

# William Chuang

# Curriculum Vitae

Department of Mathematics  
University of Arizona  
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<https://williamchuang.github.io>

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## EDUCATION

### University of Arizona

PhD Student in Mathematics, Fall 2022 – Present

### San Francisco State University

M.A., Mathematics, Spring 2022

Thesis: The Hausdorff Dimension of Limit Sets of Well-distributed Schottky Groups

Advisor: Dr. Chun-Kit Lai

### University of San Francisco

B.S., Mathematics, Fall 2018

Major GPA: 3.88/4.00

Minor in Computer Science

Graduated with Honors

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## RESEARCH INTERESTS

Mathematical Physics, Hyperbolic Geometry, and Deep Learning Theory (a combination of applications of mathematical analysis, topology and geometry, modern algebra, random matrix theory, information geometry, approximation theory, convex optimization, statistical inference, statistical mechanics, statistical field theory, category theory, types and programming language, formal verification, compiler construction, computer architecture, and theoretical neuroscience)

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## OTHER INDEPENDENT PROJECTS

### University of Arizona

Independent study: real and complex analysis, and applications of hyperbolic geometry with Prof. David Glickenstein, Fall 2023

### University of Arizona

RTG project: The scaling factor of self-attention weights in transformers with Prof. Ning Hao, Fall 2023

### San Francisco State University

The Computation of Hausdorff Dimension of Limit Sets of Schottky Groups with Dr. Chun-Kit Lai, June 2021 – May 2022

### **San Francisco State University**

Independent Study: A Study on Prime Geodesic Theorem and Limit Sets of Schottky groups, January 2021 – May 2021

Write a document summarizing the modern approach to prove the theorem with an emphasis on the growth rate based on the Hausdorff dimension of the limit set of the Schottky group.

Advisor: Dr. Chun-Kit Lai

### **San Francisco State University**

Topology Project: A Study on Fundamental Groups, September 2020 – December 2020

Advisor: Dr. Emily Clader

### **San Francisco State University**

Independent Study: A Study on Hom-Polytopes, September 2019 – December 2019

Combinatorics Project: A Study on Simplicial Complexes, January 2019 – May 2019

Advisor: Dr. Joseph Gubeladze

### **University of San Francisco**

Independent Study: A Study on Prime Number Theorem, January 2018 – May 2018

Advisor: Dr. Paul Zeitz

### **Pennsylvania State University–University Park**

Functional Analysis Project: A Study on Hardy's Proof on Uniform Distribution, January 2018 – May 2018

Independent Study: Reading "Lecture Notes on Functional Analysis: With Applications to Linear Partial Differential Equations", January 2018 – May 2018

Advisors: Dr. Sergei Tabachnikov and Dr. Moisey Guysinsky

### **Pennsylvania State University–University Park**

Topology Project: Solving  $(9, 8, 4, 3, 7)$ -linkage problem, January 2018 – May 2018

Topology Final Project: Conway's Basic Theorem, September 2017 – December 2017

Advisor: Dr. Sergei Tabachnikov

### **University of San Francisco**

Capstone Project: Using Graph Theory to Implement a Search Engine in Inverted Index Data Structure, January 2018 – May 2018

Advisor: Dr. Chris Bryan

### **University of San Francisco**

Capstone Project: Applying Method of Steepest Descent and Cauchy Contour Integrals on Fisher Exact Test, January 2018 – May 2018

Advisor: Dr. Xuemei Chen

### **University of San Francisco**

Research Assistant, August 2016 – May 2017

Worked on Lecture Notes for MSAN504 Review of Probability and Statistics

Advisor: Dr. Jeff Hamrick

## University of San Francisco

Summer Research Project: Applying Combinatorics, Differential Geometry, Graph Theory, and Deep Learning in Therapeutic Video Games for Disabled Patients, June 2016 – September 2016

Capstone Project: Implementing Applications of Dijkstra Algorithm, Spring 2016

Advisor: Dr. David Galles

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## PRE-BACCALAUREATE INDEPENDENT PROJECTS

### National Taiwan University

Research student at LeCosPA, September 2011 – May 2013

- My old profile page: Tao-Mao Chuang
- LeCosPA people at that time

Research topics that have partially presented in weekly group meetings, weekly journal club, weekly tea time meetings, and courses of cosmological physics and advanced research topics, including but not limited to the following:

- computations on bremsstrahlung and Cherenkov radiation
- quantum gravity in 2+1 dimensions using the Chern-Simons term
- cosmological constant problem, vacuum structure, and vacuum energy
- radiation from moving mirrors and black holes, Schwinger mechanism, Casimir effect, Hawking radiation, Unruh effect, and the existence of a mechanism for their reverse effects
- investigated if low-energy nuclear reactions might serve as the foundation for a potentially carbon-free energy source
- metamaterials and analog models of gravity
- instability of Anti-de Sitter Spacetime
- induced gravity—a revisit, Coleman-Weinberg–Witten theorem on Lorentz violation, and Ads/CFT correspondence

Advisor: Dr. Pisin Chen

### National Taiwan University

Studied Kontsevich-Soibelman wall crossing formula derivations and applications for mathematical quantum field theory, January 2012 – May 2012

Studied the method that solves 3D Ising model using the conformal bootstrap, 2011

Advisor: Dr. Heng-Yu Chen

### National Taiwan University

A Study on Lee-Yang Theorem and the application of Riemann zeta function in Statistical Mechanics, January 2012 – May 2012

Advisor: Dr. Ning-Ning Pang

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## WORK EXPERIENCE

### University of Arizona

Graduate Teaching Assistant of MATH 112 College Algebra, Fall 2022  
Graduate Teaching Assistant of MATH 112 College Algebra, Spring 2023  
Graduate Teaching Assistant of MATH 112 College Algebra, Fall 2023  
Tutor of MATH 129 Calculus II, Fall 2023  
Grader of Math 129 Calculus II final exam, Fall 2023  
Grader of Math 122B/125 Calculus I final exam, Fall 2023  
Advisors: Mitchell Wilson, Tina Deemer, Catherine Yslas, and Prof. David Glickenstein

### San Francisco State University

Graduate Teaching Assistant of Calculus, Spring 2022  
Grader of MATH 227 [05] Calculus II  
Instructor of MATH 226 [38] Calculus I (the fourth hour of MATH 226 [37])  
Instructor of MATH 227 [06] Calculus II (the fourth hour of MATH 227 [05])  
Instructor of MATH 227 [36] Calculus II (the fourth hour of MATH 227 [35])  
Advisors: Prof. Kim Seashore, Prof. Shandy Hauk, and Prof. Eric Hsu

### San Francisco State University

Graduate Teaching Assistant of Pre-Calculus, Fall 2019  
Advisor: Prof. Kim Seashore

### University of San Francisco

San Francisco Math Circle, Fall 2016  
Advisor: Prof. Paul Zeitz

### National Dong Hwa University

Undergrad Research Assistant, Spring 2010  
Hired and advised by Prof. Cheng-Pang Liu

### National Dong Hwa University

Tutor of Calculus and General Physics, August 2008 – December 2009  
Hired by NDHU Department of Physics

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## AWARDS AND HONORS

- Nominated for MSRI Summer Graduate School on Metric Geometry and Geometric Analysis at University of Oxford, UK, Fall 2021
- Dean's Honor Roll, University of San Francisco, Spring 2018
- Mathematics Advanced Study Scholarship and Internal Scholarship (from MASS program), The Pennsylvania State University–University Park, Fall 2017
- Dean's Honor Roll, University of San Francisco, Spring 2015, Fall 2016, and Spring 2017
- Pi Mu Epsilon Honor Society at University of San Francisco
- President's List, National Dong Hwa University, March 2008, November 2008, March 2009, March 2010

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## CERTIFICATES

- MASS Program, achieved all requirements of the 2017 Mathematics Advanced Study Semesters program at The Pennsylvania State University
- ACM Special Interest Group on Management of Data, SIGMOD 2016, recognition of service award
- Tackling the Challenges of Big Data, an online program developed by the faculty of the MIT Computer Science and Artificial Intelligence Laboratory, Feb 3–March 17, 2015

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## SKILLS

- Problem Solving; Can learn new skills quickly.
- Programming Languages: C/C++, Python, R, Java, Lisp, Shell Script, Sed, Awk, LaTeX, Mathematica
- Packages and Libraries: PyTorch, Lightening, Numpy, Pandas, Scikit, Matplotlib, Orge3D
- Recently, learning Haskell and Lean
- Designing algorithms to construct examples for studying theoretical research in math, physics, statistics, and computer science