

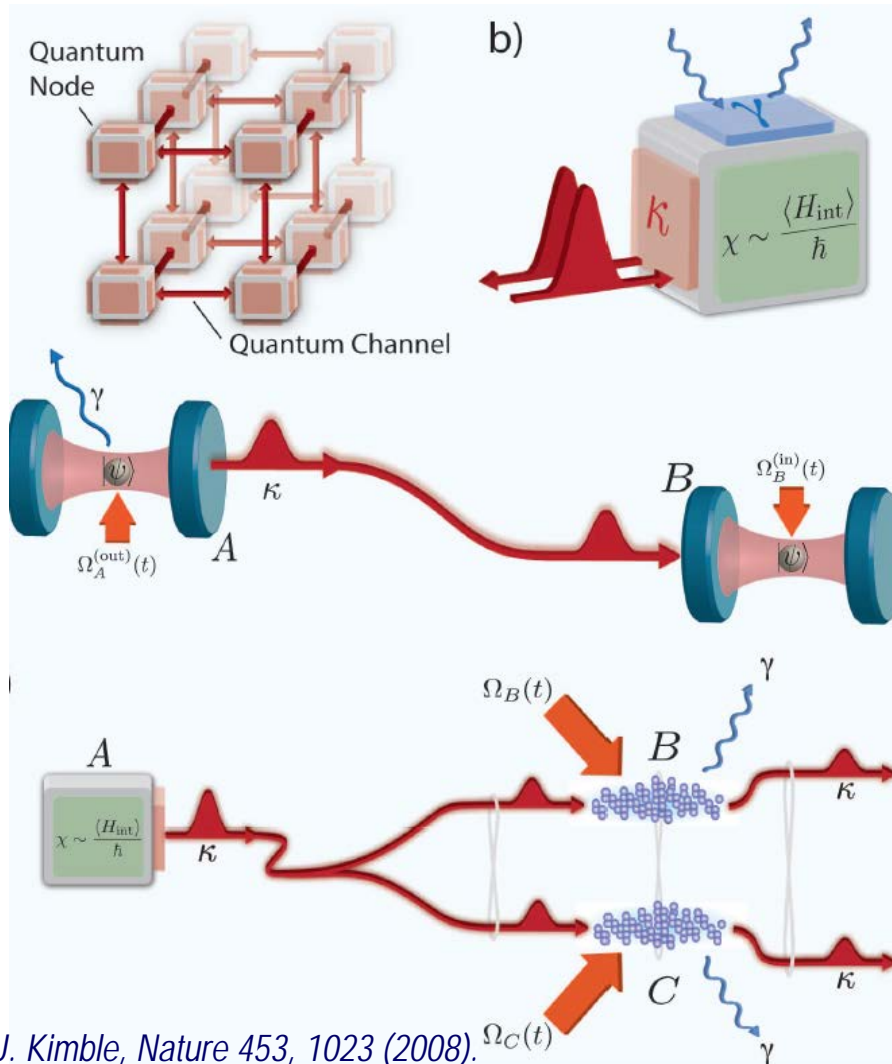
Working Group 1: Generation, detection, manipulation & storage of quantum states of light at the nanoscale

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University of Technology of Troyes (UTT)

