Nick Materise

Current Position

01/2024–Present **Staff Scientist**, *LLNL*, Livermore, CA.
- Design and measurement of novel superconducting quantum devices
- Investigating correlated errors in superconducting circuits
- Calibration of single and two qubit gates for warm-dense matter quantum simulation

Education

08/2018–12/2023 **PhD Applied Physics**, *Colorado School of Mines*, Golden, CO.
- Advised by Dr. Eliot Kapit
- Thesis title: *Design of tunable couplers and investigation of materials loss mechanisms in 2D and 3D superconducting systems*

09/2011–05/2016 **B.S. Electrical Engineering & Physics**, *Northeastern University*, Boston, MA.
Minor in Mathematics, *magna cum laude*

Research Experience

06/2016–08/2018 **Computer Scientist**, *LLNL*, Livermore, CA.
- Experimental Focus: developing drivers for superconducting qubit hardware, performing qubit characterization, and 3D cavity measurements
- Theory / Computational Focus: modeling dissipation in superconducting circuits with finite element solvers, integro-differential equations, and circuit quantum electrodynamics approaches

07/2015–12/2016 **Materials Science Co-op**, *LLNL*, Livermore, CA.
Purpose: To simulate theoretical sources of noise in superconducting qubits

03/2014–03/2015 **Research Assistant**, *Northeastern University*, Boston, MA.
Focus: To accelerate the calculation of periodic metamaterial structures using GPUs

07/2013–12/2013 **Quantum Information Co-op**, *Raytheon BBN Technologies*, Cambridge, MA.
Focus: To develop low-latency signal demodulation firmware for superconducting qubit readout

06/2012–12/2012 **Research Experience for Undergraduates**, *Northeastern University*, Boston, MA.
Focus: To develop an efficient adaptive integration routine for parallel architectures.

Other Professional Experience

07/2014–12/2014 **Rocket Exhaust Plume Modeling Co-op**, *Spectral Sciences, Inc.*, Burlington, MA.
Focus: To augment existing computational tools for inspection of rocket plume spectra.

Awards and Honors

10/2024 **Postdoc Research SLAM! Finalist**, *LLNL, Livermore, CA.*

10/2023 **NIST NRC Postdoctoral Fellowship Awardee**, *NIST Boulder.*

09/2018–12/2023 **Graduate Fellowships for Science, Technology, Engineering, and Mathematics Diversity**, *Colorado School of Mines.*

03/2014–05/2016 **NSF Cybersecurity Scholarship for Service**, *Northeastern University.*

Publications

Journals

[1] E. T. Holland, Y. J. Rosen, **N. Materise**, N. Woollett, T. Voisin, Y. M. Wang, S. G. Torres, J. Mireles, G. Carosi, and J. L DuBois. High-kinetic inductance additive manufactured superconducting microwave cavity. *Applied Physics Letters*, 111(20):202602, 2017. DOI: https://doi.org/10.1063/1.5000241.

[2] S.G. Jones, **N. Materise**, K.W. Leung, J. C. Weber, B. D. Isakov, X. Chen, J. Zheng, A. Gyenis, B. Jaeck, and C.R.H. McRae. Grain size in low loss superconducting Ta thin films on c axis sapphire. *Journal of Applied Physics*, 134(14):144402, 10 2023. DOI: https://doi.org/10.1063/5.0169391.

[3] **N. Materise**, M.C. Dartiailh, W.M. Strickland, J. Shabani, and E. Kapit. Tunable capacitor for superconducting qubits using an InAs/InGaAs heterostructure. *Quantum Science and Technology*, 8(4):045014, 2023. DOI: https://dx.doi.org/10.1088/2058-9565/aceb18.

[4] **N. Materise**, S. Charkam, Y. Lu, J. Koch, and E. Kapit. Field overlap integral method to estimate static and driven interaction rates in superconducting circuits, 2024. Manuscript in preparation.

[5] C. G. Torres-Castanedo, D. P. Goronzy, T. Pham, A. McFadden, **N. Materise**, P. Masih Das, M. Cheng, D. Lebedev, S. M. Ribet, M. J. Walker, D. A. Garcia-Wetten, C. J. Kopas, J. Marshall, E. Lachman, N. Zhelev, J. A. Sauls, J. Y. Mutus, C. R. H. McRae, V. P. Dravid, M. J. Bedzyk, and M. C. Hersam. Formation and microwave losses of hydrides in superconducting niobium thin films resulting from fluoride chemical processing. *Advanced Functional Materials*, 34(36):2401365, 2024. DOI: https://doi.org/10.1002/adfm.202401365.

Conferences

[1] Y. Ukidave, F. N. Paravecino, L. Yu, C. Kalra, Z. Chen, A. Momeni, **N. Materise**, B. Daley, and D. Kaeli. NUPAR: A Benchmark Suite for Modern Heterogeneous Architectures. In *International Conference on Performance Engineering*, 2015. DOI: https://doi.org/10.1145/2668930.2688046.

[2] **N. Materise**. An Introduction to Superconducting Qubits and Circuit Quantum Electrodynamics. In *Proceedings of the 2nd Workshop on Microwave Cavities and Detectors for Axion Research*, 2018. DOI: https://doi.org/10.1007/978-3-319-92726-8_10.

Technical Reports

[1] J. L DuBois, G. Carosi, N. Woollett, E. Holland, M. Horsley, D. Qu, **N. Materise**., O. Drury, G. Chapline, and S. Friedrich. Report to Lincoln Labs on TWPAs, 2017. Lawrence Livermore National Laboratory, DOI: https://doi.org/10.2172/1399728.

Patents

[1] E. Kapit, **N. Materise**, and J. Shabani. Tunable capacitor for superconducting qubits, U.S. Patent Application No. 17/564,789, December 2020.

[2] E. Kapit, S. Chakram, **N. Materise**, and J. Koch. Galvanic Coupling Element for 3D Superconducting Cavities, U.S. Patent Application No. Not Assigned, February 2023.

Conference & Workshop Talks

11/2022–11/2023 **American Vacuum Society International Symposium**.

10/2022 **Superconducting Quantum Materials & Systems Center Meeting**, *Batavia, IL*.

03/2018–03/2023 **American Physics Society March Meeting**.

01/2017, 08/2015 **Microwave Axion Dark Matter Experiment Cavity Workshop**, *Livermore, CA*.

09/2012 **Massachusetts Green High Performance Computing Center Workshop**.

Professional Activities

08/2018–Present **Journal Referee**, *Applied Physics Letters, Physical Review Applied, Nature Physics, Physical Review Letters, Physical Review A, New Journal of Physics*.

2024 **Chair of Hiring Committee**, *LLNL, Livermore, CA*.

Software and Hardware Skills

Languages: Python, C, Julia, LaTeX, OpenCL, CUDA, VHDL, Mathematica, Bash Scripting

Modeling Software: COMSOL, Ansys HFSS, SolidWorks, AutoDesk Inventor

Lab Skills: Oscilloscopes, waveform generators, multimeters, soldering, vector network analyzers, spectrum analyzers (scalar), cryogenic systems, manual and automatic wirebonding