

# Justin Kulp

Simons Center for Geometry and Physics  
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## Education and Academic Positions

- 2023–Present **Research Assistant Professor**, *Simons Center for Geometry and Physics & C.N. Yang Institute for Theoretical Physics*, Stony Brook, USA
- 2019–2023 **PhD. Physics**, *University of Waterloo*, Canada  
Thesis Title: Topological Manipulations of Quantum Field Theories  
Supervisors: Davide Gaiotto, Jaume Gomis.  
Perimeter Institute for Theoretical Physics, Resident PhD. Student.
- 2018–2019 **MSc. Physics**, *University of Waterloo*, Canada  
Essay Title: *Orbifolds, Anomalies, and Topological Field Theories*  
Supervisor: Davide Gaiotto.
- 2018–2019 **Perimeter Scholars International**, *Perimeter Institute*, Canada  
Student in Perimeter Scholars International at the Perimeter Institute for Theoretical Physics.
- 2013–2017 **HBSc. Mathematics and Physics Minor**, *Lakehead University*, Canada  
Thesis Title: *Representation Theory and Quantum Mechanics*  
Supervisor: Andrew J. Dean.  
GPA: 99/100

## Selected Honours and Awards

- 2024–2026 **NSERC Canada Postdoctoral Fellowship** (\$45k/yr)  
Nationally competitive postdoctoral research fellowship awarded by Natural Sciences and Engineering Research Council of Canada.
- 2020–2023 **NSERC Canada Graduate Scholarship - Doctoral** (\$35k/yr)  
Nationally competitive doctoral research scholarship awarded by Natural Sciences and Engineering Research Council of Canada on recommendation of the University of Waterloo.
- 2019–2020 **Traditional Fulbright Canada Student Award** (\$20k)  
Nationally and cross-disciplinary competitive scholarship for Canadian graduate students or professionals who wish to study and/or conduct research in the US. Declined award.
- 2017 **Canadian Governor General's Academic Silver Medal**  
Awarded for having the highest average in an Honours Bachelor degree at a Canadian university.

## Publications and Preprints

- [1] Davide Gaiotto, Justin Kulp, and Jingxiang Wu. “Higher Operations in Perturbation Theory” (Mar. 2024). arXiv: 2403.13049 [hep-th].

- [2] Kasia Budzik, Davide Gaiotto, Justin Kulp, Brian R. Williams, Jingxiang Wu, and Matthew Yu. “Semi-Chiral Operators in 4d  $\mathcal{N} = 1$  Gauge Theories” (June 2023). arXiv: 2306.01039 [hep-th].
- [3] Kasia Budzik, Davide Gaiotto, Justin Kulp, Jingxiang Wu, and Matthew Yu. “Feynman diagrams in four-dimensional holomorphic theories and the Operatope”. *JHEP* 07 (2023). <https://github.com/TwistedQFTs/laman-loopstrap>, p. 127. DOI: 10.1007/JHEP07(2023)127. arXiv: 2207.14321 [hep-th].
- [4] Diego García-Sepúlveda, Alfredo Guevara, Justin Kulp, and Jingxiang Wu. “Notes on resonances and unitarity from celestial amplitudes”. *JHEP* 09 (2022), p. 245. DOI: 10.1007/JHEP09(2022)245. arXiv: 2205.14633 [hep-th].
- [5] Ivan M. Burbano, Justin Kulp, and Jonas Neuser. “Duality defects in  $E_8$ ”. *JHEP* 10 (2022), p. 186. DOI: 10.1007/JHEP10(2022)187. arXiv: 2112.14323 [hep-th].
- [6] Davide Gaiotto and Justin Kulp. “Orbifold groupoids”. *JHEP* 02 (2021), p. 132. DOI: 10.1007/JHEP02(2021)132. arXiv: 2008.05960 [hep-th].
- [7] Justin Kulp. “Two More Fermionic Minimal Models”. *JHEP* 03 (2021), p. 124. DOI: 10.1007/JHEP03(2021)124. arXiv: 2003.04278 [hep-th].
- [8] Hubert de Guise, Dylan Spivak, Justin Kulp, and Ish Dhand. “D-functions and immanants of unitary matrices and submatrices”. *Journal of Physics A: Mathematical and Theoretical* 49.9 (Jan. 2016). arXiv: 1511.01851 [math-ph].

## Presentations and Seminars

- 2024 **Higher Categorical Tools for Quantum Phases of Matter**, *Perimeter Institute*, Canada  
*Twisted Tools for (Untwisted) Quantum Field Theory*. Also presented at Yale Geometry, Symmetry, and Physics seminar.
- 2023 **PITP Gong Show**, *IAS*, USA  
*Holomorphic Confinement of  $\mathcal{N} = 1$  SYM*.
- 2023 **Séminaire de Physique Théorique**, *IHES*, France  
*Self-Similar Quasicrystals and Hyperbolic Honeycombs*. Also presented at Perimeter Institute, University of Pennsylvania, and SCGP.
- 2022 **Harvard CMSA Seminar**, *Harvard CMSA*, USA  
*Holomorphic Twists and Confinement in  $\mathcal{N} = 1$  SYM*. Invited talk. Also presented at Johns Hopkins University.
- 2022 **Generalized Global Symmetries, Quantum Field Theory, and Geometry**, *Simons Center for Geometry and Physics*, USA  
*Quasicrystals and Decapods*. Selected talk and accompanying poster.
- 2022 **Simons Confinement Collaboration Inaugural Workshop**, *Princeton PCTS*, USA  
*Confinement and Holomorphic Twists of  $\mathcal{N} = 1$  SYM*. Invited talk. Also presented at Perimeter Institute.

