

Brandon Rayhaun

Curriculum Vitæ

🏠 Varian Physics Building, 382 Via Pueblo
Mall, Stanford University, Stanford, California
94305
📞 +1 (714) 580-3760
✉️ brayhaun@stanford.edu
🌐 <http://www.brandonrayhaun.com/>

Education

Stanford University, Stanford, CA
PhD in Physics, 2016 – present
PhD advisor: Shamit Kachru

University of Chicago, Chicago, IL
MS in Physical Sciences, 2015 – 2016
Master's thesis advisor: Jeffrey Harvey
Master's thesis title: Infinite products in skew-holomorphic moonshine

BS in Mathematics, Minor in Physics, 2011 – 2015
Phi Beta Kappa (junior year), dean's list, general university honors

Publications

Penumbral Moonshine, with J. Duncan and J. Harvey, *in preparation*.

Kitaev's quantum double model as an error correcting code, with S. Cui, D. Ding, X. Han, G. Penington, D. Ranard, and Z. Shangnan. (arXiv: [1908.02829](https://arxiv.org/abs/1908.02829))

Attractive Strings and Five-Branes, Skew-Holomorphic Jacobi Forms and Moonshine, with M. Cheng, J. Duncan, S. Harrison, J. Harvey, and S. Kachru, *J. High Energ. Phys.* (2018) 2018: 130. [https://doi.org/10.1007/JHEP07\(2018\)130](https://doi.org/10.1007/JHEP07(2018)130). (arXiv: [1708.07523](https://arxiv.org/abs/1708.07523))

Simulating tactile signals from the whole hand with millisecond precision¹, H. P. Saal, B. P. Delhaye, B. C. Rayhaun, & S. J. Bensmaia, *Proceedings of the National Academy of Sciences*, 2017, [doi:10.1073/pnas.1704856114](https://doi.org/10.1073/pnas.1704856114).

Traces of singular moduli and moonshine for the Thompson group², with J. Harvey, *Communications in Number Theory and Physics*, Vol. 10 Num. 1 (2016). (arXiv: [1504.08179](https://arxiv.org/abs/1504.08179))

Teaching

Teaching Assistantships

<i>PHYSICS 231</i> , Graduate Quantum Mechanics II, Stanford University	Spring 2019
<i>PHYSICS 130</i> , Quantum Mechanics I, Stanford University	Winter 2018 & Winter 2019
<i>PHYSICS 70</i> , Modern Physics, Stanford University	Fall 2018
<i>PHYSICS 65</i> , Quantum and Thermal Physics, Stanford University	Spring 2018
<i>PHYSICS 111</i> , Partial Diff. Eqs. of Mathematical Physics, Stanford University	Fall 2017
<i>PHYSICS 44</i> , Electricity & Magnetism Lab, Stanford University	Spring 2017
<i>MATH 131-132</i> , Calculus I-II, University of Chicago	Fall 2014 – Winter 2015

Organizer and lecturer (awarded **SPICE grant)** Fall 2017 – Fall 2018
SITP Student Seminar, Stanford Institute for Theoretical Physics

Co-organizer and lecturer, with J. A. Harvey Fall 2015 – Spring 2016
Moonshine Journal Club, U of C Department of Physics and Department of Mathematics

¹Chicago Biomedical Consortium article

²Quanta Magazine article

Undergraduate Experience

Research with Jeffrey Harvey <i>U of C Department of Physics, Enrico Fermi Institute</i>	Current, from Spring 2014
Enrico Fermi Institute Summer Internship <i>U of C Department of Physics, Enrico Fermi Institute</i>	Summer 2015
Lee Teng Internship in Accelerator Physics <i>Physics Division, Argonne National Laboratory</i>	Summer 2014
REU at Conte Center for Computational Neuropsychiatric Genomics <i>U of C Conte Center for Computational Neuropsychiatric Genomics</i>	Summer 2013
Research in Bensmaia Somatosensory Lab <i>U of C Department of Computational Neuroscience</i>	Winter 2012 – Winter 2015
Participant in Mathematics Directed Reading Program <i>U of C Department of Mathematics</i>	Spring 2013 – Summer 2014
Metcalf Research Internship in Physics <i>Magnetic Devices Group, IBM, Almaden</i>	Summer 2012
Cofounder, V.P., Head of Committee on Educational Develop. <i>NEURO Club (Neuroscience Education, Undergraduate Research & Outreach), U of C</i>	Winter 2011 – Spring 2014

Event Participation

AMS Fall Eastern Sectional Meeting <i>Binghamton University, Binghamton, New York</i>	2019
TASI - The Many Dimensions of Quantum Field Theory <i>University of Colorado Boulder, Boulder, Colorado</i>	2019
Chiral Algebras for the 21st Century <i>UC Davis, Davis, California</i>	2019
Conference on Number Theory, Geometry, Moonshine & Strings III <i>Simons Foundation, New York, New York</i>	2019
Moonshine Workshop <i>Erwin Schrodinger International Institute for Mathematics and Physics, Vienna, Austria</i>	2018
Bootstrap School <i>Caltech, Pasadena, California</i>	2018
SoCal Grad Strings and Fields <i>UCSB, Santa Barbara, California</i>	2018
AIM SQuaRE: Indefinite theta functions and moonshine <i>American Institute of Mathematics, San Jose, California</i> <i>with J. Duncan, M. Griffin, J. Harvey, and M. Mertens</i>	2018
Conference on Number Theory, Geometry, Moonshine & Strings II <i>Simons Foundation, New York, New York</i>	2018
Google X meeting regarding quantum gravity, information, and computation <i>Google X, Mountain View, California</i>	2017
Conference on Number Theory, Geometry, Moonshine & Strings <i>Simons Foundation, New York, New York</i>	2017
VPTL Identity in the Classroom Learning Community <i>Stanford University, Stanford, California</i>	2017

