### Monday, November 16, 2020

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<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>11:00am-12:00pm</td>
<td><strong>Algebraic Topology</strong> -- John Greenlees (University of Warwick) <em>The singularity category of the cochains of classifying spaces of finite groups [joint work with G.Stevenson and D.Benson]</em> -- online Virtual</td>
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<tr>
<td>11:00am-11:50am</td>
<td><strong>Student Analysis</strong> -- Tejaswi Tripathi (University of Michigan) <em>Combinatorics and Random Matrix Theory</em> -- Virtual East Hall</td>
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<tr>
<td>12:30pm-2:30pm</td>
<td><strong>Special Events</strong> -- Jia Guo Guo (UM) <em>Dissertation Defense: Three problems in stochastic control and applications.</em> -- Virtual</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>RTG Seminar on Number Theory</strong> -- Shizhang Li (UM) <em>A leftover comparison of prismatic and certain crystalline cohomology</em> --</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Integrable Systems and Random Matrix Theory</strong> -- Sitai Li (University of Michigan) <em>Asymptotics in the sharp-line Maxwell-Bloch system without solitons</em> -- Zoom Meeting: 91617339235 Passcode: 651935 Virtual</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Midwest Dynamics and Group Actions</strong> -- Jonathan DeWitt (The University of Chicago) <em>Simultaneous Linearization of Diffeomorphisms of Isotropic Manifolds</em> -- Virtual</td>
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<tr>
<td>7:00pm-8:00pm</td>
<td><strong>Student Math Finance</strong> -- Berkan Yilmaz (University of Michigan) <em>Pathwise Derivation of Doob Inequalities</em> -- <a href="https://umich.zoom.us/j/99487325343">https://umich.zoom.us/j/99487325343</a> Virtual</td>
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### Tuesday, November 17, 2020

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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Colloquium Series</strong> -- Catherine Goldstein (CNRS, Institut de mathématiques de Jussieu Paris Gauche) <em>Hermite’s mathematics as natural science</em> -- Zoom East Hall</td>
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<tr>
<td>5:00pm-6:00pm</td>
<td><strong>Complex Analysis, Dynamics and Geometry</strong> -- Danny Stoll (U(M)) <em>The Combinatorics of Escape Regions</em> -- Virtual</td>
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<tr>
<td>5:00pm-6:00pm</td>
<td><strong>Student Combinatorics</strong> -- Michael Mueller () <em>Introduction to Schubert Calculus</em> -- Virtual</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Student Dynamics/Geometry Topology</strong> -- Max Lahn (University of Michigan) <em>Length spectrum as an isometry invariant</em> -- Zoom link: <a href="https://umich.zoom.us/j/94090012548">https://umich.zoom.us/j/94090012548</a> Virtual</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Algebraic Geometry</strong> -- Lena Ji (Princeton University) <em>Geometrically non-reduced varieties</em> -- Zoom East Hall</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Financial/Actuarial Mathematics</strong> -- Bahman Angoshtari (University of Miami) <em>Optimal Consumption under a Habit-Formation Constraint Based on Average Past Consumption</em> -- Passcode: 790109 <a href="https://umich.zoom.us/j/9540765241">https://umich.zoom.us/j/9540765241</a> Virtual</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>MCAIM Colloquium</strong> -- Gigliola Staffilani (MIT) <em>The many faces of dispersive equations</em> -- Zoom Meeting ID: 947 2346 1309 . Zoom Link: <a href="https://umich.zoom.us/j/94723461309">https://umich.zoom.us/j/94723461309</a> . Virtual</td>
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<tr>
<td>4:00pm-5:30pm</td>
<td><strong>RTG Seminar on Geometry, Dynamics and Topology</strong> -- Asaf Katz (U Michigan) <em>Equidistribution and measure classification for the horocyclic flow</em> -- <a href="https://umich.zoom.us/j/91734725787">https://umich.zoom.us/j/91734725787</a> -- 3866 East Hall</td>
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<td><strong>Topology</strong> -- Robert Lipshitz (University of Oregon) <em>Floer homology and Smith theory</em> -- Virtual</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Differential Equations</strong> -- Ricardo Grande (University of Michigan) <em>Continuum limit of discrete NLS-type equations</em> -- Zoom ID: 983 6567 6067 Passcode: 2020 Virtual</td>
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</tr>
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<td>5:00pm-6:00pm</td>
<td><strong>Student Commutative Algebra</strong> -- Teresa Yu (University of Michigan) <em>Introduction to Stanley---Reisner Theory</em> -- Virtual</td>
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<tr>
<td>11:00am-11:50am</td>
<td><strong>Representation Stability</strong> -- Robert Laudone (UM) <em>K-L theory V: Parabolic KL polynomials</em> -- Online</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Applied Interdisciplinary Mathematics (AIM)</strong> -- Baole Wen (University of Michigan) <em>Steady coherent states in Rayleigh-Bénard convection</em> -- (Zoom) (Joint with MICDE) East Hall</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Student Algebraic Geometry</strong> -- Jonghyun Lee () <em>27 lines on a smooth cubic surface</em> --</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Preprint Algebraic Geometry</strong> -- Shubhodip Mondal () <em>Lyubeznik numbers of projective varieties depend on the embedding</em> -- Zoom East Hall</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Student AIM Seminar</strong> -- Georg Hahn (Harvard University) <em>Quadratic unconstrained binary optimisation and recent advances in quantum annealing</em> -- Zoom Virtual</td>
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Abstracts for the week of November 15th, 2020 - November 21st, 2020

