Juan Serratos

Updated March 21, 2024

Email: Jserrato@usc.edu
Citizenship: United States & Mexico

Education

University of Pennsylvania — Philadelphia, PA
Doctor of Philosophy in Mathematics

University of Southern California (USC) — Los Angeles, CA
BA with honors in Mathematics

Research experience

SGI, Massachussets Insitute of Technology — July – Aug. 2024
Summer Geometry Initiative

Directed Research, USC — Aug. – Dec. 2023
Semester-long directed research project focusing on representation theory, an introduction to the geometric Langlands program, Galois representations, and perverse sheaves. Written a final project entitled, *Fontaine's p-adic period ring* B_{dR}.
With Anne Dranowski

Number Theory REU, Occidental College — May – Aug. 2023

- A 10-week summer research project on modular forms and theta series, focusing on degree three monogenic and Galois $K/\mathbf{Q}$ number fields, at Occidental College, Los Angeles. Accepted for JMM 2024 conference. Funded by NSA.
- Proved the following theorem: Let $f(X) = X^3 + aX + b$ be irreducible over $\mathbf{Q}$ and take α as a root of $f(X)$ in its splitting field. Set $K = \mathbf{Q}(\alpha)$.
  (a) If $K/\mathbf{Q}$ is Galois, then $a < 0$, and if $b \equiv 1 \pmod 2$ then $a \equiv 1 \pmod 2$. Furthermore, if $K/\mathbf{Q}$ is monogenic with respect to α, i.e. $\mathcal{O}_K = \mathbf{Z}[\alpha]$, then $b \equiv 1 \pmod 2$.
  (b) Assume $K/\mathbf{Q}$ is Galois and monogenic. If $p \equiv 2 \pmod 3$, then p is unramified in K. Moreover, if f is irreducible modulo p, then p is inert in K. In particular, $p = 2$ is always inert in K.

With Jim Brown

Directed Research, USC Aug. – Dec. 2022

- Studied modern algebraic geometry under the guidance of Aravind Asok that is required for the Weil Conjectures and étale cohomology.
- Participated in *Math 614: Topics in Algebraic Geometry: Algebraic Groups and Actions* at USC, a graduate course on (functorial) algebraic geometry, mainly using *Introduction to Algebraic Geometry and Algebraic Groups* by Michel Demazure.
- Finished with an independent thesis-like paper written throughout the months leading up to December.

With Aravind Asok

(Independent) Research Project, USC Feb. – May 2023

- Independent reading project on p-adic numbers, adic spaces, and formal schemes, progressing through Scholze and Weinstein's *Berkeley Lectures on p-adic Geometry*.
- Research on $\mathbf{A}^1_{\mathbf{Z}_p[T]} = \operatorname{Spec} \mathbf{Z}_p[T]$, resulting in a descriptive depiction analogous to Mumford's $\operatorname{Spec} \mathbf{Z}[T]$ and am the sole author of arXiv: 2304.03523. (Submitted for journal review.)

Undergraduate Research Project, USC Aug. – Dec. 2022
Focused on reading and progressing through Milne's *Lectures on Étale Cohomology* and unsorted papers found online in a similar context.
With Tianle Liu

Undergraduate Research Project, USC Jan. – May 2022

- Participated in an undergraduate departmental reading project—we are paired up with graduate mentors to source and study a chosen math topic.
- Initially focused on learning homological algebra, specifically about spectral sequences, but then moved on: Learned the basics of scheme theory via Hartshorne's *Algebraic Geometry* and Vakil's *The Rising Sea: Foundations of Algebraic Geometry*. Ongoing project to write complete solutions to Vakil's book.

With Wenhan Jiang

Papers

Lattices and their associated theta series for linear codes defined over $\mathbf{F}_8$
In preparation
Jim Brown, Juan Serratos, Uma Tikekar, Johnthan Webb

On the prime spectrum of the p-adic integer polynomial ring with a depiction
arXiv: 2304.03523
Juan Serratos

Seminar Talks

Algebraic Curves: Genus and Diophantine Geometry July 2023
Occidental College

Childrens pictures of $\operatorname{Spec} A$ June 2023
Occidental College

Étale Cohomology, as motivated by the Weil Conjectures Dec. 2022
University of Southern California

Arithmetic Schemes: David Mumford's depiction of $\operatorname{Spec} \mathbb{Z}[T]$ May. 2022
University of Southern California

Skills

Languages
Spanish - Fluent
French - Conversational
Programming
Python, SAGE, LaTeX