




# 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.

### 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

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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>  |
| Nov. 2020 |  Certificate in Online Course Facilitation <ul style="list-style-type: none"> <li>• Completed a four-week program</li> </ul>   |

### Lecturing

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| Fall, 2022 |  MATH 137 - Calculus I for Honours Mathematics, University of Waterloo |
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## Programming Skills

Fortran, Maple, Git, L<sup>A</sup>T<sub>E</sub>X

## 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 <ul style="list-style-type: none"><li>• Reviewed applications and recommended funding</li></ul>
2020–2024	📖 Student Mentoring <ul style="list-style-type: none"><li>• Mentored students at various levels—middle school to doctoral</li></ul>

## Areas of Interest

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

## References

### Research

📖 <b>Dr. Benoit Charbonneau</b> University of Waterloo Department of Pure Mathematics ✉ benoit.charbonneau@uwaterloo.ca	📖 <b>Dr. Derek Harland</b> University of Leeds School of Mathematics ✉ D.G.Harland@leeds.ac.uk
📖 <b>Dr. Ruxandra Moraru</b> University of Waterloo Department of Pure Mathematics ✉ moraru@uwaterloo.ca	📖 <b>Dr. Paul Norbury</b> University of Melbourne School of Mathematics and Statistics ✉ norbury@unimelb.edu.au

### Teaching

📖 <b>Dr. Blake Madill</b> University of Waterloo Department of Pure Mathematics ✉ bmadill@uwaterloo.ca	📖 <b>Dr. Henry Shum</b> University of Waterloo Department of Applied Mathematics ✉ henry.shum@uwaterloo.ca
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