Directed Reading Program Presentations

Friday, 12/6 **Noon** **Exley 058** **Pizza Lunch!**

Braid Theory: Braids as a Group - Sam Wheeler

Braids have cultural significance and appear both in everyday life and scientific studies. As mathematicians, we can weave our way through the abstract study of braids, which tie together intriguing examples in geometry and group theory. We will see that braids with a given number of strands form a group under braid concatenation. We will introduce braids as geometric objects and then reinterpret them as algebraic concepts, adding notation to differentiate them.

Pure Braids and Equivalence - Amit Piryatinsky

Now that we understand the group properties of braids, we may wonder: What does it mean for two braids to be equivalent? Is there a process we can use to tell them apart? We will address this problem by examining pure braids. Our first step will be to recognize whether a given braid is pure. Then, we will use a process known as "combing" to determine whether the pure braid is trivial. Finally, we will show that these steps give us a way of determining if two braids are equivalent.

Prime Number Races - Ethan Chu

The behavior of prime numbers is widely studied but not fully understood. One interesting area of study focuses on prime number races through arithmetic progressions–that is examining how many primes are congruent to some a modulo q compared to how many primes are congruent to b modulo q up to some fixed number X. An unexpected result mathematicians have found through data is that for some arithmetic progressions, one progression seems to always take the lead. If the behavior of prime numbers is truly random, what could account for such biases? In this talk we will focus on the race between primes of the form $4n + 1$ and $4n + 3$, and try to understand how the famous Riemann Hypothesis plays a role in the outcome of this race.

Recurrence, Ergodicity, and the Circle-Rotation Map - Ziye Zhu

Recurrence is a central theme of ergodic theory, addressing how points in measurable dynamical systems return close to their initial positions under iteration. In this presentation, we take a measure-theoretic approach to explore ergodic and non-ergodic behaviors through the circle rotation map R_α. We will discuss the Poincaré recurrence theorem as a pigeonhole principle for the subject and examine induced transformation as a consequence of recurrence.

CAT(0) Cube Complexes - Tariq Wright

CAT(0) cube complexes represent an interesting subset of the non-positively curved cube complexes. Cube complexes are constructed by gluing together cubes of arbitrary dimensions along their faces. We can see examples of CAT(0) cube complexes in trees, as well as products of cube complexes. In this presentation we will discuss the criteria for a space to be CAT(0), and describe which cube complexes are CAT(0). We will also explore features of CAT(0) cube complexes such as hyperplanes, pocset structure and ultrafilters which will help us to garner a better understanding of CAT(0) cube complexes.