

# Joseph Rennie

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## EDUCATION

### University of Illinois at Urbana-Champaign

PH.D. IN MATHEMATICS ..... Expected May 2022 | Champaign, IL

Advisor: Charles Rezk

Prospectus Title: "A Galois Theoretic Structure Theorem for Higher Toposes"

M.S. IN THE TEACHING OF MATHEMATICS ..... May 2021 | Champaign, IL

### Reed College

BACHELOR OF ARTS IN MATHEMATICS ..... May 2015 | Portland, OR

### Independent University of Moscow

MATH IN MOSCOW PROGRAM ..... Spring 2014 | Moscow, Russia

## PUBLICATIONS

1. Alex Christensen, Pamela E. Harris, Zakiya Jones, Marissa Loving, Andrés Ramos Rodríguez, Joseph Rennie, and Gordon Rojas Kirby. "A Generalization of Parking Functions Allowing Backward Movement". In: *The Electronic Journal of Combinatorics* 27.1 (Feb. 2020), P1.33
2. Jerrell Cockerham, Melissa Gutiérrez González, Pamela E. Harris, Marissa Loving, Amaury V. Miniño, Joseph Rennie, and Gordon Rojas Kirby. "Weight  $q$ -multiplicities for representations of the exceptional Lie algebra  $\mathfrak{g}_2$ ". In: *Bulletin of the Belgian Mathematical Society - Simon Stevin* 27.5 (2020), pp. 641–662
3. R.E. Garcia, P.E. Harris, M. Loving, L. Martinez, D. Melendez, J. Rennie, G. Rojas Kirby, and D. Tinoco. "On Kostant's weight  $q$ -multiplicity formula for  $sl_4(\mathbb{C})$ ". In: *Applicable Algebra in Engineering, Communications and Computing* (2020)
4. **(Under review)** Pamela E. Harris, Marissa Loving, Juan Ramirez, Joseph Rennie, Gordon Rojas Kirby, Eduardo Torres Davila, and Fabrice O. Ulysse. *Visualizing the Support of Kostant's Weight Multiplicity Formula for the Rank Two Lie Algebras*. 2019

## RECENT TEACHING EXPERIENCE

### UIUC Math Department

INSTRUCTOR OF RECORD: A MATHEMATICAL WORLD ..... Fall 2021

- Adapted my previously designed online course for an in-person learning environment
- Determined the specific topics of the entire semester
- Independently wrote the learning objectives and assessments
- Created discussions/lectures that centered around active engagement

INSTRUCTOR OF RECORD: A MATHEMATICAL WORLD ..... Fall 2020

- Carefully designed the first online offering of the Math course for non-majors
- Determined the specific topics of the entire semester
- Independently wrote the learning objectives and assessments
- Created discussions/lectures that centered around active engagement
- Established a supportive environment for students, by consciously molding online forum culture, checking on student wellness regularly, and adapting my availability to meet class needs

NETMATH TEACHING ASSISTANT: LINEAR ALGEBRA ..... Summer 2020

- Helped manage an online, self-paced, accredited math teaching platform which utilized a forum, Mathematica notebooks for homework and lectures, and digital open-ended exams
- Focused on the linear algebra course which served over eighty students in the span of eight weeks

**TEACHING ASSISTANT: CALCULUS II** ..... Spring 2020

- Adapted discussion to online format within a week
- Joined the List of Teachers Ranked as Excellent by Students

**MERIT TEACHING ASSISTANT: CALCULUS II** ..... Fall 2019

**MERIT TEACHING ASSISTANT: MULTIVARIABLE CALCULUS** ..... Fall 2017, Spring 2018

- Taught and mentored a calculus discussion section for underrepresented students and students from small towns
- Continually adapted assessments and discussion based on student performance
- Discussed learning strategies with students both individually and collectively
- Met on-on-one with students with the goal of providing individualized study plans

**Mathematical Sciences Research Institute**

**MSRI-UP GRADUATE STUDENT MENTOR** ..... Summer 2019

- Supervised six research teams of three undergraduate students culminating in three accepted publications and two more in review
- Monitored the group dynamics to ensure a positive math research experience for all participants
- Maintained mentorship connection with students beyond the end of the program

**Education Justice Project**

**COMPUTER LAB VOLUNTEER** ..... Fall 2016 to February 2020

- Designed and implemented programming/math workshops for incarcerated men
- Workshops facilitated: Python programming, Algorithms and Data Structures, Introduction to Programming (student-led)

**Illinois Geometry Lab**

**RESEARCH PROJECT LEADER** ..... Summer 2018, Summer 2021

- Designed and supervised a mathematical research project for advanced high school students
- Taught students core prerequisite Linear Algebra concepts in a week
- Taught students computational mathematics techniques and collaborative programming essentials (e.g. Git and effective documentation)

**COMPUTATIONAL MATH WORKSHOP DIRECTOR** ..... Spring 2018, Fall 2018, Spring 2019

- Designed and taught a two-week intensive introduction to computational math research for undergraduates
- Taught skills such as Git, Sage, Python, Object-Oriented Programming, Computational Linear Algebra, and more

**Private Tutoring**

**MATH/PHYSICS/COMPUTER SCIENCE TUTOR** ..... Fall 2018 to Spring 2021

- Taught an average of three to four students weekly every semester
- Selected topics: Multivariable Calculus, Single-variable Calculus, Linear Algebra, Introduction to Proofs and Mathematical Logic, Differential Equations/Engineering Applications, Business Linear Algebra, and Statistics

