CAMERON CALCLUTH

Website: phys.cam • Email: calcluth@gmail.com

EDUCATION

PhD Candidate | Chalmers University of Technology, Sweden (expected 2025)

Supervisors: Giulia Ferrini (Chalmers University of Technology), Alessandro Ferraro (University of Milan)
Examiner: Göran Johansson (Chalmers University of Technology)
Thesis: *From simulatability to quantum advantage with continuous variable quantum computers.*

As a PhD student, I am researching quantum advantage, which refers to the ability of quantum systems to solve certain problems exponentially faster than classical computers. My work in this field has led to the publication of four research papers, three of which I authored as the lead researcher. I am also actively involved in several ongoing projects investigating the boundaries of what is possible with quantum computing.

Visiting Fellow of the Department | Harvard University (2023)

I was awarded funding to visit Harvard University for three months to visit Professor Arthur Jaffe's group and collaborate with Xun Gao. The project is ongoing and involves exploring the ability of a type of continuous variable circuits to perform certain calculations faster than an equivalent qubit-based circuit.

Theoretical Physics BSc, MPhys (International) | First Class | University of Leeds (2019)

Supervisors: Jacob Sherson (Aarhus, Bachelor Thesis), Zlatko Papić (Leeds, Master Thesis)
Bachelor Thesis: *Gamification of NP-hard spin glass problems and comparison with quantum annealing computers.*
Master Thesis: *Single to many-body quantum scars.*

I graduated with a first class integrated master's degree from the University of Leeds. I also spent a year at Aarhus University as part of an Erasmus study abroad programme.

PUBLICATIONS

CC, A. Ferraro, J. Bermejo-Vega, O. Hahn, G. Ferrini, (in preparation). *Classical algorithm to simulate realistic Gottesman-Kitaev-Preskill states that scales inversely to level of squeezing.*
CC, N. Reichel, A. Ferraro, G. Ferrini, 2024. *Sufficient condition for universal quantum computation using bosonic circuits.* PRX Quantum 5, 020337.
CC, A. Ferraro, G. Ferrini, 2023. *Vacuum provides quantum advantage to otherwise simulatable architectures.* Phys. Rev. A 107, 062414.
CC, A. Ferraro, G. Ferrini, 2022. *Efficient simulation of Gottesman-Kitaev-Preskill states with Gaussian circuits.* Quantum 6, 867.
L. García-Álvarez, **CC**, A. Ferraro, G. Ferrini, 2020. *Efficient simulatability of continuous-variable circuits with large Wigner negativity.* Phys. Rev. Research 2, 043322.

INVITED TALKS

2024	Sufficient condition for universal quantum computation using bosonic circuits.
	Central European Workshop on Quantum Optics, Olomouc, Czech Republic.
2024	From simulatability of continuous variable quantum computation to universality with GKP states.
	WACQT Review May Meeting, Gothenburg, Sweden.
2023	Vacuum provides quantum advantage to otherwise simulatable architectures.
	NONGAUSS Workshop, Olomouc, Czech Republic.
2023	From simulatability of continuous variable quantum computation to universality with GKP states.
	MIT QIP group meeting, MA, USA.
2023	Vacuum provides quantum advantage to otherwise simulatable architectures.
	Prof. Arthur Jaffe's group meeting at Harvard, MA, USA.

CONTRIBUTED TALKS AND POSTER PRESENTATIONS

2023	Vacuum provides quantum advantage to otherwise simulatable architectures. Poster presentation. QIP, Ghent, Belgium.
2022	Vacuum provides quantum advantage to otherwise simulatable architectures. Contributed talk. QMATH, UC Davis, CA, USA.
2022	Vacuum provides quantum advantage to otherwise simulatable architectures. TQC, University of Illinois, IL, USA.
2021	Efficient simulation of Gottesman-Kitaev-Preskill states with Gaussian circuits. Online presentation. Q-Tech-2020. (delayed one year due to the pandemic)
2021	Efficient simulation of Gottesman-Kitaev-Preskill states with Gaussian circuits. Online presentation. APS March Meeting.

