PhoG PROJECT 820635

QUANTUM Basic science

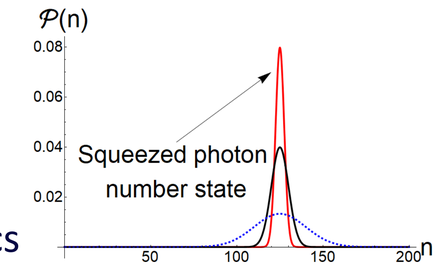
SUB-POISSONIAN PHOTON GUN BY COHERENT DIFFUSIVE PHOTONICS

INTRODUCTION

- Goal: to deliver deterministic and compact sources of highly non-classical states, **from sub-Poissonian light to multi-mode entanglement**, all using a single technological platform of integrated **waveguide networks with engineered loss.**
- We will build working prototypes and develop the technological foundation for the applications of the **Pho**ton **G**un (**PhoG**) sources in advanced **optical imaging and metrology.**

WHY?

- **Sub-Poissonian statistics** and **multi-partite entanglement** for a range of applications: **deterministic source**
- Applications:
  - Metrology
  - Atomic clocks
  - Imaging
  - Simulations of complex dynamics
  - "Cheap" quantum source for quantum technologies

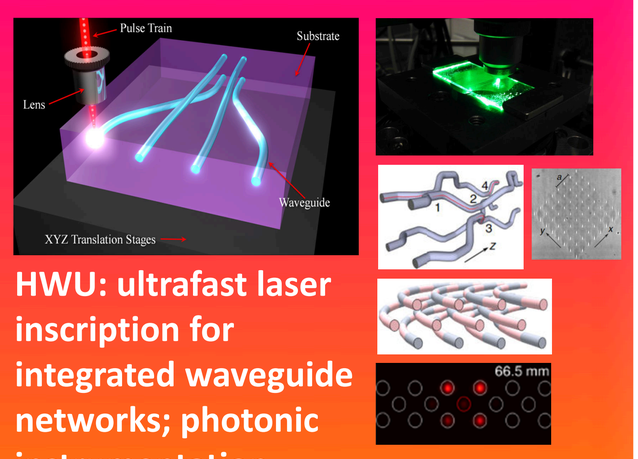


HOW?

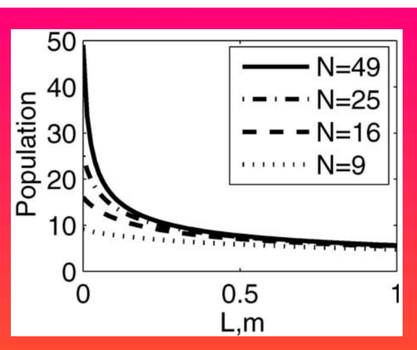
- Unique light propagation regimes using **coherent diffusive photonics** operating within **dissipatively coupled waveguide networks** in linear and non-linear glass materials (laser inscribed waveguide systems).
- Key: the linear and non-linear **engineered loss**
- Devices built using **ultrafast laser inscription**

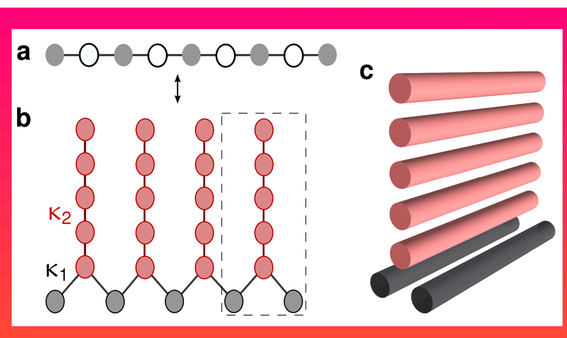
PHYSICS

- Dissipative coupling can drive towards non-classical states. Enables effects such as: entanglement generation; decoherence protection; optical equalization
- Engineered two-photon loss channel drives towards single-photon steady state
- Light flows diffusively while retaining coherence and entanglement

