Quantum and Linear-Optical Computation Group

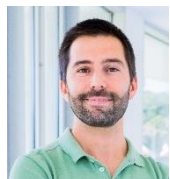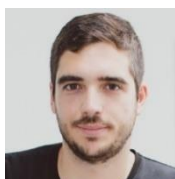INL — INTERNATIONAL IBERIAN NANOTECHNOLOGY LABORATORY

- Founded 2019 (FCT Institutional funding)
- Focuses on Theoretical Quantum computation.
- Over 50 publications + 1 patent

Senior researchers:

Leonardo Novo (interim Group Leader)

Rui Soares Barbosa

Ernesto Galvão (INL/ UFF)

Luis Soares Barbosa (INL/ Uminho/INESC-TEC)

Luís P. Santos (INL/ Uminho/INESC-TEC)
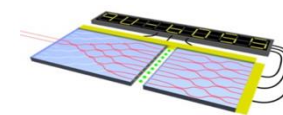
Postdocs:

Lorenzo Catani

Som Kanjilal

Benoît Seron

EC-funded projects:

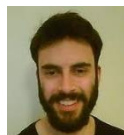EPIQUE

FoQaCiA

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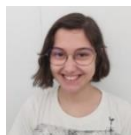**Graduate students:**

Anita Camillini

Rafael Wagner

Eduardo Araújo

Angelos Bampounis

Sara Franco

Niko Wittrock

Michael Oliveira

Alexandra da Costa Alves

Mafalda da Costa Alves

Antonio Ruiz Molero

Diogo Gomes

Manisha Jain

Marco Robbio

Ana Lúcia Barros

Carolina Sobral

Mafalda Couto

Ricardo Silva

+ 3 graduated PhD
6 graduated MSc

National funding:

fct Fundação para a Ciência e a Tecnologia

QUANTUM PORTUGAL INITIATIVE

Co-supervisions:

Universidade do Minho
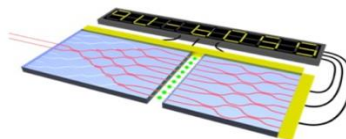
U.PORTO

universidade de aveiro

Photonic Quantum Computation:

- Techniques for **characterizing photonic quantum devices**; **Computational applications** of photonic devices.

- Partners in **EC-funded projects**:

European Photonic Quantum Computer

Quantum advantage via non-linear Boson Sampling

Efficient Verification of QC Architectures with bosons

- Selected publications: Rodari et al. "Semi-Device-Independent Characterization of Multiphoton Indistinguishability." *PRX Quantum*, 2025   Hoch, et al. "Modular quantum-to-quantum Bernoulli factory in an integrated photonic processor." *Nature Photonics*, 2025   Wagner et al, "Coherence and contextuality in a Mach-Zehnder interferometer", Quantum 2024

Foundations of quantum computation:

- **Resources** for quantum computation; Exploring different **quantum computational models**.

- EU-Coordinators of **FOQACIA** project (11 partners from Europe and Canada).

Foundations of QC advantage

- Selected publications: Wagner et al, "Inequalities witnessing coherence, nonlocality, and contextuality", PRA 2024   S Abramsky, RS Barbosa, "The logic of contextuality", CSL 2021

Quantum software engineering (in collaboration with INESCTEC)

- **Quantum algorithms** (optimization, machine learning,…); **Programming languages** & **formal methods**.

- Partners of **EuroQHPC**: integration of quantum computers in supercomputing centers.

- Selected publications: FCR Peres, EF Galvão, "Quantum circuit compilation and hybrid computation using Pauli-based computation", Quantum 2023   A Sequeira, LP Santos, LS Barbosa, "On quantum natural policy gradients" IEEE Transactions on Quantum Engineering, 2024

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Connections to Galicia

- INL–CESGA Quantum Computing Workshop 2023

- Hosted 2 student internships from Universidade da Coruña

- Antonio Ruiz-Molero, PhD student in the group, working with CESGA on qubit characterisation in CESGA's quantum computer

- Involved in joint project proposals with Galicia and Norte region