Algebraic Topology
Monday, November 16, 2020, 11:00am-12:00pm
online Virtual
John Greenlees (University of Warwick)

The singularity category of the cochains of classifying spaces of finite groups [joint work with G.Stevenson and D.Benson]

For an ordinary commutative Noetherian ring $R$ we would define the singularity category to be the quotient of the (derived category of) finitely generated modules modulo the (derived category of) fg projective modules ["the bounded derived category modulo compact objects"]. This is trivial if and only if $R$ is regular.

To cover cochains on the classifying space, with coefficients in a field $k$ of characteristic $p$ we take $C^\bullet(BG;k)$ to be the commutative ring spectrum of maps from $BG$ to the Eilenberg-MacLane spectrum, and work in the category of module spectra over it. It is then easy to define the compact objects, but finitely generated objects need more ingenuity. The talk will describe the definition and show that the singularity category is trivial exactly when $G$ is $p$-nilpotent. We will go on to describe the singularity category for groups with cyclic Sylow $p$-subgroup.

Student Analysis
Monday, November 16, 2020, 11:00am-11:50am
Virtual East Hall
Tejaswi Tripathi (University of Michigan)

Combinatorics and Random Matrix Theory

A wide variety of problems in combinatorics can be solved in terms of random matrix theory. In this talk, we'll discuss two key examples from combinatorial theory, viz., Ulam's increasing subsequence problem, and directed last passage percolation. Interestingly, certain key quantities associated with these problems behave statistically like the eigenvalues of a large random matrix. We'll discuss definitions, results, and describe some real-world applications. Time permitting, we'll briefly overview the techniques used in the proof.
Special Events  
Monday, November 16, 2020, 12:30pm-2:30pm  
Virtual  
Jia Guo Guo (UM)  
*Dissertation Defense: Three problems in stochastic control and applications.*

This thesis mainly concludes three different projects that I am devoted to: Recombining Tree Approximations for Optimal Stopping for Diffusions (Chapter 2), Continuity of Utility Maximization under Weak Convergence (Chapter 3) and Disorder Detection with Costly Observations (Chapter 4). The first two projects are related work. The third one is based on [16].

In Chapter 2, we develop two numerical methods for optimal stopping in the framework of one dimensional diffusion. Both of the methods use the Skorohod embedding in order to construct recombining tree approximations for diffusions with general coefficients. This technique allows us to determine convergence rates and construct nearly optimal stopping times which are optimal at the same rate. Finally, we demonstrate the efficiency of our schemes on several models.

In Chapter 3, we find sufficient conditions for the continuity of the utility maximization problem from terminal wealth under convergence in distribution of the underlying processes. We provide several examples which illustrate that without these conditions, we cannot generally expect continuity to hold. Finally, we apply our continuity results to numerical computations of the shortfall risk in the Heston model.

