

# WILLIAM D. KALFUS

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## EDUCATION

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| AUG 2020 -<br>PRESENT  | Yale University, New Haven, CT<br><i>Ph.D. Applied Physics</i><br>Advisor: Prof. Rob Schoelkopf<br>Current Research: Novel methods for high-fidelity control of logical qubits encoded in bosonic modes of a superconducting cavity   | GPA not yet assigned                                     |
| SEP 2015 -<br>MAY 2020 | Northeastern University, Boston, MA<br><i>B.S. Electrical Engineering, Minor in Physics</i> <ul style="list-style-type: none"><li>• Summa Cum Laude</li><li>• Elected to Tau Beta Pi</li><li>• President of IEEE Student Chapter, arranged weekly seminars and workshops</li><li>• Lead Engineer of Northeastern University IEEE Micromouse Robotics Team</li><li>• Placed on Dean's List every semester of eligible enrollment</li></ul> | GPA in Major: 3.959/4.000<br>Cumulative GPA: 3.897/4.000 |

## PUBLICATIONS

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- **W. D. Kalfus**, G. J. Ribeill, G. E. Rowlands, H. K. Krovi, T. A. Ohki, L. C. G. Govia, “Neuromorphic computing with single-element quantum reservoirs” (in preparation)
- **W. D. Kalfus**, D. F. Lee, G. J. Ribeill, S. D. Fallek, A. Wagner, B. Donovan, D. Ristè, T. A. Ohki, “High-fidelity control of superconducting qubits using direct microwave synthesis in higher Nyquist zones” [arXiv:2008.02873 \[quant-ph\]](https://arxiv.org/abs/2008.02873) (under review)
- D. Ristè, L. C. G. Govia, B. Donovan, S. D. Fallek, **W. D. Kalfus**, M. Brink, N. T. Bronn, T. A. Ohki, “Real-time processing of stabilizer measurements in a bit-flip code” *npj Quantum Information* 6, 71 (2020); [doi:10.1038/s41534-020-00304-y](https://doi.org/10.1038/s41534-020-00304-y)

## PRESENTATIONS

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- L. Govia, G. Ribeill, **W. Kalfus**, G. Rowlands, H. Krovi, T. Ohki, “Quantum Reservoir Computing with a Single Nonlinear Oscillator”, Special Session on Quantum Reservoirs, International Conference on Neuromorphic Systems, July 2020 (virtual due to pandemic, first author is presenter)
- **W. Kalfus**, D. F. Lee, S. Fallek, G. Ribeill, A. Wagner, M. Gustafsson, T. Ohki, B. Donovan, D. Ristè, “Practical Microwave Direct Digital Synthesis for Superconducting Qubit Control”, Focus Session on Superconducting Qubit Readout, Detection, and Classical Control Electronics, APS March Meeting A36.00004, March 2020, (virtual due to pandemic; [view recording](#))
- D. Ristè, L. C. G. Govia, B. Donovan, S. D. Fallek, **W. D. Kalfus**, M. Brink, N. T. Bronn, J. M. Chow, “Real-Time Decoding of Repeated Stabilizer Measurements in a Bit-Flip Code” APS March Meeting W16.00009, March 2020, Denver, CO (first author is presenter)
- **W. Kalfus**, D. F. Lee, S. Fallek, G. Ribeill, M. Gustafsson, B. Hassick, T. Ohki, B. Donovan, D. Ristè, “Novel Superconducting Qubit Control Hardware Targeted Toward Experiments with Logical Qubits” IARPA LogiQ PI Meeting, July 2019, Denver, CO (Poster)

