Charlotte G. L. Bøttcher

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Google Scholar

Education

1. **PhD, Physics** Harvard University — 2017 – May 2022
2. **MA, Physics** Harvard University — 2017 – May 2022
3. **Special Student Program, Physics** Harvard University — 2016 – 2017
4. **BS, Physics** University of Copenhagen, Niels Bohr Institute — 2013 – 2016

Research Position

1. **Assistant Professor, Applied Physics** Stanford University — Starting position January 2025
2. **Post-Doctoral Associate, Applied Physics** Yale University — September 2022 – present
3. **Post-Doctoral Associate, Physics** Harvard University — May 2022 – September 2022
4. **Intern, IBM Quantum** Yorktown — May 2021 – August 2021
5. **Intern, IBM Quantum** Yorktown — June 2020 – September 2020

Research Experience

1. **Department of Physics**, Harvard University — 2016 – 2022
   Advisor: Prof. Amir Yacoby — Cambridge, MA
   - ▷ Development of new probes of quantum materials: leveraging techniques from circuit quantum electrodynamics to study unconventional superconductors.
   - ▷ Longitudinal spin-photon coupling: coupling of a high-impedance superconducting resonator and spin qubit for scalable long-distance two-qubit coupling.
2. **IBM Quantum**, Yorktown — 2020 – 2021
   Manager: Dr. Patryk Gumann — Yorktown
   - ▷ Interfacing van der Waals (vdW) materials with superconducting resonators: microwave detection of material's internal properties (eg. kinetic inductance) for developing vdW-based voltage-tunable superconducting qubit architectures.
   - ▷ Building and setting up transfer stage, glovebox, and atomic force microscope for processing air sensitive vdW materials.
   - ▷ Developing fabrication recipes for hybrid superconductor-vdW devices.
3. **Research Laboratory of Electronics**, Massachusetts Institute of Technology — 2017 – 2019
   Advisor: Prof. William Oliver — Cambridge, MA
   - ▷ Development of high magnetic-field-resilient planar superconducting resonators in collaboration with Lincoln Laboratory. Designed and measured resonators in the single-photon regime in presence of high DC magnetic fields.

4. **Center for Quantum Devices**, Niels Bohr Institute 2013 – 2016
   Advisor: Prof. Charles Marcus Copenhagen, DK

   ▷ Study of the superconductor-insulator transition in a new platform; a superconductor-semiconductor Josephson junction array. Using various tuning parameters (gate-voltage, temperature, magnetic field) to drive transitions into superconducting, metallic and insulating phases and study quantum critical behavior.

   ▷ Development and measurement of new device architectures for determining the effective charge e^* in the Fractional Quantum Hall regime.

5. **Theoretical particle physics and cosmology**, Niels Bohr Institute 2014 – 2015
   Advisor: Prof. Niels Obers Copenhagen, DK

   ▷ Gravity from string theory. Deriving graviton states by considering closed bosonic string states and the effects of placing a single string in the background of many closed strings.

Recognitions

1. IBM PhD fellowship 2019–2021
2. IBM intern stipend spring 2021
3. IBM intern stipend spring 2020
4. Augustinus Foundation 2019 – 2020
5. Knud Højgaard's Foundation 2017
6. Danish National Research Foundation (DNRF) 2016 –2017
7. University of Copenhagen Scholarship 2016 –2017

Publications

1. **C. G. L. Bøttcher**, N. R. Poniatowski, U. Vool, M. Wesson, A. Grankin, V. Galitski, A. Yacoby, "Circuit QED detection of induced two-fold anisotropic pairing in a hybrid superconductor-ferromagnet bilayer." arXiv:2306.08043, submitted to *Nature* (2023).

2. **C.G.L. Bøttcher**, F. Nichele, J. Shabani, C. J. Palmstrøm, C. M. Marcus, "Dynamical vortex transitions in a gate-tunable Josephson junction array," arXiv:2212.08651, accpeted in *Physical Review B* (2022).

3. **C.G.L. Bøttcher**, F. Nichele, J. Shabani, C. J. Palmstrøm, C. M. Marcus, "The Berezinskii-Kosterlitz-Thouless transition and anomalous metallic phase in a hybrid Josephson junction array," arXiv:2210.00318, submitted to *Physical Review Letters* (2022).

4. **C.G.L. Bøttcher**, S. P. Harvey, S. Fallahi, G. C. Gardner, M. J. Manfra, U. Vool, S. D. Bartlett, A. Yacoby, "Parametric longitudinal coupling between a high-impedance superconducting resonator and a semiconductor quantum dot singlet-triplet spin qubit," *Nature Communications* **13**, 4773 (2022), arXiv:2107.10269.

5. N.R. Poniatowski, J.B. Curtis, **C.G.L. Bøttcher**, V.M. Galitski, A. Yacoby, P. Narang, and E. Demler, "Surface Cooper pair spin waves in triplet superconductors," *Physical Review Letters* **129**, 237002 (2022), arXiv:2112.12146.

6. L. D. Alegria, **C. G. L. Bøttcher**, A. K. Saydjari, A. T. Pierce, S. H. Lee, S. P. Harvey, U. Vool, A. Yacoby, "High-energy quasiparticle injection into mesoscopic superconductors," *Nature Nanotechnology* **16**, 404-408 (2021), arXiv:2005.00584.

