Colin Roberts

Colorado State University
Department of Mathematics

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Education

Graduate Education Aug. 2017 - July 2022
Colorado State University
Mathematics Ph.D. Program

Undergraduate Education Aug. 2012 - May 2017
Colorado State University
Bachelor of Science in General Mathematics & Physics

Industry Experience

Staff Research Engineer 2024 – 2025
Pluto

- Led cryptography R&D team developing memory-bound NIVC proving systems and managed open-source cryptography repository with 15+ contributors; researched and implemented secure computation solutions using ZK, MPC, and TEEs for Web Proofs

Staff Research Engineer 2022 – 2024
Primitive

- Lead developer of open-source Rust-based multi-agent simulation framework with 700+ stars; designed novel AMMs for DeFi and contributed to multiple blockchain projects including revm and ethers-rs

Research Experience

Thesis

- C. Roberts, *Hodge and Gelfand Theory in Clifford Analysis and Tomography*, PhD Thesis, Colorado State University, 2022. (Link)

Preprints

1. C. Roberts, *A Gelfand Transform for Spinor Fields on Embedded Riemannian Manifolds*, preprint, 2022. Available at arXiv: 2203.00118.

Published Works

3. A. Albarakati, M. Budisic, R. Crocker, J. Glass-Klaiber, S. Iams, J. Maclean, N. Marshall, C. Roberts, and E. S. Van Vleck, *Model and Data Reduction for Data Assimilation: Particle Filters Employing Projected Forecasts and Data with Application to a Shallow Water Model*, Computers & Mathematics with Applications, 2021.

2. Brooks Adams, Henry Adams, and Colin Roberts, *Sweeping Costs of Planar Domains*, In Erin W Chambers, Brittany T Fasy, and Lori S Ziegelmeier, eds., *Research in Computational Topology*, pages 71-92, AWM Springer series, volume 13, 2018.

1. Jonathan Gilbert, Colin Roberts, and Jacob Roberts, *Near-Resonant Light Propagation in an Absorptive Spatially Anisotropic Ultracold Gas*, Journal of the Optical Society of America B, pages 718–723, volume 25, number 4, 2018.

Internships and Research Programs

NASA Internship Program; Space Communications and Navigation - 2021.

- Brought together topological electromagnetism and topological fluid dynamics to develop a framework for the Vlasov equation for application in plasma physics in group collaboration.

AIM Summer School on Dynamics, Data, and the COVID-19 Pandemic - Supported by the NSF, 2020.

- Utilized a epidemic model to predict the impact that different mitigation techniques would have on the spread of COVID-19 in communities with schools.

Mathematics and Climate Research Network Summer School and Academic Year Engagement Program - Supported by the NSF and AIM, 2019.

- Worked with eight other collaborators to develop novel code that combines data reduction techniques with a particle filter algorithm to improve the utility in high dimensional models.

Research Talks

Lorentzian Geometry and Topological Electromagnetism. Greenslopes graduate steudent seminar at Colorado State University, August 26th, 2021

A Topological Approach to Plasmas. Glenn Talks, NASA Glenn, July 9th, 2021

Clifford Analysis and a Noncommutative Gelfand Representation. Ph.D. Preliminary Exam, Colorado State University, April 8th, 2021

Model and Data Reduction Techniques for Data Assimilation. SIAM Northern States Sections Student Chapters Conference (NSS-SC), October 16$^{\text{th}}$, 2020

A Multiscale Approach to Modeling University Impact on municipal COVID-19 dynamics. Greenslopes graduate student seminar at Colorado State University, August 27$^{\text{th}}$, 2020

Model and Data Reduction Techniques for Data Assimilation. SIAM Mathematics of Planet Earth (MPE20), August 11$^{\text{th}}$, 2020

Riemannian Geometry for Dummies. Greenslopes graduate student seminar at Colorado State University, January 30$^{\text{th}}$, 2020

Geometric Algebra and Spinors. Solving Problems in Applied Mathematics at Colorado State University, October 21$^{\text{st}}$, 2019

Information and Entropy. Data Science Seminar at Colorado State University, September 19$^{\text{th}}$, 2019

Differential Forms and Stokes' Theorem in $\mathbb{R}^3$. Greenslopes graduate student seminar at Colorado State University, September 6$^{\text{th}}$, 2019