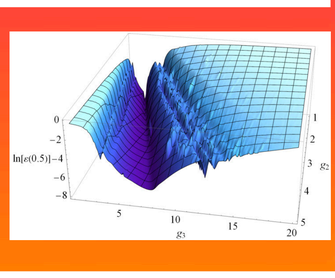


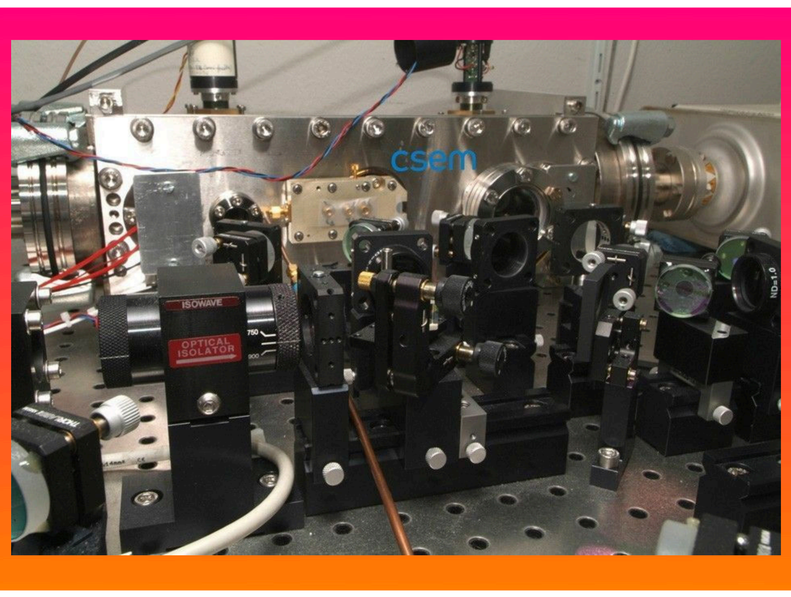
HWU: ultrafast laser inscription for integrated waveguide networks; photonic instrumentation



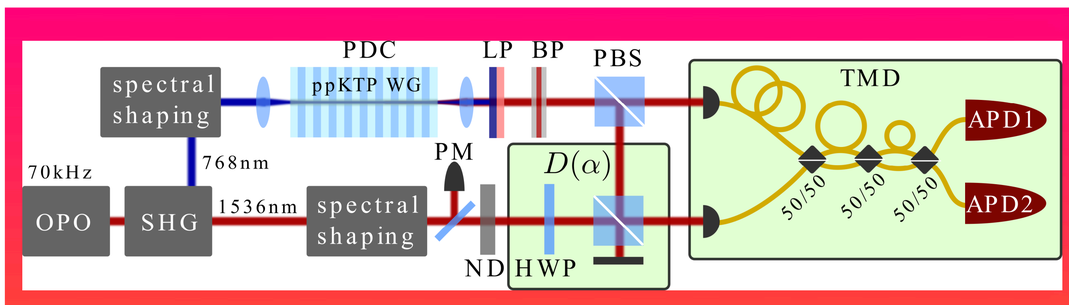


USTAN, IPNASB: quantum correlation flow through coherent-diffusive devices; simulation of complex quantum systems; quantum state generation

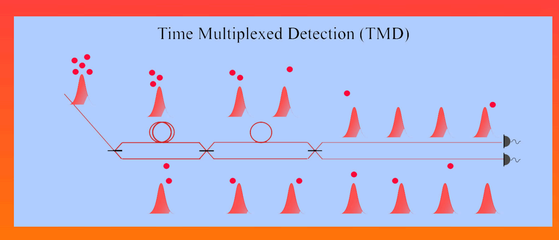




CSEM: time and frequency standards; atomic clocks with quantum-enhanced performance



UPB: quantum diagnostics; alternative platforms towards metrology applications



EXPECTED DELIVERABLES

- Integrated photonic sources in well-defined modes, **with user-selected quantum properties**
- Optical equalizer and quantum networks based on management of quantum correlation flow in waveguide arrays
- **Entanglement-enhanced imaging** with benchmarked improvement in resolution and signal-to-noise ratio (SNR)
- **Atomic clocks** with quantum-entanglement-enhanced frequency stability
- Assessment of **technology benefits** and **roadmap** for metrology applications and TRL expansion

CONSORTIUM

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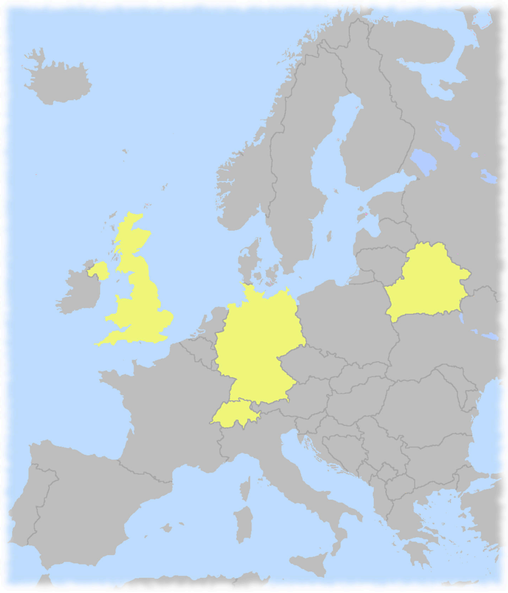

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