Spring School on Super String Theory and Related Topics <i>International Center for Theoretical Physics, Trieste, Italy</i>	2016
CAURS (Chicago Area Undergraduate Research Symposium) <i>Northwestern University, Evanston, Illinois</i>	2015
4th Joint Meeting of the APS Div. of Nuclear Physics and the Phys. Soc. of Japan <i>Hawaii</i>	2014
U.S. Particle Accelerator School <i>University of New Mexico</i>	2014

Research talks

Penumbral moonshine

AMS Fall Sectional Meeting, Binghamton University, Fall 2019.

B. Rayhaun. (invited talk)

Thompson and Penumbral Moonshine

Moonshine conference, Erwin Schrodinger Institute, Summer 2018.

B. Rayhaun. (invited talk)

Skew-holomorphic moonshine

Stanford Institute for Theoretical Physics, Stanford University, Fall 2016.

B. Rayhaun. (research talk)

Inside the Monster: traces of singular moduli and moonshine for the Thompson group

CAURS (Chicago Area Undergraduate Research Symposium), Northwestern University, 2015

B. Rayhaun[†] and J. Harvey. (awarded *Top Oral Presentation, poster*)

Inside the Monster: traces of singular moduli and moonshine for the Thompson group

Chicago Area Undergraduate Research Symposium & Northwestern Undergraduate Research Journal, Volume 1: 2015.

B. Rayhaun. ([online publication](#))

Beyond Monstrous Moonshine: peculiar bridges between math and physics

Society for Physics Students, University of Chicago, Winter 2015.

B. Rayhaun. (invited talk)

Beam optics studies for the new XMAT facility at the Advanced Photon Source at ANL

4th Joint Meeting of the APS Div. of Nuclear Physics and the Phys. Soc. of Japan, HI, 2014

B. Rayhaun[†], J. Nolen, B. Mustapha, S. Kutsaev, and P. Ostroumov. ([CEU poster](#))

Beam optics studies for a uranium ion micro-beam

Lee Teng Internship in Accelerator Physics, Argonne National Laboratory, Summer 2014

B. Rayhaun[†], J. Nolen, B. Mustapha, S. Kutsaev, and P. Ostroumov. ([writeup](#), [slides](#))

Computationally modeling the somatosensory system

Conte Center for Psychiatric Genomics REU, University of Chicago, Summer 2013

B. Rayhaun, H. Saal, and S. Bensmaia. ([writeup](#), [talk](#))

Persistent homology, Euler characteristic curves, and neural data

Directed Reading Program in Mathematics, University of Chicago, Fall 2013 – Winter 2014

B. Rayhaun[†] and K. Turner. ([Fall 2013 talk](#), [Winter 2014 talk](#))

Effects of take up reel design on track following performance

IBM Metcalf Internship, Almaden, CA, Summer 2012

B. Rayhaun, W. Imaino, and G. McClelland. ([poster](#))

Seminar and miscellaneous talks

4d $\mathcal{N} = 2$ theories and their associated chiral algebras

SITP Student Seminar, Stanford University, Spring 2018.

B. Rayhaun.

Quantum gravity

Society for Physics Students, Stanford University, Winter 2018.

B. Rayhaun. (invited talk)

The Kosterlitz-Thouless phase transition and CFT

SITP Student Seminar, Stanford University, Fall 2018.

B. Rayhaun.

ADE classifications through string theory

SITP Student Seminar, Stanford University, Fall 2017.

B. Rayhaun.

Umbral moonshine

Moonshine Journal Club, University of Chicago, Spring 2016

B. Rayhaun. (two lectures)

Black holes, quantum information, and the holographic principle

Society for Physics Students, University of Chicago, Winter 2016.

B. Rayhaun. (invited talk)

Construction of the moonshine module V^{\natural}

Moonshine Journal Club, University of Chicago, Winter 2016

B. Rayhaun. (lecture)

Moonshine and physics

Graduate Student Seminar in Algebra and Number Theory, Emory University, Fall 2016.

B. Rayhaun. (invited talk)

Kac-Moody algebras and conformal field theory

Moonshine Journal Club, University of Chicago, Fall 2015

B. Rayhaun. (two lectures)

Theory of modular functions

Moonshine Journal Club, University of Chicago, Fall 2015

B. Rayhaun. (lecture)

Languages

Programming languages

Fluent: Sage, Python, C, Haskell, GAP, Elm, \LaTeX , MATLAB

Basic knowledge: html, Awk, COSY Infinity

Natural languages

Fluent: Assyrian, English

Basic knowledge: 日本語 (Japanese), French

Diversions

Music (competitive classical piano, electronic music production and audio engineering, guitar, drums), skiing, automotive overhaul and track racing, computers and electronics, hiking, **blogging**.