
Curriculum Vitae

Education

- 2016–present **Doctor of Philosophy (expected: June 2023)**
Mathematics Department, University of California at Santa Cruz
Santa Cruz, California, USA
- 2012–2015 **Master of Mathematics**
Chern Institute of Mathematics, Nankai University
Tianjin, China
- 2008–2012 **Bachelor of Science**
School of Mathematical Sciences, Nankai University
Tianjin, China

Research Interests

My current research focuses on Bruhat-Tits buildings and p -adic representations. Currently, I'm considering simplicial balls in Bruhat-Tits buildings. The larger goal is to understand the fixed-point sets in Bruhat-Tits buildings and their applications to p -adic representations. Other interests include algebraic analysis, mathematical physics, representation theory, p -adic geometry, tt geometry, higher category theory, homotopical algebras, transcendental number theory, etc.

Publications and Preprints

- Xu Gao, “**Simplicial volumes in Bruhat-Tits buildings of split classical type**”, arXiv:2210.03328.
- Xu Gao, “**Extensions and Non-abelian Cohomology of Pre-Lie Algebras**”, *Master degree thesis*, 2015, Nankai University.
- Xu Gao, Ming Liu, Chengming Bai, and Naihuan Jing, “**Rota-Baxter Operators on Witt and Virasoro Algebras**”, *Journal of Geometry and Physics*, vol.108, 2016, pp.1-20.

Research Experience

Math Department – University of California at Santa Cruz
1156 High St, Santa Cruz, CA 95064
✉ xgao26@ucsc.com • 🌐 [kausyu.github.io](https://github.com/kausyu)

- 2020–present With the advice of *Junecue Suh*, I study the asymptotic growth of the simplicial volume in Bruhat-Tits buildings. A formula of the simplicial volume is deduced from the theory of concave functions, and the asymptotic dominant terms are found in split classical cases. One interesting intermediate result is the interpretation of simplicial distance in terms of the highest root.
- 2016–2018 I learned vertex operator algebras under the advice of *Chongying Dong*. During that time, I tried to consider chiral algebras. To understand such objects, I learned the theory of D-modules and multicategories.
- 2015 I studied the nonabelian cohomology of pre-Lie algebras using homotopy theory and deformation theory. The result contains interpretations of the second cohomology of pre-Lie algebra in terms of the Deligne groupoid and of the intrinsic cohomology.
- 2014 I studied a classification problem of Rota-Baxter operators under the advice of *Chengming Bai*. Although this problem seems hard to do, I find a way to solve it using the idea of algebraic sets.

Honors

- 2014 First prize of Hu Guoding Scholarship at Nankai University
2007 First prize of China National Mathematics Olympiad (CNMO)

Academic Talks

- May 9, 2022 **How many vertices are there in a simplicial ball of radius r (in a Bruhat-Tits Building)?**, *UCSC Graduate Colloquium*, (slides)
- Nov 22, 2021 **Stable Simplexes of p -adic Representations in Bruhat-Tits Buildings.**, *UCSC Graduate Colloquium*, (slides)
- May 24, 2019 **Transcendence of Periods.**, *PhD qualifying oral Presentation*, (slides)

Attended Academic Activities

- June 7–18, 2021 **Sparsity of Algebraic Points**, *MSRI Summer Graduate School*
Mathematical Sciences Research Institute
- March 2–6, 2019 **Topology and Arithmetic**, *Arizona Winter School*
University of Arizona
- August 2019 **Vertex Operator Algebras and Related Topics**, Sichuan University
- May 2016 **Workshop on Lie Theory and Representation Theory**, Sichuan University
- July 2014 **The Lie Theory Workshop**, Sichuan University
- June 2013 **Sino-French Conference on Arithmetic Geometry**, Nankai University

Teaching Experiences

Graduate Student Instructor at **University of California at Santa Cruz**

Duties include instructing students, holding office hours, responding to questions, preparing the course materials such as slides, course notes, and website, and preparing and grading quizzes, homework, and exams.

Fall 2022 **MATH 110: Introduction to Number Theory**, (Course materials on website)

Teaching Assistants at **University of California at Santa Cruz**

Duties include organizing discussion sections, holding office hours, responding to questions, reviewing quizzes, writing solutions, and grading homework and exams.

Summer 2022 **MATH 22: Introduction to Calculus of Several Variables**

Spring 2022 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Winter 2022 **MATH 19A: Calculus for Science, Engineering, and Mathematics**

Fall 2021 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Summer 2021 **MATH 110: Introduction to Number Theory**

Spring 2021 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Winter 2021 **MATH 110: Introduction to Number Theory**

Fall 2020 **MATH 11A: Calculus with Applications**

Summer 2020 **MATH 110: Introduction to Number Theory**

Spring 2020 **MATH 111B: Algebra**

Winter 2020 **MATH 110: Introduction to Number Theory**

Fall 2019 **MATH 100: Introduction to Proof and Problem Solving**

Summer 2019 **MATH 117: Advanced Linear Algebra**

Spring 2019 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Winter 2019 **MATH 19A: Calculus for Science, Engineering, and Mathematics**

Fall 2018 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Summer 2018 **MATH 21: Linear Algebra**

Spring 2018 **MATH 21: Linear Algebra**

Winter 2018 **MATH 110: Introduction to Number Theory**

Winter 2018 **MATH 111: Algebra**

Fall 2017 **MATH 21: Linear Algebra**

Fall 2017 **MATH 100: Introduction to Proof and Problem Solving**

Summer 2017 **The Calculus courses**

Spring 2017 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Winter 2017 **MATH 19B: Calculus for Science, Engineering, and Mathematics**

Fall 2016 **MATH 19A: Calculus for Science, Engineering, and Mathematics**

Teaching Assistants at **Nankai University**

Duties include responding to questions, grading homework, and exams.

2014-2015 **Calculus**

Organized Reading Groups

2019–2020 **Arakelov geometry**, with Jianqi Liu and Yufei Zhang

2019 **Homotopical algebra**, with Tzu-Mo Kuo, Jianqi Liu, Yufei Shan, and Yufei Zhang

Fall 2018 **Homological algebra**, with Tzu-Mo Kuo, Jianqi Liu, Yufei Shan, and Yufei Zhang

2017–2018 **D-modules**, with Tzu-Mo Kuo and Yufei Shan

2017 **Chiral algebras**, with Yiyi Zhu

Spring 2016 **Primes in arithmetic progressions**, with Hanbin Zhang

2015–2016 **Algebraic geometry**, with Hanbin Zhang

2014–2015 **Neukirch's algebraic number theory**, with Hanbin Zhang and Yiyi Zhu

2013–2014 **Category theory**, with Hanbin Zhang and Yiyi Zhu

Other Skills

I know \LaTeX programming and wrote some auxiliary packages. I uploaded the following one, which I thought would be useful to others.

2020-01-02 **secnum** – A macro to format section numbering intuitively