In Chapter 4, we study the Wiener disorder detection problem where each observation is associated with a positive cost. In this setting, a strategy is a pair consisting of a sequence of observation times and a stopping time corresponding to the declaration of disorder. We characterize the minimal cost of the disorder problem with costly observations as the unique fix-point of a certain jump operator, and we determine the optimal strategy.

Join Zoom Meeting  
https://umich.zoom.us/j/91352637463  
Meeting ID: 913 5263 7463  
Passcode: 354139

RTG Seminar on Number Theory  
Monday, November 16, 2020, 3:00pm-4:00pm  
Shizhang Li (UM)  
*A leftover comparison of prismatic and certain crystalline cohomology*

In this talk I shall motivate and state a comparison between prismatic and a certain crystalline cohomology which was considered by Breuil, Caruso, …., Bhatt--Morrow--Scholze. Time permitting, I might even be able to explain all the notions that one needs to make sense of what's being compared. This is a joint work with Tong Liu.

http://www.math.lsa.umich.edu/seminars_events/ - Page 4/12
Integrable Systems and Random Matrix Theory  
**Monday, November 16, 2020, 4:00pm-5:00pm**  
*Sitai Li (University of Michigan)*  
*Asymptotics in the sharp-line Maxwell-Bloch system without solitons*

In this talk, we discuss the asymptotics in the (characteristic) Cauchy problem for the Maxwell-Bloch equations of light-matter interaction, under assumptions that prevent the generation of solitons. Both cases (initially stable/unstable media) are considered. In particular, we describe a layer phenomenon in which, even for smooth initial data, the solution makes a sudden transition over an infinitesimally small propagation distance. At a formal level, this phenomenon has been described by other authors in terms of a self-similar solution that satisfies an ordinary differential equation related to the Painlevé-III (PIII) equation. We show that the two cases of stable/unstable medium are related to different PIII equations and their Riemann-Hilbert problems. Our analysis of the temporal boundary conditions satisfied by the electric field and medium density matrix reveals slow decay of the electric field in one direction that is actually inconsistent with the simplest version of the scattering theory. The results are then carefully compared to direct numerical simulations.

Midwest Dynamics and Group Actions  
**Monday, November 16, 2020, 4:00pm-5:00pm**  
*Jonathan DeWitt (The University of Chicago)*  
*Simultaneous Linearization of Diffeomorphisms of Isotropic Manifolds*

Suppose that $M$ is a closed isotropic Riemannian manifold and that $R_1, \ldots, R_m$ generate the isometry group of $M$. Let $f_1, \ldots, f_m$ be smooth perturbations of these isometries. We show that the $f_i$ are simultaneously conjugate to isometries if and only if their associated uniform Bernoulli random walk has all Lyapunov exponents zero. This extends a linearization result of Dolgopyat and Krikorian from $S^n$ to real, complex, and quaternionic projective spaces.

Student Math Finance  
**Monday, November 16, 2020, 7:00pm-8:00pm**  
*Berkan Yilmaz (University of Michigan)*  
*Pathwise Derivation of Doob Inequalities*

In this talk, we will provide an interesting (informally known as "cute") derivation of Doob's Martingale Inequalities. The derivation provides a good case for the argument that quantitative finance can indeed inform mathematical thought.
Charles Hermite's name has been attributed to several objects and results in mathematics, from Hermitian matrices to Hermite polynomials to Hermite's identity or Hermite-Minkowski theorem. Despite his achievements and central role in the mathematical life of the 19th century, he often appears as an anti-hero, opposed to anything modern, be it ideals, non-Euclidean geometry or set theory. I will try to explain his point of view which is linked to a vision of mathematics as a natural, observational science, and show how this perspective shaped his mathematical work and his requirements on what good mathematics should be.