& Félix Bussièrès
University of Geneva & IdQuantique



The dream of a quantum internet



-Quantum nodes & quantum channels

-Interaction box: light-matter

-Entanglement between nodes

-Quantum memories

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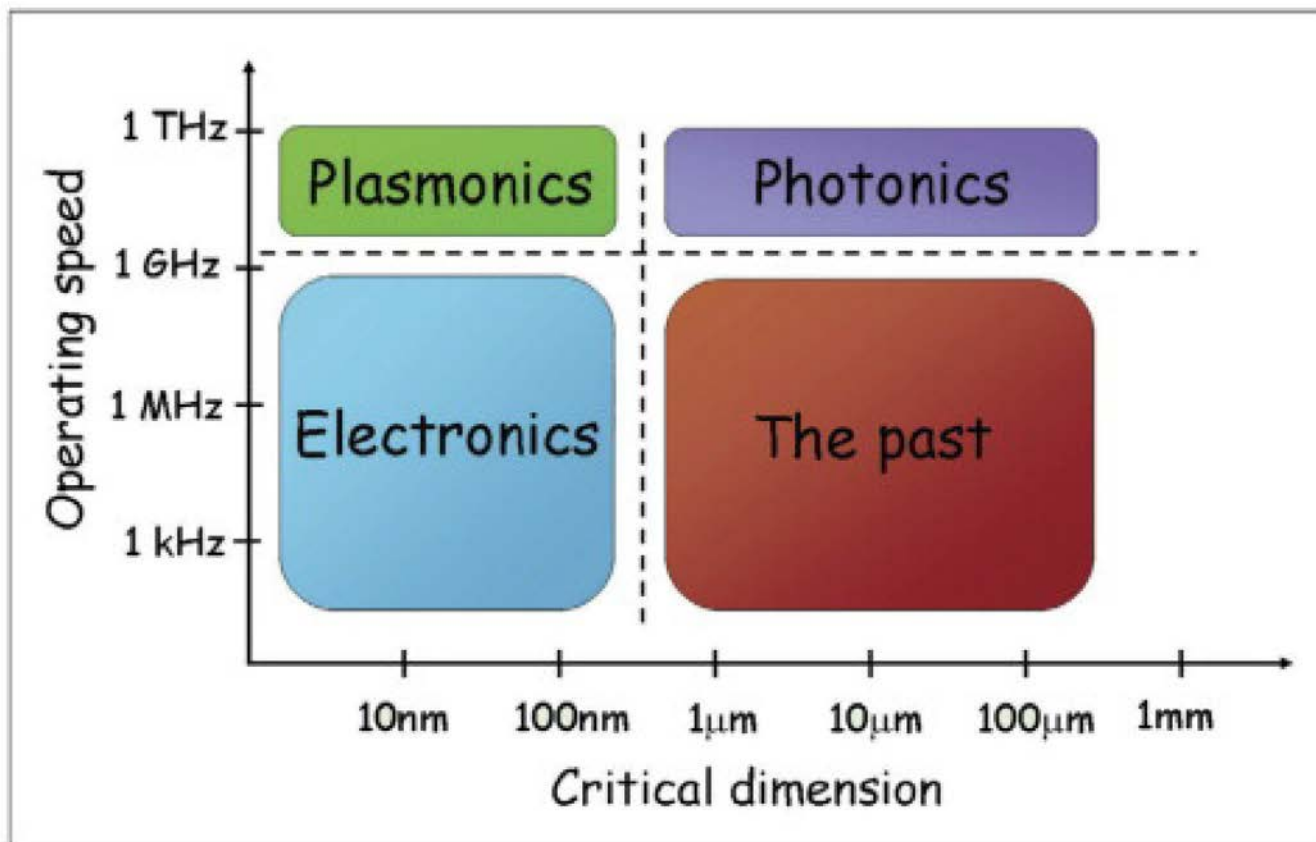


Many platforms
& aspects



Nano-optics & nanophotonics

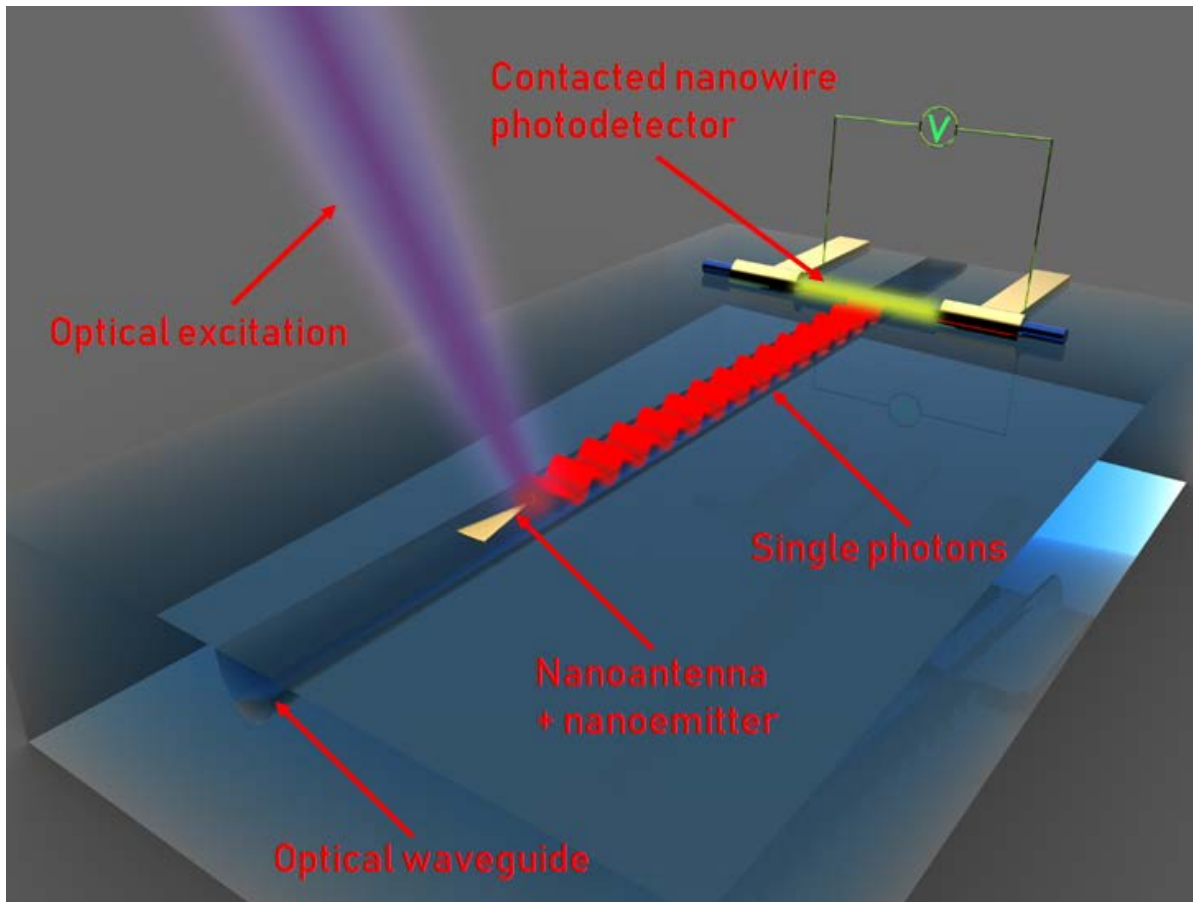
📦 Harnessing nano-objects instead of single atoms





