Schedule

Geometry & Topology	9:30AM	Professor Schultens
	10:00AM	George Mossessian
Analysis & PDEs	10:30AM	Professor Hunter
	11:00AM	Kevin Schenthal
Physics & Mathematical Physics	11:30AM	Dr Ryan James
	12:00 PM	Eric Brattain-Morrin
Lunch	12:30PM	to 1:10PM
Algebra & Discrete Mathematics	1:15PM	Henry Kvinge
	1:45PM	Professor Liu
Statistics, Probability, & Optimization	2:15PM	Professor Anderes
	2:45PM	Philip Kopel
	3:15PM	Jamie Haddock

Abstracts

Geometry & Topology

Professor Schultens
Title: The Kakimizu complex
Abstract:We will define knots and Seifert surfaces, demonstrate Seifert's algorithm, which shows that every knot possesses a Seifert surface, discuss the abundance of Seifert surfaces for certain knots, and define the Kakimizu complex of a knot. We will conclude by stating key theorems describing the geometry of the Kakimizu complex.

George Mossessian
Title:
Abstract: The stable genus problem for 3-manifolds asks, given two Heegaard splittings for one 3-manifold, what is the genus of their common stabilization. We will construct a family of examples that have two genus-n splittings whose common stabilization has genus 2n-1.

Analysis & PDEs

Professor Hunter
Title: Nonlinear surface waves
Abstract: Surface waves are waves that propagate along a boundary, interface, or free surface. The most familiar surface waves are water waves on a river or ocean. Other examples are Rayleigh waves on an elastic solid, optical surface plasmons on the interface between an insulator and a conductor, and waves on a vorticity discontinuity in an incompressible, inviscid fluid flow. An

asymptotic analysis of these waves typically leads to nonlocal, nonlinear evolution equations for the amplitude of the wave on the surface. We will show some of these equations and discuss issues related to well-posedness, singularity formation, and weak solutions.

Kevin Schenthal
Title:
Abstract:

Physics & Mathematical Physics

Dr Ryan James
Title: New Horizons in Information Theory
Abstract: Information theory was initially created to address engineering problems within the realm of communication, but quickly found application in fields from biology to philosophy. The demands of science, however, can be quite different than those of communication engineering. Here, after giving a brief overview of basic measures of information, we discuss their limitations when faced with the questions asked by modern science. These include the interpretation of multivariate information measures, quantifying redundancy, and measuring information flow between agents.

Eric Brattain-Morrin
Title: Completeness of the Bethe Ansatz for the Periodic Asymmetric Simple Exclusion Process
Abstract: The periodic asymmetric simple exclusion process (ASEP) consists of N particles on a ring with L sites that randomly hop left or right to unoccupied spaces in continuous time. ASEP has become a basic paradigm in non-equilibrium statistical mechanics. The master equation for the process may be solved using the Bethe ansatz, but the periodicity leads to non-trivial conditions on the parameters of the ansatz known as the Bethe equations. We will discuss elements of the rigorous proof that the ansatz is actually complete, which draws upon a range of techniques from algebraic geometry, topology and enumerative combinatorics.

Algebra & Discrete Mathematics

Professor Liu
Title:Introduction to Ehrhart Theory
Abstract: Given an integral convex polytope P, for any positive integer t we denote by i(P,t) the number of lattice points inside the tth dilation tP of P. Eugene Ehrhart discovered in 1960s that i(P, m) is a polynomial in t of degree dim(P). So we often call i(P, t) the Ehrhart polynomial of P.

In this talk, I will survey some well-known results related to Ehrhart polynomials, and tools that can be used to study them. If time permits, I will also discuss some of my own results on this subject. No previous knowledge on this topic is required.

Henry Kvinge
Title:The influence of the Kirillov-Reshetikhin crystal $B^{1,1}$ on the structure of simple cyclotomic KLR modules.
Abstract: Khovanov-Lauda-Rouquier (KLR) algebras were invented to categorify the negative

half of the quantum Kac-Moody algebra associated to a symmetrizable Cartan data. It was later shown by Lauda-Vazirani that the simple modules of the cyclotomic KLR algebra, R^Λ, carry the structure of the highest weight crystal $B(\Lambda)$. It follows from this that any properties of $B(\Lambda)$ should be the shadow of some module-theoretic property of simple R^Λ-modules.

In classical affine type, highest weight crystals (which are infinite) have the remarkable property that they can be constructed from the tensor product of the much more tractable perfect crystals (which are finite). In this talk I will describe the algebraic analogue of this phenomenon in terms of simple R^Λ-modules in the case where the perfect crystal is the Kirillov-Reshetkhin crystal $B^{1,1}$ and Λ is the fundamental weight Λ_i.

This is joint work with Monica Vazirani.

Statistics, Probability & Optimization

Professor Andres

Title: A quadratic estimator of random field nonstationarity.

Abstract: More than a decade ago two physicists, Wayne Hu and Takemi Okamoto, invented a new estimator for measuring the dark matter distortion imprinted on the our observations of the cosmic microwave background (which is a relic signal of the big bang). Their estimator, called the quadratic estimator, quickly became the state-of-the-art tool for detecting, measuring and mapping dark matter. From a spatial statistics perspective this estimator has some remarkable properties. In this talk I will present ongoing work on the analysis of the quadratic estimator in the context of both cosmology and in a more generalized setting of estimating random field non-stationarity.

Philip Kopel

Title: The Remarkable Random Matrix

Abstract: Random matrix theory is the crown jewel of mathematics, and the Circular Law is one of the most brilliant facets of random matrix theory. I will present and discuss this remarkable theorem, along with several recently obtained related results, as well as some interesting questions that have not yet been settled. No prior knowledge is assumed.

Jamie Haddock

Title: Motzkin's Method and the randomized Kaczmarz Method

Abstract: We discuss three methods for addressing the linear feasibility problem, i.e. What is a solution of the linear inequalities, $Ax \leq b$? The first two are the famous methods of Kaczmarz and Motzkin, while the third is a hybrid of the two previous methods.