Elena Callus

postdoctoral researcher

date of birth: 17th July, 1994
nationalities: Maltese & Finnish
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ORCiD: 0000-0001-9650-4390
topics of interest: quantum information theory, quantum computing with continuous-variables, quantum resource theories
date of CV: October 1, 2025

research positions

Sep 2023 – present **postdoctoral researcher**

Friedrich–Schiller–Universität, Jena, Germany

working in the research group of Prof. Martin Gärttner at the Institute of Condensed Matter Theory and Optics (group webpage), with a focus on entanglement in CV systems with a phase-space approach.

Oct 2019 – Jul 2023 **doctoral researcher**

University of Sheffield, United Kingdom

worked in the theory branch of the LDSD group (group webpage), researching quantum optics. specifically, investigated applications of light–matter interaction in entanglement generation and syndrome extraction for quantum error correction, as well as unidirectional photonic transport in waveguide-coupled nanocavities with experimental collaboration.

education

Oct 2019 – Jul 2023 **doctoral candidate (PhD)**

University of Sheffield, United Kingdom

supervised by Prof. Pieter Kok, working in the LDSD group within the Department of Physics & Astronomy. thesis: *Applications of light–matter interaction in semiconductor structures* (link to thesis). defence held on 13th September 2023.

Oct 2014 – Jul 2018 **Bachelor of Science (Honours)**

University of Malta, Malta

joint honours degree in physics & mathematics. graduated with first class honours (*summa cum laude*). bachelor dissertation supervised by Dr André Xuereb: *A quantum perspective on random walks on graphs*.

publications

1. **E. Callus**, M. Gärttner, T. Haas. *Derivatives of phase-space distributions reveal continuous-variable entanglement*. Manuscript in preparation (2025).
2. **E. Callus**, M. Gärttner, T. Haas. *Interferometric detection of continuous-variable entanglement using two states*. Phys. Rev. A **112**, 033704 (2025).
3. N. J. Martin, D. Hallett, M. Duda, L. Hallacy, **E. Callus**, L. Brunswick, R. Dost, E. Clarke, P. K. Patil, P. Kok, M. S. Skolnick, L. R. Wilson. *Purcell-Enhanced, Directional Light–Matter Interaction in a Waveguide-Coupled Nanocavity*. Optica **12** (7), 1100-1108 (2025).
4. **E. Callus**, P. Kok. *Spin-augmented observables for efficient photonic quantum error correction*. Phys. Rev. A **108**, 042613 (2023).
5. **E. Callus**, P. Kok. *Cumulative generation of maximal entanglement between spectrally distinct qubits using squeezed light*. Phys. Rev. A **104**, 052407 (2021).

supervision & teaching

· **co-supervision** of bachelor's thesis of B. Bützker (FSU Jena, 2025). *Entanglement and multimode squeezing in high harmonic generation*.

· **supervision** of master's research internship of F. Armbruster (FSU Jena, 2025). *Separability criteria in continuous-variable systems*.

· **supervision** of summer internship of M. Duda (University of Sheffield, 2022).

· **co-ordinating & teaching** of masters module *Quantum information theory* (FSU Jena, 2025/26).

· **tutor** for *Fundamentals of Modern optics* & *Pre-course in Mathematics* (master's modules), *Optics & waves* (bachelor's module).

service to the scientific community

referee for following international scientific journals: *Physical Review Letters*, *Physical Review A*, *Physical Review B*, *Physical Review Research*, *AVS Quantum Science*.

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