- 2022 **Strings 2022**, *University of Vienna, Austria*  
*Holomorphic QFTs: Higher Structures and Bootstrap*. Selected talk and accompanying poster. Gong show prize winner.
- 2022 **Global Categorical Symmetries**, *Perimeter Institute, Canada*  
*Duality Defects in  $E_8$* . Invited talk and accompanying poster on paper *Duality Defects in  $E_8$* .
- 2022 **Celestial Holography '22**, *Princeton Center for Theoretical Science, USA*  
*The 3d  $O(N)$  Model on the Celestial Circle*. Invited talk on "Notes on Resonances and Unitarity from Celestial Amplitudes".
- 2021 **PI Grad Conference**, *Perimeter Institute, Canada*  
*Topological Aspects of QFT*. Invited talk surveying role of topology in high energy physics.
- 2021 **PI Quantum Fields and Strings Meeting**, *Perimeter Institute, Canada*  
*Duality Defects in  $E_8$* . Invited talk on paper "Duality Defects in  $E_8$ "
- 2020 **Harvard CMSA Condensed Matter Seminar**, *Harvard CMSA, USA*  
*Orbifold groupoids*. Invited talk on paper "Orbifold groupoids." Also at Perimeter Institute.
- 2020 **PI Quantum Fields and Strings Meeting**, *Perimeter Institute, Canada*  
*Fermionization and Minimal Models*. Talk on paper "Two More Fermionic Minimal Models."
- 2019 **PSI Winter School**, *Perimeter Institute, Canada*  
*Scattering in Chern-Simons Matter Theories*. Crossing-symmetry violation and scattering in Chern-Simons matter theories. Presented with Lorenzo di Pietro, Diego García, Jingxiang Wu, Matthew Yu, and Keyou Zeng.
- 2018 **PSIminar: PSI Student Colloquium**, *Perimeter Institute, Canada*  
*Aperiodic Tilings in Physics*. Introduction to quasicrystals and applications to AdS/CFT, topological insulators, and string compactifications.
- 2017 **Lakehead University Mathematics Colloquium**, *Lakehead University, Canada*  
*Aperiodic Tilings: An Introduction*. Invited speaker. Overview of research on aperiodic tilings.
- 2016 **ATLAS Canada Summer Student Presentation**, *University of Toronto, Canada*  
*Beta Testing ITk Modules*. Overview of summer work testing semiconductor detector for ATLAS. Presented with Nicholas Zutt.
- 2016 **ATLAS Toronto Presentation**, *University of Toronto, Canada*  
*Decays of the Higgs Boson*. Overview of work investigating decays of the Higgs boson.

## Academic Work and Volunteer Experience

- 2023–Present **Journal Referee SciPost**, *Online*
- 2022–Present **Journal Referee JHEP**, *Online*
- 2022–Present **Anomalology Moderator and Organizer**, *Online*
- 2021–2023 **Science Faculty Council**, *University of Waterloo, Canada*  
 Elected graduate student representative to university Science Faculty Council.
- 2020–2022 **PhysicsOH Community Contributor and Moderator**, *Online*
- 2019–2023 **Student Seminar Manager**, *Perimeter Institute, Canada*

- 2017 **Project Assistant**, *Lakehead University*, Canada  
Wrote labs and edited course notes for PHYS-2111 and PHYS-4113 at Lakehead University.
- 2016 **Lakehead University Annual Donor Reception**, *Lakehead University*, Canada  
Invited speaker on behalf of student body, spoke on topic of external donations and funding.
- 2014–2015 **University Senator**, *Lakehead University*, Canada  
Student representative on Lakehead University Senate.
- 2014–2015 **University Academic Appeals Committee Member**, *Lakehead University*, Canada  
Student representative on Lakehead University Academic Appeals Committee.

