




# Christopher Lang, Ph.D.

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 <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


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### Certifications

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|-----------|---|
| Mar. 2022 |  Certificate in University Teaching <ul style="list-style-type: none"> <li>• Completed three teaching courses over multiple terms</li> <li>• Wrote a report, “Understanding and Mitigating STEM Student Resistance to Active Learning”</li> <li>• Received and reflected on two teaching observations</li> </ul> |
| Dec. 2020 |  Fundamentals of University Teaching <ul style="list-style-type: none"> <li>• Completed six teaching workshops</li> <li>• Participated in three microteaching sessions</li> </ul>  |

## Teaching (continued)

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- 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

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Fortran, Maple, Git,  $\LaTeX$





## Awards

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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

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- 2025  Reviewer for zbMath Open
- 2023–2025  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

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

## References

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### Research

📖 **Dr. Benoit Charbonneau**  
University of Waterloo  
Department of Pure Mathematics  
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📖 **Dr. Ruxandra Moraru**  
University of Waterloo  
Department of Pure Mathematics  
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📖 **Dr. Derek Harland**  
University of Leeds  
School of Mathematics  
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📖 **Dr. Paul Norbury**  
University of Melbourne  
School of Mathematics and Statistics  
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### Teaching

📖 **Dr. Blake Madill**  
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📖 **Dr. Henry Shum**  
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