Tensor Structures on Manifolds. Tensors: Algebra-Computation-Applications (TACA-2019), June 13$^{\text{th}}$, 2019

The Principle of Least Action and Variational Methods. Mathematical Physics Lab at Colorado State University, April 23$^{\text{rd}}$, 2019

Tensors and Exterior Algebra. Greenslopes graduate student seminar at Colorado State University, March 14$^{\text{th}}$, 2019

Special Relativity. Mathematical Physics Lab at Colorado State University, January 29$^{\text{th}}$, 2019

Incompressible Fluid Flow: Arnold's Geometrical Approach. Solving Problems in Applied Mathematics Seminar at Colorado State University, November 6$^{\text{th}}$, 2018

Introduction to Riemannian Geometry, Part 2. Mathematical Physics Lab at Colorado State University, October 16$^{\text{th}}$, 2018

Introduction to Riemannian Geometry, Part 1. Mathematical Physics Lab at Colorado State University, October 9$^{\text{th}}$, 2018

Organization and Service

Graduate Student Council Representative	Aug. 2020 - Aug. 2021
Liaison for SIAM Chapter at Colorado State University	Aug. 2019 - May 2020
Presenter for Math Jam Junior at Windsor Charter Academy	Dec. 19, 2019.
Mentor Meetup with Graduate Center for Inclusive Mentoring at Colorado State University	Nov. 4, 2019
Mentor for Association for Women in Mathematics at Colorado State University	Aug. 2019 - Dec. 2019

Organizer for Lie Theory Reading Group	Oct. 2019 - Dec. 2019
Founder/Organizer of the Mathematical Physics Lab	Aug. 2018 - May 2019
Co-organizer for the Greenslopes graduate seminar	Jan. 2019 - May 2019
President of the Society of Physics Students chapter at Colorado State University	Aug. 2016 - May 2017
Voting member for physics for the College Council for the College of Natural Sciences	Aug. 2015 - Dec. 2016
Tutor for the physics department at Colorado State University	Mar. 2015 - May 2016

Teaching

Instructor of Record for:

Chemistry 384, *Supervised College Teaching*	Fall 2021 – Spring 2022
Math 271/272, *Applied Mathematics for Chemists I/II*	Fall 2019 - Spring 2022

- Developed course content including a self-contained open source textbook with publicly available MATLAB examples.

Math 255, *Calculus for Biological Scientists II*	Spring 2019
Math 155, *Calculus for Biological Scientists I*	Fall 2018
Math 340, *Introduction to Ordinary Differential Equations*	Summer 2018
Math 160, *Calculus for Physical Scientists I*	Spring 2018
Math 161, *Calculus for Physical Scientists II*	Fall 2017

Course Development:

Math 118, *College Algebra in Context II*	Summer 2019

Learning Assistant:

PH 141, *Physics for Scientists and Engineers I*	Fall 2015

Awards and Honors

Louis and Gladys Weber Scholarship	2016
Donovan B. and Sally S. Hicks Scholarship	2016
Colorado State Honors Scholarship	2012-2016
Western Undergraduate Exchange Scholarship	2012-2016
College of Natural Sciences Dean's List	Fall 2014, Fall 2015

Workshops and Research Meetings Attended

AIM Summer School on Dynamics, Data, and the COVID-19 Pandemic, 2020

MCRN Summer School and Academic Year Engagement Program, 2019

Biology, Analysis, Geometry, Energies, Links [BAGEL19]: A Program on Low-dimensional Topology, Geometry, and Applications, 2019

Tensors: Algebra-Computation-Applications (TACA), 2019

Professional Affiliations

Member: American Mathematical Society

Member: Society for Industrial and Applied Mathematics

Member: American Physical Society

Member: American Association for Physics Teachers

Member: Sigma Pi Sigma Honors Physics Fraternity

Advisor

Name	Clayton Shonkwiler
Department	Colorado State Mathematics
Position	Assistant Professor
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Committee

Name	Henry Adams
Department	Colorado State Mathematics
Position	Assistant Professor
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Name	Wolfgang Bangerth
Department	Colorado State Mathematics
Position	Professor
Contact	wolfgang.bangerth@colostate.edu

Name   Jacob Roberts
Department   Colorado State Physics
Position   Professor, Department Chair
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