## Additional Research Experience

- 2018 **Visiting Graduate Student**, *Perimeter Institute*, Canada  
**Supervised by Dr. Latham Boyle, Perimeter Institute for Theoretical Physics**  
Studied AdS/CFT and “conformal quasicrystals.” Computed packing densities of quasicrystals.
- 2017 **Research Assistant**, *Lakehead University*, Canada  
**Supervised by Dr. Hubert de Guise, Department of Physics, Lakehead University**  
Led research constructing  $SU(N)$  “anticoherent states” and developed geometric representation for symmetrized  $SU(N)$  states, generalizing known work on  $SU(2)$ .
- 2017 **Research Assistant**, *Waterloo*, Canada  
**Supervised by Dr. Latham Boyle, Perimeter Institute for Theoretical Physics**  
Proved equivalencies between certain aperiodic tilings. Proved some important topological defects in quasicrystals cannot be classified by natural topological charges/invariants.
- 2016 **Student Researcher (NSERC USRA)**, *University of Toronto*, Canada  
**Supervised by Dr. Robert Orr, Department of Physics, University of Toronto**  
Tested trigger and detection system for semiconductor particle detector in ATLAS experiment. Prepared glue studies for ATLAS inner tracker.
- 2015 **Student Researcher (NSERC USRA)**, *University of Toronto*, Canada  
**Supervised by Dr. Peter Krieger, Department of Physics, University of Toronto**  
Analyzed faults in liquid argon forward calorimeter for the ATLAS experiment.
- 2014 **Research Assistant**, *Lakehead University*, Canada  
**Supervised by Dr. Hubert de Guise, Department of Physics, Lakehead University**  
Investigated “generalized determinants” of matrices and connections to Wigner D-functions.

## Complete Honours and Awards

- 2024–2026 **NSERC Canada Postdoctoral Fellowship** (\$45k/yr)  
Graduate
- 2020–2023 **NSERC Canada Graduate Scholarship - Doctoral** (\$35k/yr)
- 2020–2023 **University of Waterloo President’s Graduate Scholarship** (\$5k/yr)  
Awarded to graduate students holding major federal/provincial competition-based scholarships.
- 2019–2020 **Traditional Fulbright Canada Student Award** (\$20k)
- 2019 **University of Waterloo Marie Curie Award** (\$883)

- 2018-2019 **NSERC Canada Graduate Scholarship - Masters** (\$17.5k)  
Nationally competitive master's research scholarship awarded by NSERC of Canada on recommendation of the University of Waterloo.
- 2018-2019 **University of Waterloo President's Graduate Scholarship** (\$10k)
- 2018-2019 **Perimeter Scholars International Award** (\$30k)  
Awarded to attend Perimeter Scholars International at the Perimeter Institute.

Undergraduate

- 2017 **Canadian Governor General's Academic Silver Medal**
- 2017 **Lakehead University Dean's Medal for the Faculty of Science and Environmental Studies**  
Awarded to the highest-ranking graduating student in Science and Environmental Studies.
- 2017 **Lakehead University Dean's Scholar Award for Mathematics**  
Awarded to the highest-ranking graduating student in Mathematics.
- 2013-2017 **Lakehead University Presidential Scholarship** (\$30k)  
Awarded to up to two students each year for academic achievement and significant contributions to their school and community.
- 2013-2017 **C.D. Howe Scholarship Endowment Fund** (\$22k)  
Awarded for academic achievement, community, and extracurricular activities.
- 2013-2017 **Lakehead University Presidents List**  
Awarded to eligible students who achieved a 90% or higher term average.
- 2013-2017 **Lakehead University Dean's List**  
Awarded to eligible students who achieved a 80% or higher term average.
- 2017 **Department of Mathematical Sciences Award** (\$500)  
Awarded to a student for the highest average in mathematics at Lakehead University.
- 2016 **Quaestiones Naturales Article**  
Interview highlighting my research at Lakehead University on *D-functions and immanants of unitary matrices and submatrices*. Featured in *Quaestiones Naturales* Volume 4, 2016.
- 2016 **NSERC Undergraduate Student Research Award Recipient** (\$8k)  
Nationally competitive undergraduate research scholarship awarded by NSERC of Canada on recommendation of the University of Toronto.
- 2016 **Department of Mathematical Sciences Award** (\$100)
- 2015 **Dr. S. Penny Petrone Scholarship** (\$2.1k)
- 2015 **NSERC Undergraduate Student Research Award Recipient** (\$7.6k)  
Nationally competitive undergraduate research scholarship awarded by NSERC of Canada on recommendation of the University of Toronto.
- 2014 **Lakehead University Bora Laskin Memorial Scholarship in Physics** (\$650)  
Awarded to a student based on academic performance and interest in physics.
- 2014 **Dr. S. Penny Petrone Scholarship** (\$2k)

High School

- 2013 **Canadian Governor General's Academic Bronze Medal**  
Awarded to the student graduating with the highest average from a high school.
- 2013 **OSSD Gold Medal Lakehead Public Schools**
- 2013 **Canadian Suomi Foundation's Ontario Secondary School Scholarship** (\$200)
- 2013 **Canadian Suomi Foundation's Finlandia Club Award** (\$200)
- 2013 **TD Canada Trust Memorial Scholarship** (\$2k)  
Awarded to eligible students with the ten highest averages in Northern Ontario.
- 2013 **Lakehead University Group Math Competition**  
2 wins and 4 honourable mentions in Lakehead University's high school math competition.
- 2013 **Ontario Power Generation Secondary School Achievement Award** (\$500)
- 2013 **Ontario Secondary Schools Teachers' Federation Award of Academic Excellence**
- 2013 **Superior C.V.I. Science Award in Physics**
- 2012 **Northwestern Ontario Regional Science Fair LU Engineering Award**
- 2012 **Northwestern Ontario Regional Science Fair Entrance Scholarship** (\$1k)