



# Colloquium



**MONDAY, SEPT 14, 2026**

**3:30 PM - 4:30 PM | 2048 CB**

**FROM ELLIPTIC CURVES TO GRAPH  
THEORY: THE FOUR COLOR THEOREM  
AND RANK-ZERO CURVES**

**Speaker: Ben Savoie**

## Bio

Ben is a Boya Postdoctoral Fellow at Peking University, mentored by Ruochuan Liu. He received my Ph.D. from Rice University in 2025 under Brandon Levin. His research focuses on arithmetic geometry and Galois representations, particularly the Emerton–Gee stack, mod  $p$  representation theory, and the arithmetic of elliptic curves. He also enjoys teaching and mentoring students across a broad range of mathematical levels.

## Abstract

What does the Four Color Theorem have to do with solving cubic equations? In this talk, we introduce elliptic curves and the classical problem of finding their rational points. For elliptic curves of the form  $y^2 = x^3 + bx$  over the Gaussian rationals  $\mathbb{Q}(i)$ , we construct a graph whose vertices correspond to the prime factors of  $b$  and whose edges are determined by quadratic-residue relationships. We establish a relationship between the graph's binary Laplacian and a Selmer group of the curve, which provides an explicit upper bound for its rank in terms of connected components and bicycles of the graph. This translation allows us to apply graph-theoretic methods directly to arithmetic questions. As an application, we will use the Four Color Theorem to produce large collections of rank-zero elliptic curves, each with only finitely many rational points.

**Refreshments will be provided!**