Christopher Lang, Ph.D.

cjlang@uwaterloo.ca https://cjlang96.github.io/
https://github.com/cjlang96

Education

2020 – 2024 **Ph.D., University of Waterloo**
Pure Mathematics - Thesis title: *Solitons with continuous symmetries*

2019 – 2020 **Master of Advanced Study, University of Cambridge (Queens' College)**
Mathematics

2014 – 2019 **BMath, Co-op, University of Waterloo**
Mathematical Physics and Pure Mathematics

Research

Journal Articles

1. **C. J. Lang**, "Hyperbolic monopoles with continuous symmetries," *Journal of Geometry and Physics*, vol. 203, p. 105 258, 2024, ISSN: 0393-0440. DOI: 10.1016/j.geomphys.2024.105258. arXiv: 2310.10626.
2. B. Charbonneau, A. Dayaprema, **C. J. Lang**, Á. Nagy, and H. Yu, "Construction of Nahm data and BPS monopoles with continuous symmetries," *Journal of Mathematical Physics*, vol. 63, no. 1, p. 013 507, 2022, **Editor's Pick**, ISSN: 0022-2488. DOI: 10.1063/5.0055913. arXiv: 2102.01657.
3. **C. J. Lang** and M. L. Waite, "Scale-dependent anisotropy in forced stratified turbulence," *Physical Review Fluids*, vol. 4, p. 044 801, 4 2019. DOI: 10.1103/PhysRevFluids.4.044801.

Preprints

1. **C. J. Lang**, "Instantons with continuous conformal symmetries: Hyperbolic and singular monopoles and more, oh my!" 2025. arXiv: 2501.07406.
2. **C. J. Lang**, "Fixed points of lie group actions on moduli spaces: A tale of two actions," 2024. arXiv: 2412.06970.

Invited Talks

1. *An introduction to monopoles, instantons, and more*, Colloquium talk, Memorial University of Newfoundland, Oct. 2024.
2. *Instantons with continuous symmetries*, Geometric Models of Matter, University of Leeds, Aug. 2024. URL: https://www.youtube.com/watch?v=a5dZKpBPkxQ&.
3. *Spherically symmetric hyperbolic monopoles*, CMS Winter Meeting, Dec. 2023.
4. *Spherically symmetric hyperbolic monopoles*, Colloquium talk, Memorial University of Newfoundland, Oct. 2023.
5. *Revisiting symmetric hyperbolic monopoles*, Differential Geometry Working Seminar, University of Waterloo, Jul. 2023.
6. *Hyperbolic monopoles with continuous symmetries (Part 2)*, Differential Geometry Working Seminar, University of Waterloo, Mar. 2023.

7. *Hyperbolic monopoles with continuous symmetries*, Differential Geometry Working Seminar, University of Waterloo, Nov. 2022.
8. *Understanding and mitigating student resistance to active learning*, Graduate Students in Teaching Conference, University of British Columbia, May 2022.
9. *The spectral curve of a SU(2) monopole (Part 2): Identifying subbundles*, Differential Geometry Working Seminar, University of Waterloo, Apr. 2022.
10. *Understanding and mitigating student resistance to active learning*, Teaching and Learning Conference, University of Waterloo, Apr. 2022.
11. *The spectral curve of a SU(2) monopole (Part 1): A holomorphic vector bundle*, Differential Geometry Working Seminar, University of Waterloo, Mar. 2022.
12. *Constructing BPS monopoles with spherical symmetry*, Oxford–London Gauge Assembly, University College London, Jun. 2021.
13. *Constructing Nahm data and BPS monopoles with continuous symmetries*, Ottawa Mathematics Conference, University of Ottawa, May 2021.
14. *Constructing BPS monopoles with spherical symmetry*, GSTGC, Indiana University, Apr. 2021.
15. *On the charge density and asymptotic tail of a monopole*, Differential Geometry Working Seminar, University of Waterloo, Mar. 2021.
16. *The many faces of monopoles*, Differential Geometry Working Seminar, University of Waterloo, Feb. 2021.
17. *Using group actions to simplify differential equations*, Part III Seminar Series, University of Cambridge, Dec. 2019.
18. *Simplifying Nahm data with group actions*, CUMC, Queen's University, Jul. 2019.
19. *The ADHM–Nahm procedure*, Geometry Seminar, University of Waterloo, Jun. 2019.
20. *Simplifying Nahm data with group actions*, Geometry Seminar, University of Waterloo, May 2019.
21. *Local isotropy in stratified turbulence*, USRA Mini-Conference, University of Waterloo, Aug. 2018.

Thesis

1. **C. J. Lang**, "Solitons with continuous symmetries," Ph.D. Thesis, University of Waterloo, Waterloo, Canada, 2024. URL: https://hdl.handle.net/10012/20906.

Teaching

Certifications

Mar. 2022 — Certificate in University Teaching
- Completed three teaching courses over multiple terms
- Wrote a report, "Understanding and Mitigating STEM Student Resistance to Active Learning"
- Received and reflected on two teaching observations

Dec. 2020 — Fundamentals of University Teaching
- Completed six teaching workshops
- Participated in three microteaching sessions

Teaching (continued)

Nov. 2020 — Certificate in Online Course Facilitation
- Completed a four-week program

Lecturing

Fall, 2022 — MATH 137 - Calculus I for Honours Mathematics, University of Waterloo

Programming Skills

Fortran, Maple, Git, LaTeX

Awards

2023–2024	Rai Mathematics Graduate Scholarship	$5,000
	Ontario Graduate Scholarship	$15,000
2022	Outstanding Teaching Assistant Award	$100
2020–2023	Alexander Graham Bell CGS - Doctoral	$105,000 (total)
2020–2024	President's Graduate Scholarship	$40,000 (total)
2019	Jessie Zou Excellence in Research (Finalist)	$1,000 (for recipient)
	NSERC CGS - Masters (Declined)	$27,000
2016, 2018 & 2019	NSERC Undergraduate Student Research Award	$13,500 (total)

Service Work

2023–2024 — Math Contest Marking with CEMC

2022–2024 — GSEF Project Review Committee
- Reviewed applications and recommended funding

2020–2024 — Student Mentoring
- Mentored students at various levels—middle school to doctoral

Areas of Interest

Lie theory, representation theory, moduli spaces, and gauge theory—specifically instantons and monopoles

References

Research

Dr. Benoit Charbonneau
University of Waterloo
Department of Pure Mathematics
benoit.charbonneau@uwaterloo.ca

Dr. Derek Harland
University of Leeds
School of Mathematics
D.G.Harland@leeds.ac.uk

Dr. Ruxandra Moraru
University of Waterloo
Department of Pure Mathematics
moraru@uwaterloo.ca

Dr. Paul Norbury
University of Melbourne
School of Mathematics and Statistics
norbury@unimelb.edu.au

Teaching

Dr. Blake Madill
University of Waterloo
Department of Pure Mathematics
bmadill@uwaterloo.ca

Dr. Henry Shum
University of Waterloo
Department of Applied Mathematics
henry.shum@uwaterloo.ca