Combining for applications

Full integration and quantum nanophotonics



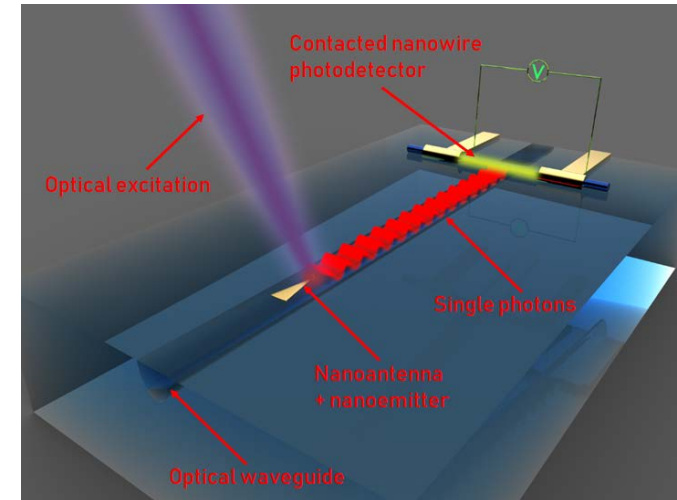


WG1 sections

1- Single-photon sources

**2- (Superconducting)
single-photon detectors**

**3- Manipulation and storage
of single photons**

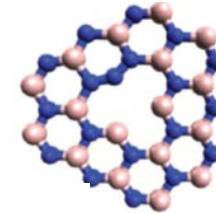




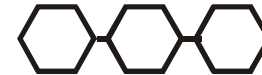
1- Single photon sources

📁 Main challenges to address

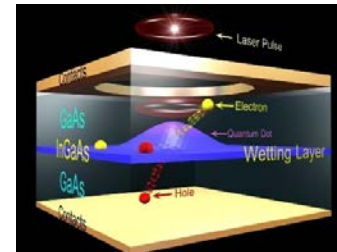
- Truly on demand
- High throughput
- Coherent & indistinguishable photons
- Telecom photons
- Integrated into optical waveguides & fibres



