

# Gray Reid

COMPUTATIONAL MODELING AND MACHINE LEARNING, NYC

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## Skills

### Scientific Computing

- HPC, Numerical Methods, Computational Modeling
- Finite Difference, Finite Element, Spectral Methods, Monte Carlo, AMR, Multigrid
- Optimization, Profiling, Debugging

### Machine Learning

- Neural Networks, Deep Learning, Reinforcement Learning
- Attention Mechanisms, Transformers, CNNs, RNNs, GANs, Diffusion Models, GRUs, LSTMs

### Languages and Frameworks

- C, Python, Fortran
- Pytorch, Jax, TensorFlow
- MPI, OpenMP, CUDA

### Numerical Analysis

- Error analysis, Stability Analysis, Complexity Analysis, Convergence Analysis
- Conditioning, Discretization

### Mathematics and Physics

- Calculus, PDEs, SDEs, ODEs
- Lagrangian Mechanics, Hamiltonian Mechanics
- Quantum Mechanics, Statistical Mechanics, Thermodynamics
- Field Theory, Fluid Dynamics, Electromagnetism, General Relativity
- Linear Algebra, Probability, Statistics

### Research

- Research Design, Scientific Writing, Literature Review
- Data Analysis, Data Visualization
- Mentoring, Curriculum Development, Presentations

## Education

### PhD Physics

Vancouver, BC, Canada

UNIVERSITY OF BRITISH COLUMBIA

2024

- Developed high-performance numerical simulations of gravitational collapse improving resolution and accuracy by several orders of magnitude over state-of-the-art AMR simulations without significantly increasing computational cost
- Developed expertise in computational modeling, numerical methods, high performance computing, debugging and optimization of massively parallel systems

### BSc Honours Physics

Wolfville, NS, Canada

ACADIA UNIVERSITY

2012

- Highlighted deficiencies in existing techniques for modeling TEM imaging of materials and developed new methods for addressing these deficiencies
- Developed improved equations describing cavity ring-down spectroscopy for use in chemical sensing applications

## Profile

- Recent PhD graduate in computational physics with extensive expertise in scientific computing, numerical methods, and machine learning. Specializes in developing and optimizing novel algorithms for large-scale simulations and data analysis. Demonstrated ability to improve computational efficiency and accuracy in complex physical systems modeling, achieving significant improvement over state-of-the-art techniques.
- Seeking to transition from academic research to industry. Eager to apply advanced mathematical modeling and machine learning techniques to tackle challenging problems in Artificial Intelligence, Interpretability and Safety. Committed to leveraging strong research and teaching background to drive ethical innovation and contribute to high-impact teams.

## Select Publications

### Universality in the Critical Collapse of the Einstein-Maxwell System

PHYSICAL REVIEW D

2023

- Improved resolution and accuracy of in-lab adaptive mesh refinement (AMR) software for simulation of generic PDEs
- Improved resolution and accuracy by several orders of magnitude over previous investigations of the Einstein Maxwell system
- Resolved conflicts with previous investigations and provided a framework for understanding discrepancies in related literature.

### Reference Metric Approach to the Z4 System

PHYSICAL REVIEW D

2023

- Derived a novel hyperbolic formulation of General Relativity using a reference metric approach
- Achieved performance equivalent or exceeding leading formulations of General Relativity such as GBSSN and FCCZ4
- Demonstrated the stability of the formulation through a pseudodifferential first order reduction and simulations in the strong field regime

### Stability of Nonminimally Coupled Topological-Defect Boson Stars

PHYSICAL REVIEW D

2024

- Performed both fully non-linear and semi-analytic stability analysis for stationary solutions in  $f(R)$  gravity
- Resolved the open question of stability for topological-defect boson stars in  $f(R)$  gravity

## Select Awards

### NSERC CGSD

University of British Columbia

### Four Year Fellowship

University of British Columbia

### NSERC CGSM

University of British Columbia

### Governor General's Medal

Acadia University