Christopher Lang

Contact Information

Upper Island Cove, NL, Canada

cjlang@uwaterloo.ca
(905) 510-0707

Education

University of Waterloo — 2020 - Present
PhD, Pure Mathematics

University of Cambridge (Queens' College) — 2019 - 2020
Master of Advanced Study, Mathematics

University of Waterloo — 2014 - 2019
BMath, Co-op, Mathematical Physics and Pure Mathematics (double major)

Honours and Awards

Rai Mathematics Graduate Scholarship	2023 - Present
Ontario Graduate Scholarship	2023 - Present
Outstanding Teaching Assistant Award	2022
Alexander Graham Bell CGS - Doctoral	2020 - 2023
President's Graduate Scholarship	2020 - Present
Jessie Zou Excellence in Research (Finalist)	2019
NSERC CGS - Masters (Declined)	2019
NSERC Undergraduate Student Research Award	2016, 2018 & 2019
Term Dean's Honours List	2014 - 2018
President's Research Award	2016
Faculty of Mathematics Scholarship	2014
President's Scholarship of Distinction	2014
Oakville Soccer Club Scholarship	2014

Publications

Lang, C.J., "Hyperbolic monopoles with continuous symmetries", (2023) arXiv:2310.10626 (Submitted to *J. Geom. Phys.*)

Editor's Pick: Charbonneau, B., Dayaprema, A., Lang, C.J., Nagy, Á. & Yu, H., "Construction of Nahm data and BPS monopoles with continuous symmetries", *J. Math. Phys*. **63**(1), 013507 (2022). arXiv:2102.01657. https://doi.org/10.1063/5.0055913

Lang, C.J. & Waite, M.L., "Scale-dependent anisotropy in forced stratified turbulence", *Phys. Rev. Fluids* **4**, 044801 (2019). https://doi.org/10.1103/PhysRevFluids.4.044801

Programming Skills

Fortran, Maple, Git, Linux, LaTeX

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Conferences & Invited Talks

Colloquium Talk, Memorial University of Newfoundland, "Spherically Symmetric Hyperbolic Monopoles"	Oct, 2023
Differential Geometry Working Seminar, University of Waterloo "Revisiting Symmetry Hyperbolic Monopoles"	July, 2023
Differential Geometry Working Seminar, University of Waterloo "Hyperbolic monopoles with continuous symmetries (Part 2)"	Mar, 2023
Differential Geometry Working Seminar, University of Waterloo "Hyperbolic monopoles with continuous symmetries"	Nov, 2022
CMS Summer Meeting	June, 2022
Graduate Students in Teaching Conference, University of British Columbia, "Understanding and Mitigating Student Resistance to Active Learning"	May, 2022
Differential Geometry Working Seminar, University of Waterloo "The spectral curve of a SU(2) monopole (Part 2): identifying subbundles"	Apr, 2022
Teaching and Learning Conference, University of Waterloo, "Understanding and Mitigating Student Resistance to Active Learning"	Apr, 2022
Differential Geometry Working Seminar, University of Waterloo "The spectral curve of a SU(2) monpole (Part 1): a holomorphic vector bundle"	Mar, 2022
Oxford-London Gauge Assembly, University College London, "Constructing BPS Monopoles with Spherical Symmetry"	June, 2021
Ottawa Mathematics Conference, University of Ottawa, "Constructing Nahm Data and BPS Monopoles with Continuous Symmetries"	May, 2021
GSTGC, Indiana University, "Constructing BPS Monopoles with Spherical Symmetry"	Apr, 2021
Differential Geometry Working Seminar, University of Waterloo "On the charge density and asymptotic tail of a monopole"	Mar, 2021
Differential Geometry Working Seminar, University of Waterloo "The many faces of monopoles"	Feb, 2021
Geometry, Analysis, and Quantum Physics of Monopoles, BIRS	Jan, 2021
Part III Seminar Series, University of Cambridge, "Using Group Actions to Simplify Differential Equations"	Dec, 2019
CUMC, Queen's University, *"Simplifying Nahm Data with Group Actions"*	July, 2019

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Geometry Seminar, University of Waterloo June, 2019
"The ADHM-Nahm Procedure"

Geometry Seminar, University of Waterloo May, 2019
"Simplifying Nahm Data with Group Actions"

USRA Mini-Conference, University of Waterloo, Aug, 2018
"Local Isotropy in Stratified Turbulence"

Research Experience

University of Waterloo, Waterloo, ON

PhD Work Fall 2020 - Present
- Classified hyperbolic monopoles with continuous symmetries and generated infinite families of spherically symmetric hyperbolic monopoles
- Extended the work on asymptotic tails of SU(N) monopoles to those with arbitrary symmetry breaking
- Constructed an infinite family of spherically symmetric Nahm data depending on two parameters
- Computed the exact magnetic charge density of two subfamilies of the above family
- Examined the behaviour of the magnetic charge density for spherically symmetric monopoles with arbitrary symmetry breaking

Benoit Charbonneau, Pure Mathematics Winter 2017 & Summer 2019
- Examined monopoles with non-maximal symmetric breaking
- Created a procedure to construct axially and spherically symmetric monopoles

Michael Waite, Applied Mathematics Fall 2016 & Summer 2018
- Investigated the hypothesis that isotropy emerges at small length scales
- Applied a variety of independent methods to simulations of stratified turbulence

Yuri Leonenko, Earth and Environmental Sciences Fall 2017
- Modelled the pressure and concentration of *ex-situ* dissolution of CO_2
- Compared to experimental data and used model to estimate safe distance between wells

Ghazal Geshnizjani, Applied Mathematics Winter 2016
- Evaluated the finite length of past-directed geodesics and checked if the boundary of these geodesics corresponds to a singularity
- Reviewed a previous paper about singularities in black holes and applied it to inflationary spacetimes

McMaster University, Hamilton, ON

Spencer Smith, Computing and Software Summer 2015
- Applied software engineering methodologies to existing scientific software
- Case study: DiskFit, astrophysics software modelling disk galaxies

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Teaching Certifications	Certificate in University Teaching	Mar, 2022
	Fundamentals of University Teaching	Dec, 2020
	Certificate in Online Course Facilitation	Nov, 2020
Teaching Experience	Calculus 1 for Honours Math - MATH 137	Fall 2022
Areas of Interest	Monopoles and gauge theory	
References	Dr Benoit Charbonneau, Pure Mathematics, University of Waterloo, Email: benoit.charbonneau@uwaterloo.ca	
	Dr Ruxandra Moraru, Pure Mathematics, University of Waterloo, Email: moraru@uwaterloo.ca	
	Dr Ákos Nagy, BEIT Canada, Email: akosnagymath@gmail.com	
Teaching Reference	Dr Blake Madill, Pure Mathematics, University of Waterloo, Email: bmadill@uwaterloo.ca	