



Exponent®
Engineering & Scientific Consulting

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Professional Profile

Emma Batson, Ph.D. is a consultant in the Electrical Engineering practice at Exponent with expertise in the design, modeling, fabrication, testing, and characterization of sensors and microelectronics. In particular, she has deep expertise in the cleanroom fabrication of superconducting single-photon detectors and readout circuits for the quantum computing industry. She has 8 years of experience designing and testing nanoscale superconducting microwave circuits and 6 years of cleanroom and microscopy experience.

Prior to joining Exponent, Dr. Batson received her Ph.D. in electrical engineering at the Massachusetts Institute of Technology. As a doctoral student, she developed fabrication methods and characterization protocols to create superconducting single-photon detectors in novel materials with desirable properties for integration into quantum systems, including electrochemically doped indium tin oxide for transparency at telecommunications wavelengths and magnesium diboride for higher operating temperatures. She developed and tested models for the origins of intrinsic device noise to support these efforts. She also managed and maintained high-vacuum and cryogenic laboratory systems.

Dr. Batson has also built automated control systems for quantum-enhanced measurements and qubits, developing instrument drivers, custom software-based measurement applications and control scripts, and suitable PID control signals. She has worked for the Electric Power Research Institute (EPRI), with projects including simulating smart inverters implementing the DNP3 SCADA communication standard and performing cyber-security risk modeling with based on the NIST 800-53 control standard.

Dr. Batson has extensively operated typical semiconductor cleanroom tools used for device fabrication and characterization and developed processes which use vacuum deposition (magnetron sputtering, ALD, PECVD, thermal and electron-beam evaporation), spin coating, photo- and electron-beam-lithography, ion etching (RIE, IBE), electron microscopy (SEM, STEM with EDS and EELS), and other assorted analytical methods (XRD, XPS, FT-IR, AFM, ellipsometry, profilometry). She is familiar with electrical and multiphysics modeling languages and tools including Python, MATLAB, COMSOL, Sonnet, and LTSpice.

Academic Credentials & Professional Honors

Ph.D., Electrical Engineering, Massachusetts Institute of Technology (MIT), 2026

M.S., Electrical Engineering, Massachusetts Institute of Technology (MIT), 2022

B.S., Electrical Engineering and Physics, Massachusetts Institute of Technology (MIT), 2020

Graduate Research Fellowship Program, National Science Foundation, 2021-2026

Prior Experience

Graduate Research Assistant, Quantum Nanosystems and Nanostructures Group, Massachusetts Institute of Technology, Cambridge, MA 2020-2026

Pathways Intern, Faint Photonics Group, National Institute for Standards and Technology, Boulder, CO, 2024

Qubit by Qubit Teaching Assistant, The Coding School, Cambridge, MA, 2021-2022

Contractor, Electric Power Research Institute, Knoxville, TN, 2020

Undergraduate Research Assistant, Engineering Quantum Systems Lab, Massachusetts Institute of Technology, Cambridge, MA, 2019-2020

Intern, Quantum Information Science Laboratory, Science Undergraduate Laboratory Internships program at Oak Ridge National Laboratory, Oak Ridge, TN, 2019

Intern, Quantum-Enabled Computation Group, Lincoln Laboratory, Lexington, MA, 2018

Publications

Parzuchowski KM, Mueller E, Oripov BG, Hampel B, Chowdhury R, Patel S, Kuznesof D, Batson E, Morgenstern R, Hadfield R, Verma V, Shaw M, Allmaras J, Stevens M, Gurevich A, McCaughan A. [Reaching the intrinsic performance limits of superconducting nanowire single-photon detectors up to 0.1 mm wide](#). Optica 20206; 13(8): 1649–1657.

Incalza F, Castellani M, Paul D J, Simon A, Batson E, Mondin D, Medeiros O, Berggren KK. [Fast-recovery epitaxial NbN superconducting nanowire single-photon detectors with saturated efficiency at 1550 nm in liquid helium](#). Nano Letters 2026; 26(21):6848–6856.

Simon A, Foster R, Sahoo M, Shi J, Batson E, Incalza F, Castellani M, Medeiros O, Heil C, Berggren KK. [Ab initio modeling of nonequilibrium dynamics in superconducting detectors and qubits](#). Physical Review B 2025;112:174512.

