

Justin Kulp

Perimeter Institute for Theoretical 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
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

- 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.
- 2018–2019 **NSERC Canada Graduate Scholarship - Master's** (\$17.5k)
Nationally competitive master's research scholarship awarded by NSERC of Canada on recommendation of the University of Waterloo.
- 2018–2019 **Perimeter Scholars International Award** (\$30k)
Awarded to attend Perimeter Scholars International at the Perimeter Institute.
- 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] Kasia Budzik, Davide Gaiotto, Justin Kulp, Jingxiang Wu, and Matthew Yu.

“Feynman Diagrams in Four-Dimensional Holomorphic Theories and the Operatope” (July 2022). <https://github.com/TwistedQFTs/laman-loopstrap>. arXiv: 2207.14321 [hep-th].

- [2] 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].
- [3] 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].
- [4] Davide Gaiotto and Justin Kulp. “Orbifold groupoids”. *JHEP* 02 (2021), p. 132. DOI: 10.1007/JHEP02(2021)132. arXiv: 2008.05960 [hep-th].
- [5] Justin Kulp. “Two More Fermionic Minimal Models”. *JHEP* 03 (2021), p. 124. DOI: 10.1007/JHEP03(2021)124. arXiv: 2003.04278 [hep-th].
- [6] 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

- 2023 **PI Quantum Fields and Strings Meeting**, *Perimeter Institute, Canada*
Self-Similar Quasicrystals and Hyperbolic Honeycombs.
- 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

- 2022–Present **Journal Referee JHEP**, *Online*
- 2021–Present **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–Present **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

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)
- 2018-2019 **University of Waterloo President’s Graduate Scholarship** (\$10k)
- 2018-2019 **Perimeter Scholars International Award** (\$30k)

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)