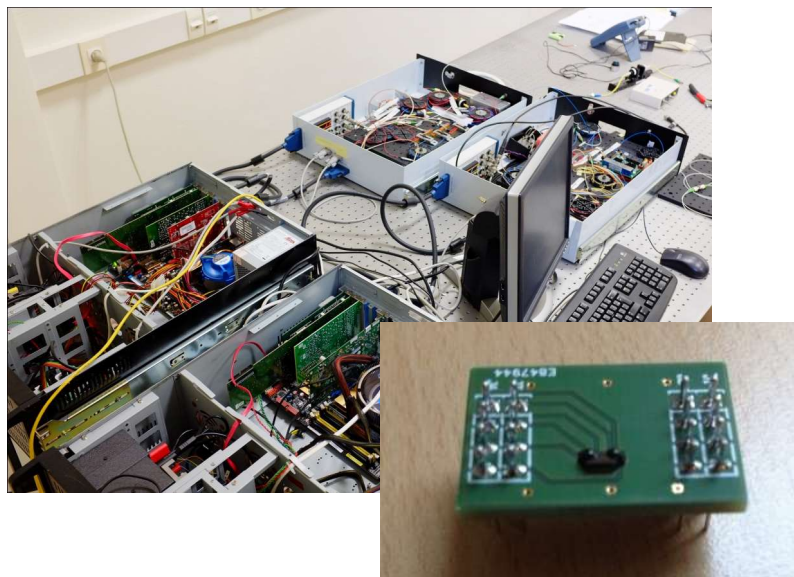


Semiconductor quantum dots for single and entangled-photon generation (C2N)



AlGaAs sources with electrical injection Polarization, energy-time entanglement (MPQ)

Frequency combs (LKB)
Photonic crystal fibers (LTCI, LCF)
Spin-photon coupling, NV centers (LPA, C2N)
Superconducting detectors (CEA, C2N)
Also INSP, GeMAC



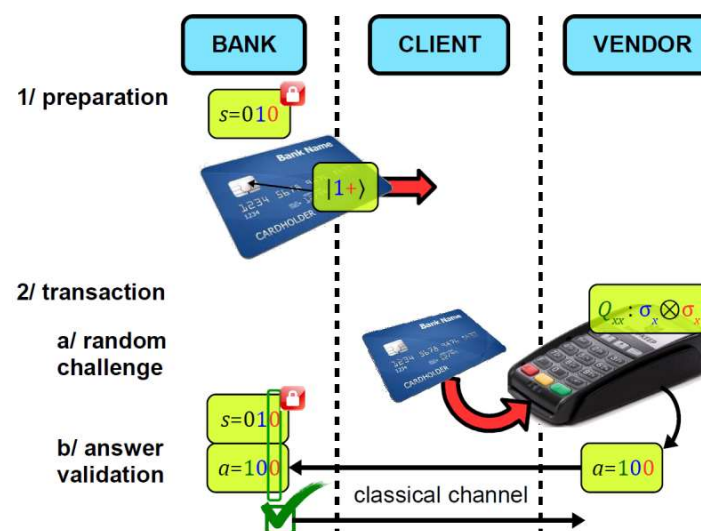
Continuous-variable (CV) QKD
Long-distance, Si photonic integration, high speed systems (LCF, LIP6, C2N)
Unconditional security proof (INRIA)

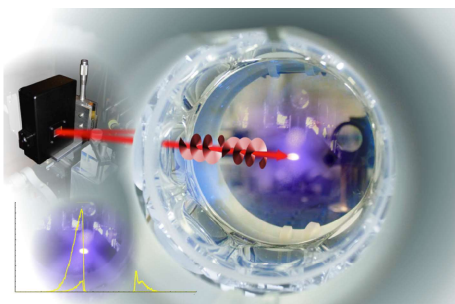
Multi-user entangled QKD with AlGaAs source (MPQ, LTCI)

Quantum cryptography toolbox

Relativistic, position-based, coin flipping, quantum money, communication complexity, hybrid, entanglement verification, ...
(PCQC - IRIF, INRIA, LIP6, LAC, LTCI)

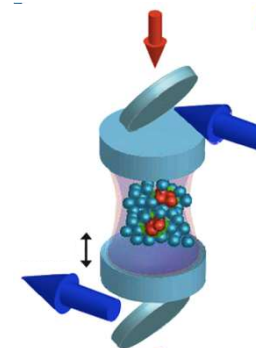
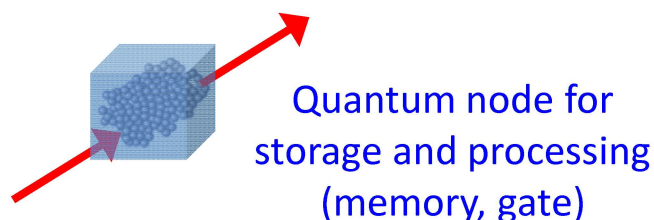
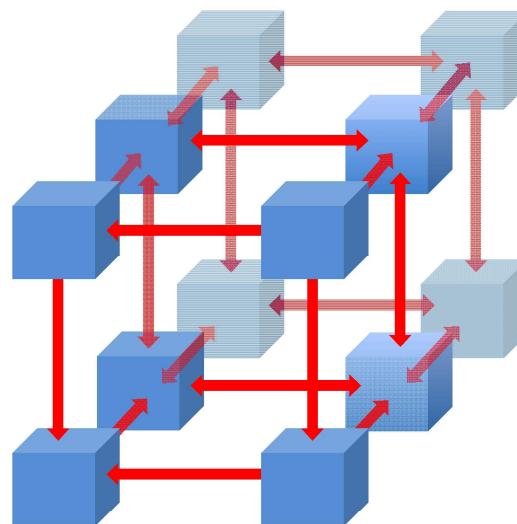
Post-quantum cryptography (INRIA, IRIF, LIP6)