Warner HK, Holzgrafe J, Yankelevich B, Barton D, Poletto S, Xin CJ, Sinclair N, Zhu D, Sete E, Langley B, Batson E, Colangelo M, Shams-Ansari A, Joe G, Berggren K K, Jiang L, Reagor M, Loncar M. [Coherent control of a superconducting qubit using light](#). Nature Physics 2025; 21:831–838.

Simon A, Foster R, Medeiros O, Castellani M, Batson E, Berggren KK. [Characterizing and modeling the influence of geometry on the performance of superconducting nanowire cryotrons](#). IEEE Transactions on Applied Superconductivity 2024; 35(5):1–5.

Kim C, Bell C, Evans J M, Greenfield J, Batson E, Berggren KK, Lewis NS, Cunnane DP. [Wafer-scale MgB2 superconducting devices](#). ACS nano 2024; 18(40):27782–27792.

Batson E, Incalza F, Castellani M, et al. [Effects of helium ion exposure on the single-photon sensitivity of MgB2 and NbN detectors](#). IEEE Transactions on Applied Superconductivity 2024; 34(7):0600906.

Charaev I, Batson E, Cherednichenko S, Reidy K Darkinskiy V, Yu Y, Lara-Avila S, Thomsen J D, Colangelo M, Incalza F, Ilin K, Schilling A, Berggren KK. [Single-photon detection using large-scale high-temperature MgB2 sensors at 20 K](#). Nature Communications 2024; 15(3973).

Colangelo M, Zhu D, Shao L, Holzgrafe J, Batson E, Desiatov B, Medeiros O, Yeung M, Loncar M, Berggren KK. [Molybdenum silicide superconducting nanowire single-photon detectors on lithium niobate waveguides](#). ACS Photonics 2024; 11(2)356–361.

Batson, E, Colangelo M, Simonaitis J, Gebremeskel E, Medeiros O, Saravanapvanantham M, Bulovic V, Keathley PD, Berggren KK. [Reduced ITO for transparent superconducting electronics](#). Superconducting Science and Technology 2023; 36(5).

Pooser RC, Savino N, Batson E, Beckey JL, Garcia J, Lawrie BJ. [Truncated nonlinear interferometry for quantum-enhanced atomic force microscopy](#). Physical Review Letters 2020; 124(23):230504.

Presentations

Batson E, Simon A, Allmaras J, Incalza F, Jacquillat A, Mondin D, Kogler E, Castellani M, Zhan E, Dinesh S, Paul DJ, Heil C, Berggren KK. Fluctuations near the current-induced transition in magnesium diboride meanders. Oral presentation, High Temperature Superconductors in High Frequency Fields Workshop, Nashville, TN, 2026.

Batson E, Simon A, Jacquillat A, Allmaras J, Foster R, Incalza F, Zhan E, Castellani M, Cunanne D, Cherednichenko S, Berggren KK. Fluctuations and dark count origins in superconducting nanowires. Invited Talk, EXCESS25@Low Temperature Detectors Workshop, Santa Fe, NM, 2025.

Batson E, Incalza F, Jacquillat A, Paul DJ, Kim C, Charaev I, Cunnane D, Cherednichenko S, Berggren KK. Fabricating high-temperature superconducting electronics in MgB₂. Oral presentation, Applied Superconductivity Conference, Salt Lake City, UT, 2024.

Batson E, Paul DJ, Charaev I, Zhou T, Colangelo M, Medeiros O, Cherednichenko S, Berggren KK. Superconducting nanowire devices in novel materials. Invited Talk, High Temperature Superconductors in High Frequency Fields Workshop, Giardini Naxos, Italy, 2023.

Charaev I, Batson E (presenter), Incalza F, Colangelo M, Drakinsky V, Lara-Avila S, Cherednichenko S, Berggren KK. Electrical Characterization of Micron-Wide Magnesium Diboride Wires for SuSPDs. Oral presentation, European Conference on Applied Superconductivity, Bologna, Italy, 2023.

Batson E, Colangelo M, Simonaitis J, Gebremeskel E, Medeiros O, Saravanapavanantham M, Nordlander J, Anderson M, Ortega Ortiz E, King M, Hurst S, Mundy J, Bulovic V, Keathley D, Berggren KK. Electrochemically Reduced ITO as a Transparent Superconductor. Oral presentation, Applied Superconductivity Conference, Honolulu, HI, 2022.

Additional Education & Training

Kaufman Teaching Certificate Program, MIT, 2024.

Peer Reviews

Reviewer for Nano Express, Physica Scripta, European Conference on Applied Superconductivity - IEEE