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## SERVICE AND OUTREACH

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**Education Justice Project**

**COMPUTER LAB COORDINATOR** ..... Fall 2018 to Fall 2020

- Maintained servers for an educational program in a prison
- Upgraded the computer lab for the incarcerated students
- Recruited and processed applications for volunteers for computational workshops
- Worked toward establishing a connection with the Illinois Geometry Lab

## Association for Women in Mathematics

VOLUNTEER ..... Spring 2016 to Fall 2019

- Helped with events which build positive math self-identity in high school girls
- Performed Mathematical magic tricks for a math carnival to promote mathematics to the public

## Advancement Via Individual Determination Program

ENGINEERING PROJECT MENTOR ..... Spring 2017

- Guided first-year high school students through an engineering project of their own design
- Gave enough creative freedom and positive feedback to encourage students to consider a career in engineering

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## RESEARCH SUMMARY

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Recently, my research has focused on the intersection of mathematical logic, and the theory of higher principal  $\mathbb{G}$ -bundles. More broadly, I aim to refine the categorical galois theory of Borceux and Janelidze to the higher categorical setting, and to present applications to logic and physics.

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## SELECTED TECHNICAL PRESENTATIONS

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### An Analytic-to-synthetic Dial in Geometry and Dynamics

MATHEMATICS TEACHER-SCHOLAR SYMPOSIUM, REED COLLEGE ..... May 2021

### Ultrafilters at the Foundations of Math

GRADUATE NON-STANDARD ANALYSIS SEMINAR, UIUC ..... March 2021

### Generalized Gauge Theory: Where Logic Meets Homotopy Theory

GRADUATE HOMOTOPY THEORY SEMINAR, UIUC ..... February 2021

### Unfolding Orbifold Theory

GRADUATE HOMOTOPY THEORY SEMINAR, UIUC ..... February 2020

### Unifying Galois Theories with Categorification

GRADUATE GEOMETRY/TOPOLOGY SEMINAR, UIUC ..... February 2020

### What is a Mathematics?<sup>1</sup>

UNDERGRADUATE SEMINAR, UIUC ..... January 2020

### Motivating Higher Toposes II: Higher Bundle Theory

GRADUATE HOMOTOPY THEORY SEMINAR, UIUC ..... October 2019

### Motivating Higher Toposes I: Geometric Characteristic Classes

GRADUATE HOMOTOPY THEORY SEMINAR, UIUC ..... October 2019

### Analytic/Synthetic Interplay in Mathematical Foundations:

#### Motivating Synthetic Homotopy Theory

MATHEMATICAL SCIENCES RESEARCH INSTITUTE, BERKELEY, CA ..... July 2019

### Modalities and Blakers-Massey

GRADUATE HOMOTOPY THEORY SEMINAR, UIUC ..... November 2018

### Equivariant Homotopy Theory of Finite Spaces and Sylow Theorems

GRADUATE HOMOTOPY THEORY SEMINAR, UIUC ..... April 2018

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## CONFERENCES ATTENDED

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<sup>1</sup>This is not a typo.

### Joint Mathematics Meeting

DENVER, CO ..... January 2020

### Society for the Advancement of Chicanos/Hispanics and Native Americans in Science

HONOLULU, HI ..... November 2019

### International Homotopy Type Theory Conference

CARNEGIE MELLON, PITTSBURGH, PA ..... August 2019

### Homotopy Type Theory Summer School

CARNEGIE MELLON, PITTSBURGH, PA ..... August 2019

### Mathematical Research Community:

#### Geometric Representation Theory and Equivariant Elliptic Cohomology

WHISPERING PINES, WEST GREENWICH, RI ..... June 2019

### Geometry in Modal Homotopy Type Theory Workshop

CARNEGIE MELLON, PITTSBURGH, PA ..... March 2019

### Homotopy Type Theory Workshop

FIELDS INSTITUTE, TORONTO, CANADA ..... June 2016

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## OTHER PROFESSIONAL TRAINING

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### Selected Programming Languages

PYTHON, MATHEMATICA, VIMSCRIPT, HASKELL, L<sup>A</sup>T<sub>E</sub>X, SAGE, AGDA, ..... 12+ months experience

### Selected Courses and Experiences

COURSE: METHODS OF EDUCATIONAL INQUIRY ..... Spring 2021

- Course on writing and fulfilling educational research project proposals

PROGRAM FOR INTERDISCIPLINARY AND INDUSTRIAL INTERNSHIPS IN ILLINOIS (PI4) ..... Summer 2017

- Cooperated with the local public health department to search for infant mortality risk factors in the given dataset

COURSE: SOCIOPOLITICAL PERSPECTIVES IN STEM EDUCATION ..... Spring 2017

- Developed a full course from the ground up, using Dr. Rochelle Gutierrez's idea of critical pedagogy

COURSE: HISTORY OF RACE IN THE U.S. .... Fall 2014

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## RECENT AWARDS AND RECOGNITION

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UIUC MATH DEPARTMENT UNIVERSITY FELLOWSHIP ..... Spring 2021

UIUC GRADUATE COLLEGE DISTINGUISHED FELLOWSHIP ..... academic years 2015, 2016, and 2018

SUMMER PRE-DOCTORAL INSTITUTE FELLOWSHIP ..... Summer 2015