

PARTICIPANT TALKS FRIDAY, AUGUST 12

5:00pm, R251 (the barn): three talks before dinner; dinner at 6:00, four later talks

Speakers, Titles, and Abstracts

Maithreya Sitaraman

Title: Exploring unknown spaces via nerves of coverings

Abstract: I will propose a method of obtaining topological information about an unknown space from minimal empirical data. The method uses empirical data to construct a suitable cover of the space from a given finite subset. One then constructs an abstract simplicial complex associated with the cover, called the nerve of the cover, and a weaker version of the nerve theorem informs us that the fundamental group of the nerve is a quotient of the fundamental group of the space. We may therefore infer topological information about the unknown space via the nerves we construct. More subtly, topological information can in fact be obtained by observing how nerves change as we add or remove points from our finite subset, and we present a result which demonstrates this latter phenomenon.

Adele Padgett

Title: An Introduction to Keisler's Order.

Abstract: Roughly, Keisler's order is an ordering on the complexity of theories. Rigorously, it orders theories by saturation of ultrapowers of their models. I will give a heuristic introduction to these terms with several examples and few (if any) proofs.

Isabella Scott

Title: A Model Theoretic Proof of Ramsey's Theorem

Abstract: I will present a proof of Ramsey's theorem using the machinery of ultrafilters, discussing the benefits and drawbacks of the method. If time permits, I will also give some refinements of the theorem.

DINNER

Zach Kirsche

Title: Introduction to Local-Global Methods in Algebraic Number Theory

Abstract: In this talk, we will construct the local fields associated to an algebraic number field and give some examples of why they are useful. We will first describe the construction of local fields and seek to classify all of the possible local fields associated with an algebraic number field. We will then use the Hasse-Minkowski theorem to show through concrete example how information over the local fields can be used to discern information about the global field.

Peter Xu

Title: The Weil-Riemann hypothesis for zeta functions of varieties over finite fields

Abstract: We are interested in understanding the number of points of nice varieties over finite fields, information which is encoded in its zeta function. Weil's conjectures, and in particular the Riemann-Weil hypothesis, helps us to understand this function, and consequently the arithmetic information we are after. Weil proved his hypothesis geometrically for the case of curves, and, following a paper by Manin, we will see how cohomological tools allow us to extend this further, with an example computation that establishes the hypothesis for a broad class of hyper-surfaces. Finally, this will give us some intuition to indicate the general direction of Grothendieck's conjectural "motivic" proof of the Weil conjectures.

Sam Spiro

Title: Fourier Analysis and Arrow's Impossibility Theorem

Abstract: In this talk I introduce the ideas of the Fourier analysis of Boolean functions. I then use these techniques to give a concise proof of Arrow's Impossibility theorem.

Enya Hsiao

Title: General relativity and black hole stability.

Abstract: General relativity started out as a field in physics, which postulates spacetime as a lorentzian manifold satisfying the Einstein field equations. But later on this subject has been taken on by mathematicians to solve problems such as existence, uniqueness and stability that physicists do not necessarily have the analytic tools to deal with. In this talk however, I shall describe an instance of how physicists help mathematicians solve physics/math problems(up to second order!) by providing an energy argument to black hole stability.