## RESEARCH AND WORK EXPERIENCE

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- JUL 2018 -  
AUG 2020
- Raytheon BBN Technologies, Cambridge, MA  
*Intern, Quantum Engineering and Computing Group*
- Demonstrated quantum advantage in neuromorphic computing using weakly nonlinear quantum oscillators as computational reservoirs in simulation and experiment
  - Developed scalable technique for control of superconducting qubits using cost-effective direct RF synthesis and demonstrated improved quantum gate error compared to existing methods
  - Designed FPGA logic for digital signal processing of qubit readout pulses
  - Extended open-source quantum programming languages to implement quantum eigensolvers on local superconducting quantum processors
  - Developed software to analyze transmission spectra of extremely-low-loss resonant structures and demonstrate advantages of novel designs and materials
- JUL -  
DEC 2017
- Qubitekk Inc., Vista, CA  
*Researcher and Program Manager*
- Developed real-time quantum error correction protocol for transmission of polarization-entangled photons through telecom single-mode fiber
  - Designed and assembled electro-optical device capable of implementing arbitrary optical elements for realization of quantum error correction protocol
  - Created motor controller for driving optical delay lines in quantum optics experiments
- MAY -  
AUG 2016
- United Parcel Service, Mahwah, NJ  
*Summer Intern, Integration Competency Center*
- Developed plugin for Apache ActiveMQ middleware to prevent reception of unwanted messages from client applications
  - Documented configuration of build reporting software for other departments in order to apply Continuous Integration techniques
- OCT 2015 -  
APR 2016
- Computational Vision Laboratory at Northeastern University, Boston, MA  
*Speech-Language Pathology and Audiology Apprentice*
- Built precision linear camera motion platform to capture stable video for computational analysis
  - Designed headset for optic flow analysis on video streams subject to human-like movement
  - Contributed to software for performing optical experiments on test subjects

## RELEVANT SKILLS AND COURSEWORK

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- **Hardware:** Learned soldering at age 9, capable of detailed and precise surface mount work. Competent in circuit design involving microcontrollers, FPGAs, digital logic, transistors, op-amps, and passive components. Extensive experience with development systems including Arduino and Raspberry Pi. Competent with lab equipment including vector network analyzers, spectrum analyzers, microwave sources, multimeters, and oscilloscopes. Competent with microwave components including mixers, amplifiers, and filters.
- **Programming Languages:** Python (including scientific packages), Julia, C/C++ (including embedded frameworks), VHDL, Verilog, Mathematica, MATLAB, Bash, NI LabVIEW, various assembly languages
- **Software:** Altium Designer, Solidworks, Jupyter Notebook, Autodesk Inventor, LTSpice, LaTeX, Xilinx Vivado, NI AWR/Microwave Office, EagleCAD, Microsoft Office (Word, Excel, PowerPoint)
- **Selected Undergraduate Coursework (*italics indicate graduate-level*):** *Nanophotonics, Quantum Mechanics, Micro- and Nanofabrication, Particle and Nuclear Physics, Hardware and System Security, Wireless Communication Circuits, Noise and Stochastic Processes*

## SELECTED INDEPENDENT TECHNICAL PROJECTS

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| SEP 2018 -<br>FEB 2019 | Electric Bicycle — <a href="http://billykalfus.com/electric-bicycle">billykalfus.com/electric-bicycle</a> <ul style="list-style-type: none"><li>• Designed custom electronics for monitoring battery pack status and bicycle speed</li><li>• Created power system for actuation of motor, headlights, turn signals, and horn</li></ul>   |
| JAN -<br>SEP 2018      | Hi-Fi Audio Amplifier — <a href="http://billykalfus.com/amp">billykalfus.com/amp</a> <ul style="list-style-type: none"><li>• Designed and assembled 24-bit, 192 kHz low-noise desktop digital-to-analog converter with cascaded filter and 100 mW headphone amplifier for high-fidelity audio streaming</li></ul>  |
| MAY 2016 -<br>DEC 2017 | 3D Printer Upgrades and Customization — <a href="http://billykalfus.com/3d-printer">billykalfus.com/3d-printer</a> <ul style="list-style-type: none"><li>• Designed and fabricated 3D printer upgrades including dual extruder, modular tool head, chocolate extruder, and non-stick build plate</li><li>• Modeled designs in Autodesk Inventor, tested prototypes, and revised design for optimal performance and fit</li></ul> |
| SEP 2012 -<br>JUN 2013 | Retro Computer System — <a href="http://billykalfus.com/retro-computer">billykalfus.com/retro-computer</a> <ul style="list-style-type: none"><li>• Designed and assembled retro computer system based on the 6502 processor, implementing custom digital logic for device addressing</li><li>• Wrote and compiled assembly code by hand to run programs and debug system</li></ul>   |

## INTERESTS

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- Eagle Scout
- Member of Mensa at age 17
- Licensed ham radio operator, Technician level (KD2JRQ)
- Conversational in Italian
- Hobbies: working on electronic projects, hiking, rock climbing