7. S. P. Harvey, **C. G. L. Bøttcher**, L. A. Orona, S. D. Bartlett, A. C. Doherty, A. Yacoby, "Coupling two spin qubits with a high-impedance resonator," *Physical Review B* **97**, 235409 (2018), arXiv:1801.04858.

8. L. A. Orona, J. M. Nichol, S. P. Harvey, **C. G. L. Bøttcher**, S. Fallahi, G. C. Gardner, M. J. Manfra, A. Yacoby, "Readout of Singlet-Triplet Qubits At Large Magnetic Field Gradients," *Physical Review B* **98**, 125404 (2018), arXiv:1802.07627.

9. **C.G.L. Bøttcher**, F. Nichele, M. Kjaergaard, H. J. Suominen, J. Shabani, C. J. Palmstrøm, C. M. Marcus, "Superconducting, insulating and anomalous metallic regimes in a gated two-dimensional semiconductor- superconductor array," *Nature Physics* **14**, 1745-2481 (2018), arXiv:1711.01451.

Manuscripts in Preparation

1. **C. G. L. Bøttcher**, N. R. Poniatowski, U. Vool, M. Wesson, A. Grankin, V. Galitski, A. Yacoby, "Enhancement of magnon-photon coupling in a mesoscopic superconductor-ferromagnet bilayer."

2. **C. G. L. Bøttcher**, B. Cava, A. Yacoby, P. Gumann, "Microwave detection of superconductivity in monolayer WTe_2."

Research Talks

1. "Interfacing quantum information and quantum sensing" — December 4, 2022
   NYU Physics Seminar, **talk** — New York, New York

2. "Towards detecting unconventional superconductivity using cQED techniques" — September 12, 2022
   QSC Thrust meeting, **talk** — presented virtually

3. "New avenues in cQED: from quantum information to quantum sensing" — April 30, 2022
   SCQTF conference at Clemson 2022, **talk** — Clemson, South Carolina

4. "New avenues in cQED: Towards long range coupling between semiconductor spin qubits" — April 19, 2022
   NYU Physics Seminar, **talk** — New York, New York

5. "Longitudinal coupling between a superconducting resonator and a singlet-triplet qubit" — March 14, 2022
   APS March Meeting 2022, **talk** — Chicago, Illinois

6. "Using circuit QED techniques for the study of quantum matter" — December 2, 2021
   Yale Quantum Institute Seminar (*invited*), **talk** — Yale, New Haven

7. "Hybrid WTe_2 quantum devices" — January 28, 2021
   Harvard Quantum Initiative, **talk** — presented virtually

8. "Superconducting resonators for quantum information and quantum sensing" — December 12, 2020
   11th International Conference on Quantum Dots, **talk** — presented virtually

9. "Field resilient resonators as highly sensitive detectors" — July 15, 2019
   Les Houches Summer School 2019, **poster** — Les Houches, France

10. "Using magnetically resilient circuit QED techniques to study 2D materials" March, 2019
APS March Meeting 2019, **talk** Boston, MA

11. "Magnetic field resilient resonators as highly sensitive detectors" August, 2018
Laboratory for Physical Sciences Quantum Computing Program Review, **poster** Denver, CO

12. "Scalable spin qubit device with a high-impedance resonator" March, 2018
APS March Meeting 2018, **talk** Los Angeles, CA

13. "Coupling two spin qubits with a high-impedance resonator" July, 2017
Laboratory for Physical Sciences Quantum Computing Program Review, **talk** San Diego, CA

14. "Measuring the superconductor-insulator transition in a semiconductor-superconductor Josephson junction array" July, 2016
University of Copenhagen, **talk** Copenhagen, DK

15. "Superconductor-insulator transition in a semiconductor-superconductor Josephson junction array"
Workshop on Localization, Interaction, and Superconductivity, June, 2016
Landau Institute, **poster** Chernogolovka, Russia

16. "Pumping quasiparticles in the Fractional Quantum Hall regime and measure the effective charge e^*" May, 2015
Danish National Research Foundation, **talk** Copenhagen, Denmark

Refereed Manuscripts

1. "Introduction to Quantum Error Correction and Fault Tolerance"
Steve M. Girvin, SciPost (2022)

Organized Conferences

1. Co-organizing "The 2nd South Carolina Quantum Technology Forum (SCQTF)". April, 2023
April 14-15, Clemson University South Carolina.

2. Co-organized "The 1st South Carolina Quantum Technology Forum (SCQTF)". April, 2022
April 29-30, Clemson University South Carolina.

Teaching Experience

1. **Research mentor for IBM intern**, a Harvard undergraduate student Summer 2021
IBM Quantum, Yorktown

▷ Developed and assigned research project on superconducting circuits: project involves designing new superconducting qubit architectures based on incorporating vdW materials using microwave simulation programs (Sonnet and COMSOL).

2. **Teaching Assistant**,PHYS 15b PSI lab: Electromagnetism. Spring 2019
Harvard University

▷ Helped develop weekly laboratory assignments and deliver course material through lab sections.

3. **High school exchange visit program**, Danish high school students. Fall 2018 and 2019
Harvard University

▷ Delivered high-level lectures on quantum information visit program.