Zoom Link: https://umich.zoom.us/j/97782878514

Passcode: 339951

The link for the recording:

https://umich.zoom.us/rec/share/u437QmxT7BZOFQzeVKdfXNjmK36H_TTjR5pYifaMs7VIrZJ26qNpSV8UeqWSwm5Z.kZhWcrAJ4LNVCWH3

We consider the parameter space Per(p, 0) of cubic polynomials with a marked critical point that is constrained to be periodic of period p. The complement of the connectedness locus consists of a finite set of punctured disks, referred to as escape regions. In this talk, I will describe some of the work of DeMarco and Pilgrim, who show that discrete structures known as pictographs can be used to partially, though not completely, distinguish escape regions up to topological conjugacy. In the latter part of the talk, I will discuss ongoing efforts to generalize the work of Blanchard, Devaney, and Keen connecting the monodromy of escape regions to automorphisms of the shift.
Student Combinatorics
Tuesday, November 17, 2020, 5:00pm-6:00pm
Virtual
Michael Mueller ()
*Introduction to Schubert Calculus*

Given a vector space $V$ of dimension $n$, the set of $k$-dimensional vector subspaces forms an algebraic variety known as the Grassmannian $\text{Gr}(k, V)$, and certain enumerative geometry questions can be phrased as questions about its cohomology. Schubert calculus is the study of this cohomology ring, which can be analyzed combinatorially in terms of certain classes known as Schubert classes (which correspond to Young diagrams). In this talk I will give an introduction to Schubert calculus and its combinatorial aspects.

Student Dynamics/Geometry Topology
Wednesday, November 18, 2020, 3:00pm-4:00pm
Zoom link: https://umich.zoom.us/j/94090012548 Virtual
Max Lahn (University of Michigan)
*Length spectrum as an isometry invariant*

It's a theorem of Otal that the marked length spectrum is a complete isometry invariant for closed surfaces of negative sectional curvature. The same can't be said for the unmarked length spectrum -- Sunada's construction provides examples of surfaces which are length isospectral but not isometric. Generalizing the methods of Maungchang, we'll discuss an ongoing attempt to salvage the unmarked length spectrum as an isometry invariant. In the process, we'll take a tour through some touchstone ideas in surface topology, including the coarse geometry of the curve complex and the Teichmüller space.

Recommended background for surface-level understanding: basic exposure to the fundamental group, covering spaces, and the classification of surfaces. For mid-level understanding: some exposure to Riemannian and/or hyperbolic geometry, the curve complex, and Teichmüller space. For technical understanding: some exposure to coarse geometry, the Gromov boundary of the curve complex and the Thurston boundary of the Teichmüller space.

Algebraic Geometry
Wednesday, November 18, 2020, 4:00pm-5:00pm
Zoom East Hall
Lena Ji (Princeton University)
*Geometrically non-reduced varieties*

In positive characteristic, there exist fibrations between smooth varieties where every fiber is singular or even non-reduced. In the latter case, the generic fiber of the fibration is geometrically non-reduced. We study the failure of generic smoothness and obtain a structural result about geometrically non-reduced varieties, with applications to Fano varieties. This is joint work with Joe Waldron.
Financial/Actuarial Mathematics  
Wednesday, November 18, 2020, 4:00pm-5:00pm  
Passcode: 790109  https://umich.zoom.us/j/95407665241 Virtual  
Bahman Angoshtari (University of Miami)  
*Optimal Consumption under a Habit-Formation Constraint Based on Average Past Consumption*  

We consider an infinite horizon optimal consumption problem for an individual who forms consumption habit based on an exponentially weighted average of her past consumption rates. We assume that the individual seeks to maximize the expected discounted CRRA utility of her relative consumption-to-habit process, and that she is unwilling to consume at a rate that is below a certain proportion of her consumption habit. We consider two cases, one in which the individual invests only in a risk-free asset, and another scenario where she invests in a Black-Scholes market. In both cases, we find that there exists a threshold $x^*$ such that if the ratio of wealth-to-habit is above (respectively, below) $x^*$, it is optimal to consume at a rate higher than (respectively, equal to) the minimum acceptable rate. Furthermore, the individual optimally consumes to attain specific wealth-to-habit and consumption-to-habit ratios. The optimal investment and consumption policies are obtained explicitly in terms of the solution of a nonlinear free-boundary problem, which we analyze in detail.