FUNDING

2023	Barbro Osher Endowment grant for a three-month visit to Harvard University. 125,000 SEK (€11,000).
2023	Chalmersska forskningsfonden grant for a three-month visit to Harvard University. 26,400 SEK (€2,300).
2023	Royal Swedish Academy of Sciences general physics scholarship for my visit to Harvard and QIP2023. 100,000 SEK (€8,700).
2017-2019	Laidlaw research and leadership scholarship which allowed me to carry out two summers of undergraduate research and attend leadership training events. University of Leeds. £10,000.

AWARDS

2020	SciCommHack award for best science communication project.
2019	University of Leeds Beaumont Award for undergraduate research.
2019	Highly commended at the Global Undergraduate Awards

UNIVERSITY SERVICE

2023-2024	Member of EDI-WACQT, a programme designed to promote equality, diversity, and inclusion in quantum technology departments across Sweden.
2019	Union representative for over 500 students, University of Leeds.

TEACHING EXPERIENCE

Note: as part of my PhD, I have taught approximately 20% of the time. I have been a TA on the following courses.

2021-2024	Modern Physics (MCC175/MCC176)
2020-2023	Quantum Mechanics (TIF290)
2020-2021	Quantum Optics and Quantum Information (FKA173)
2020-2021	Introduction to Linux (FYD500)

MASTER PROJECT SUPERVISION

Alex Maltesson. *Study of producing resourceful quantum states via modular combinations of two-qubit circuits.* (Co-supervisor: Giulia Ferrini.)

Eduardo Alberto Bardales España. *Characterization of intrinsic error channel in Gottesman-Knill-Preskill codes* (Co-supervisors: Giulia Ferrini, Timo Hillmann.)

Nicolas Reichel. *Finding magic in continuous-variable quantum computing.* (Co-supervisor: Giulia Ferrini.)

GRADUATE COURSES

Note: I have taken a total of 61 European credits (ECTS) since the start of my PhD in 2019, corresponding to 20% of the PhD.

Stockholm University / KTH (2024)
Algebraic Topology (7.5 ECTS)

RWTH Aachen University (2024)
Quantum Theory from Information Principles (5 ECTS)

Chalmers University of Technology (2020-2023)
WACQT laboratory course in quantum technology (6 ECTS) | Advanced quantum algorithms (7.5 ECTS)
Teaching, learning and evaluation (3 ECTS) | Complexity Theory: Classical and Quantum (7.5 ECTS)
Algorithms for machine learning and inference (7.5 ECTS) | Writing for publication (4.5 ECTS)
WACQT summer school in quantum technology (1.5 ECTS) | Career and personal development courses (6 ECTS)
Sustainable development: values, technology in society, and the researcher (3 ECTS)

University of Copenhagen (2019)
Summer school: Quantum Communication and Computation with Continuous Variables (2.5 ECTS)

University of Leeds (2018-2019)
Quantum Information Science (7.5 ECTS) | Quantum Field Theory (7.5 ECTS)
Quantum Many-Body Physics (7.5 ECTS) | General Relativity (7.5 ECTS)

Aarhus University (2017-2018)
Particle Physics II (10 ECTS) | Quantum Mechanics II (10 ECTS)
Programming and Numerical Methods (10 ECTS) | Quantum Engineering II (10 ECTS)

EXTRA TRAINING

2018-2019   Alumni Mentoring Programme, University of Leeds. Paired with a successful CEO of a technology
                   company.

LANGUAGES

English (native, C2)
Swedish (advanced, C1)

REFERENCES

Assoc. Prof. Giulia Ferrini   Assoc. Prof. Alessandro Ferraro
Department of Microtechnology and Nanoscience   Department of Physics
Applied Quantum Physics Laboratory   Via Celoria, 16
Chalmers University of Technology   20133 Milano
412 96 Gothenburg   Italy
Sweden