Robert Riley Nerem

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EDUCATION

Master of Science, Physics — Expected May 2022
University of Calgary, Calgary, AB
GPA: 3.93
Supervisor: Prof. Barry Sanders, Department of Physics and Astronomy
Co-supervisor: Prof. Peter Høyer, Department of Computer Science

Bachelor of Science, Physics — December 2018
Montana State University, Bozeman, MT
GPA general: 3.90, GPA physics: 3.91
Honors Degree, *summa cum laude*
Minors: Computer Science, Mathematics, Optics and Photonics, Music

PUBLICATIONS

Journal Articles

[1] D.V. Reddy, *R.R. Nerem*, S.W. Nam, R.P. Mirin, and V.B. Verma. Superconducting Nanowire Single-photon Detectors with 98% System Detection Efficiency at 1550 nm, Optica, **7**(12): 1649-1653, 23 November 2020.

[2] L.M. Smith, F. Motta, and 12 others including *R.R. Nerem*. An Intrinsic Oscillator Drives the Blood Stage Cycle of the Malaria Parasite, Plasmodium falciparum, Science, **368**(6492): 754-759, 15 May 2020.

[3] *R.R. Nerem* and D. James. Charged Particle Pickup Tube Detector used in Experimental Applications and Classroom Demonstrations, The Physics Teacher, **58**(3): 200-205, 19 February 2020.

[4] E. Berry, B. Cummins, *R.R. Nerem*, L. Smith, S. Haase, and T. Gedeon. Using Extremal Events to Characterize Noisy Time Series, Journal of Mathematical Biology, **80**: 1523-1557, 1 February 2020.

Conference Papers

[5] D.V. Reddy, *R.R. Nerem*, A.E. Lita, S.W. Nam, R.P. Mirin, and V.B. Verma. Exceeding 95% System Efficiency Within the Telecom C-band in Superconducting Nanowire Single Photon Detectors, Proceedings of CLEO: QELS Fundamental Science, San Jose, United States of America, 5 May 2019 - 10 May 2019.

Preprint

[6] A. Alase, *R.R. Nerem*, M. Bagherimehrab, P. Høyer, and B.C. Sanders. Tight Bound for Estimating Expectation Values from a System of Linear Equations, arXiv:2111.10485, *Submitted* December 2021.

[7] *R.R. Nerem* and D. Gaur. Conditions for Advantageous Quantum Bitcoin Mining, arXiv:2110.00878, *Submitted* November 2021.

[8] P. Crawford-Kahrl*, *R.R. Nerem**, B. Cummins, and T. Gedeon. Genetic Networks Encode Secrets of Their Past, arXiv:2107.12352, *Submitted* August 2021. *

indicates co-first authorship.

[9] *R.R. Nerem*, P. Crawford-Kahrl, B. Cummins, and T. Gedeon. A Poset Metric from the Directed Maximum Common Edge Subgraph, arXiv:1910.14638, October 2020.

TALKS & POSTERS

A. Alase, *R.R. Nerem*, M. Bagherimehrab, P. Høyer, and B.C. Sanders. Conditions for Efficient Quantum Computation of Expectation Values from a System of Linear Equations [poster]. July 7 2021, Conference on the Theory of Quantum Computation, Communication and Cryptography, virtual, Riga, LV.

A. Alase, *R.R. Nerem*, M. Bagherimehrab, P. Høyer, and B.C. Sanders. Conditions for Efficient Quantum Computation of Expectation Values from a System of Linear Equations [poster]. January 30 2021, Conference on Quantum Information Processing, virtual, Munich, DE.

R.R. Nerem and D. Gaur, Quantum Bitcoin Mining [poster]. January 13 - 15, 2021, Quantum Days, virtual, CA.

A. Alase, *R.R. Nerem*, M. Bagherimehrab, P. Høyer, and B.C. Sanders. Conditions for Efficient Quantum Computation of Expectation Values from a System of Linear Equations [poster]. January 13–15, 2021, Quantum Days, virtual, CA.

R.R. Nerem, C.W. Thiel, and R.L. Cone. Spectroscopic Investigation of Europium Doped Crystals for Quantum Information Applications [poster]. April 2018, Montana State University Student Research Celebration, Bozeman, MT.

R.R. Nerem, B. Pommer, A. Marsh, P.J.T. Woodburn, C.W. Thiel, and R.L. Cone. Spectroscopic Investigations of Europium Doped Crystals for Quantum Information Applications [talk]. April 2018, National Conference on Undergraduate Research, Oklahoma City, OK.

R.R. Nerem, A. Marsh, P.J.T. Woodburn, C.W. Thiel, and R.L. Cone. Scanning Fabry-Perot Interferometers For High-Resolution Laser Systems [poster]. September 2017, Optical Science & Engineering Conference, Bozeman, MT.