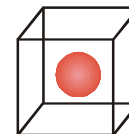
2D materials



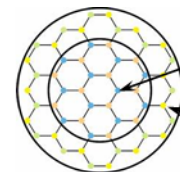
Molecule



Quantum dot



Coloured center

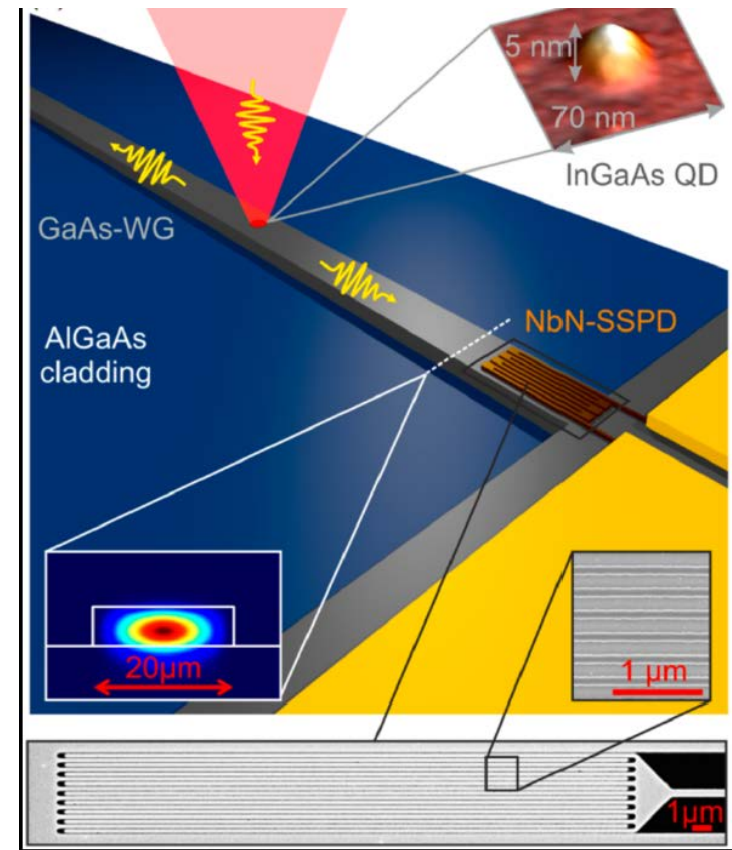


Nanocrystal

2-Single photon detectors

📁 Main challenges to address

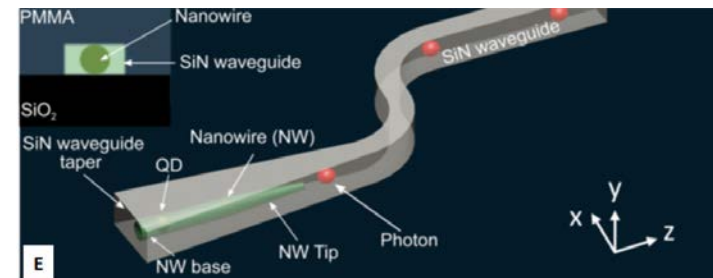
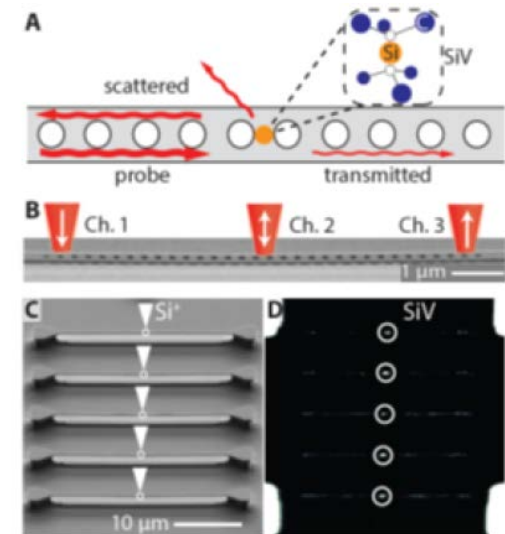
- Even more efficient
- Fast
- Telecom photons
- Avoid (too) low temperatures
- « Integratable » to other platforms



3-Manipulation & storage

📁 Main challenges to address

- Low loss
- Fast & reliable
- Telecom photons & compatible with optical fibres
- Integratable & scalable
- Long storage times
- Preserve properties: statistics, wavelength, coherence
- Telecom or convertible



Targeting applications

Multidisciplinary approach

- Engineering: quantum & nano
- Material science & engineering
- Training quantum engineers and scientists
- Standardisation & norms
- Market study
- Developing products!



Market Research Study in Nanoscale Quantum Optics

COST Action MP1403 "Nanoscale Quantum Optics (NQO)", TEMATYS

WG1 events

📅 Specific WG1 events during the COST NQO

- 2015: Single Photon Workshop in Geneva
- 2016: Single Photons Single Spins (SPSS) in Oxford (with WASPS)
- 2017: Single Photons Single Spins II (SPSS) in Troyes (with WG3), 80 participants
- To appear in 2019: Nature Reviews Physics article on « Applications of Single Photons »:
 - Introduction
 - Quantum cryptography
 - Quantum computing
 - Quantum metrology
 - Foundations of quantum mechanics
 - Single photons and biology



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Questions





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