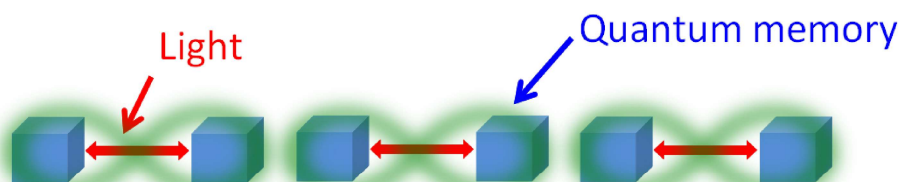
Cold atom quantum memories
High efficiency, multimode,
nanofiber and free space (LKB)

Rare earth doped crystals
New protocols, materials
(LAC, IRCP)



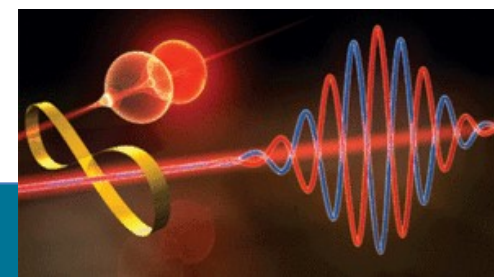
**Single-photon
switch/transistor with
Rydberg atoms (LCF)**
Also LKB, CdF, C2N

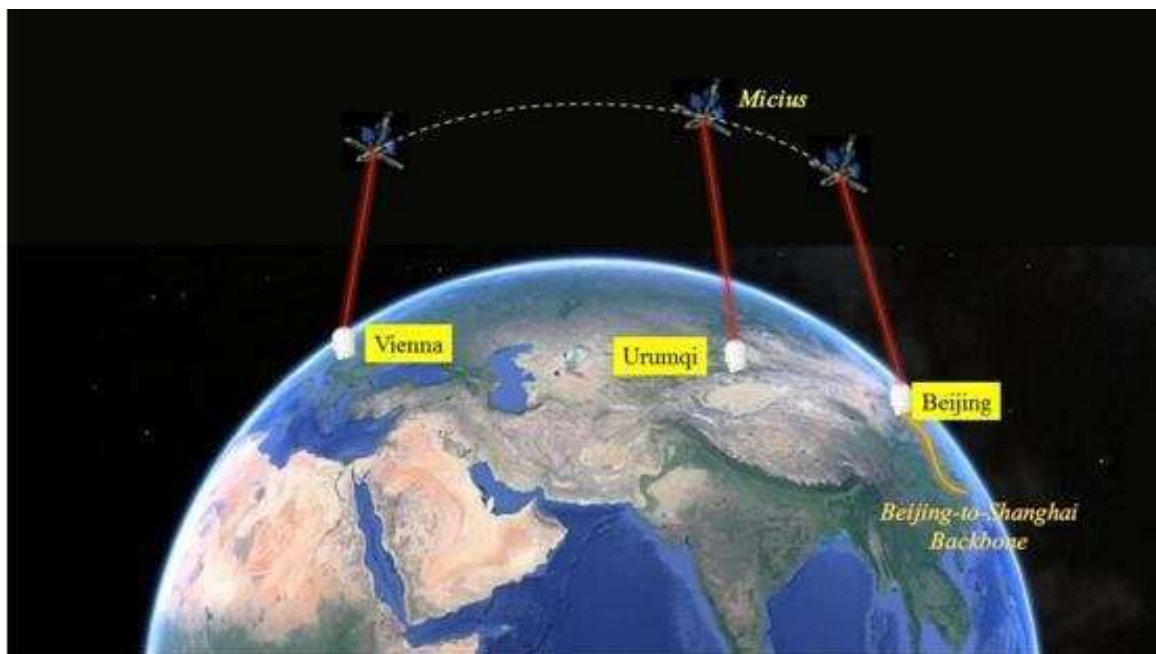
Hybrid technologies
CV-DV and other interfaces
for heterogeneous networks
(LCF, LKB, MPQ, LIP6)



Quantum repeater for long-distance communication

Figure credits: J. Laurat





Exciting times!

World leading research groups

Formidable potential for collaborations in complementary topics in quantum communications

Expanding industry links