R.R. Nerem, C.W. Thiel, and R.L. Cone. Development of Low-Cost Scanning Fabry-Perot Interferometers to Characterize High-resolution Laser Systems [poster]. April 2017, Montana State University Student Research Celebration, Bozeman, MT.

The first author indicates the presenter.

RELEVANT COURSES

Graduate

Linear Algebra, Abstract Algebra, General Topology, Algebraic Topology, Quantum Computation, Relativistic Quantum Mechanics, Computational Complexity Theory, Electricity and Magnetism

Undergraduate

Methods of Computational Physics, Advanced Optics, Laser Applications, Concepts In Programming Languages, Advanced Algorithms, Data Structures and Algorithms I & II, Networks, Applied Scientific Computing, Programming with Java, Programming with C, Techniques of Applied Math, Real Analysis I & II

RESEARCH EXPERIENCE

Computation

Quantum Researcher — Fall 2021 → Present
Quantum Algorithms Institute
Surrey, BC

- Aim to analyze and benchmark quantum machine learning algorithms for medical biology

Master's Research — Fall 2019 → Present
Prof. Barry Sanders & Prof. Peter Høyer
Institute for Quantum Science and Technology
University of Calgary, Calgary, AB

- Developed quantum algorithms for estimating expectation values, yielding end-to-end quantum algorithms for solving systems of linear equations
- Proved lower bounds for expectation value problems by reducing from oracle problems with known lower bounds
- Worked closely with a group in biology to determine applicability of machine learning quantum algorithms to pathogen identification problems in medical biology
- Evaluated implications of quantum search algorithms to the security of Bitcoin proof-of-work

Research Assistant — Fall 2018 → Summer 2019
Prof. Tomas Gedeon & Dr. Breschine Cummins, Mathematics
Montana State University, Bozeman, MT

- Developed a poset metric based on maximum common subgraphs to characterize the distance between gene expression time series
- Constructed algorithms to find the maximum common edge subgraph between two node labeled digraphs
- Determined graph structures that are conserved under evolution by vertex duplication, and developed algorithms to identify such structures
- Created Python framework to simulate genetic network evolution and compare resultant graphs with random graph models

Independent Study — Fall 2018
Prof. Linda Antas, Music Technology
Montana State University, Bozeman, MT

- Developed novel music information retrieval algorithm to detect tempo in music with swing

Experiment

Research Assistant — Summer 2018
Dr. Sae Woo Nam, Faint Photonics Group
National Institute of Standards and Technology, Boulder, CO

- Precisely measured efficiency of superconducting nanowire single-photon detectors (SNSPD) using extensive use of Python programming to automate measurements

- Automated measurement of integrated photonic devices using Python to directly interface with layout design software

Research Assistant Fall 2016 → Spring 2018
Prof. Rufus Cone & Dr. Charles Thiel, Physics
Montana State University, Bozeman, MT

- Developed a series of low-cost scanning Fabry-Perot interferometers to evaluate laser performance
- Used absorption and florescence spectrum measurements along with spectral hole burning to determine suitability of europium and thulium doped crystals for quantum information applications

Research Assistant Summer 2015, Summer 2016
Prof. Zoltan Sternovsky & Dr. David James
Institute for Modeling Plasma, Atmospheres and Cosmic Dust
University of Colorado, Boulder, CO

- Fully developed and characterized a pickup tube detector to measure charge and velocity of micron-sized particles in the accelerator housed at IMPACT
- Integrated an array of photomultiplier tubes, including design of high-speed PCB trans-impedance amplifiers, to record acceleration profiles of ablating high-velocity dust particles incident on a gas target

TEACHING EXPERIENCE

Student Fellow Fall 2018
Honors Text & Critics, Montana State University, Bozeman, MT

- Assisted in direction of class discussion and grading of student essays for a freshman honors seminar course

Graduate Teaching Assistant Fall 2019 → Spring 2020
Undergraduate Physics Laboratory, University of Calgary, Calgary, AB

- Graded student reports and directed student experiments in optics and modern physics

COMPUTER SKILLS

Advanced: Python, LaTeX
Basic: Java, C, Matlab, Unix commands

HONORS

Accelerate Scholarship, Mitacs November 2021
Outstanding Senior in Physics, Montana State University May 2019
Department of Physics Nomination for College of Letters and Science
Dean's Award for Academic Excellence, Montana State University February 2019
Undergraduate Scholars Research Grant, Montana State University 2017 → 2019
Dean's List, Montana State University 2014 → 2018
Departmental Scholarship, Montana State University Physics 2017
Eagle Scout, Boy Scouts of America 2014

PERSONAL INTERESTS

Vintage swing dancing, alpine & back-country skiing, long-distance backpacking