MCAIM Colloquium  
Wednesday, November 18, 2020, 4:00pm-5:00pm  
Zoom Meeting ID: 947 2346 1309 . Zoom Link: https://umich.zoom.us/j/94723461309 . Virtual  
Gigliola Staffilani (MIT)  
*The many faces of dispersive equations*  

In recent years great progress has been made in the study of dispersive and wave equations. Over the years the toolbox used in order to attack highly nontrivial problems related to these equations has developed to include a variety of techniques from Fourier and harmonic analysis, analytic number theory, math physics, dynamical systems, probability and symplectic geometry. In this talk I will introduce a variety of problems connected with dispersive and wave equations, such as the derivation of a certain nonlinear Schrodinger equation from a quantum many-particles system, periodic Strichartz estimates, the concept of energy transfer, the invariance of a Gibbs measure associated to an infinite dimension Hamiltonian system and non-squeezing theorems for such systems when they also enjoy a symplectic structure.
RTG Seminar on Geometry, Dynamics and Topology  
Wednesday, November 18, 2020, 4:00pm-5:30pm  
3866 East Hall  
Asaf Katz (U Michigan)  
Equidistribution and measure classification for the horocyclic flow: https://umich.zoom.us/j/91734725787

We will discuss equidistribution and measure classification for the horocyclic flow over (unit tangent bundle of) Riemann surfaces, leading to celebrated results by Furstenberg, Dani and Dani-Smillie. We will mainly follow Ch. 11 of Einsiedler-Ward (Vol 1) and Ch. 5 of Einsiedler-Ward (Vol 3).

Join Zoom Meeting (note the NEW zoo room)  
https://umich.zoom.us/j/91734725787

There is no password required at this point.

Topology  
Thursday, November 19, 2020, 3:00pm-4:00pm  
Virtual  
Robert Lipshitz (University of Oregon)  
Floer homology and Smith theory

Research over the last fifteen years has uncovered a raft of inequalities between the Floer homology invariants of a 3-manifold and of certain of its covers. We will recall some of these results, the philosophy behind them, and some of their implications and connections with classical and modern conjectures. We will then describe a new technique for proving such results, due to Tim Large, and a recent application of it, in joint work with Kristen Hendricks and Tye Lidman.

Differential Equations  
Thursday, November 19, 2020, 4:00pm-5:00pm  
Zoom ID: 983 6567 6067 Passcode: 2020 Virtual  
Ricardo Grande (University of Michigan)  
Continuum limit of discrete NLS-type equations

We will study a family of discrete NLS-type equations, including some issues with dispersion and smoothing effect which arise in this setting. Regarding the continuum limit, we will compare the approach of Kirkpatrick, Lenzmann and Staffilani (2013) and that of Hong and Yang (2019). Finally, we will explain how to combine these methods to tackle more general dispersive equations.

Join Zoom Meeting  
https://umich.zoom.us/j/98365676067

Meeting ID: 983 6567 6067  
Passcode: 2020
Student Commutative Algebra  
Thursday, November 19, 2020, 5:00pm-6:00pm  
Virtual  
Teresa Yu (University of Michigan)  
Introduction to Stanley--Reisner Theory

Stanley--Reisner theory directly links the worlds of combinatorics and commutative algebra by providing a correspondence between simplicial complexes and squarefree monomial ideals. We'll introduce this correspondence, and discuss how it can be used to compute associated primes and Hilbert series.

https://umich.zoom.us/j/99835724541

Representation Stability  
Friday, November 20, 2020, 11:00am-11:50am  
Online  
Robert Laudone (UM)  
K-L theory V: Parabolic KL polynomials
Applied Interdisciplinary Mathematics (AIM)
Friday, November 20, 2020, 3:00pm-4:00pm
(Zoom) (Joint with MICDE) East Hall
Baole Wen (University of Michigan)
Steady coherent states in Rayleigh--Bénard convection

Buoyancy-driven flows are central to engineering heat transport, atmosphere and ocean dynamics, climate science, geodynamics, and stellar physics. Rayleigh--Bénard convection—the buoyancy driven flow in a fluid layer heated from below and cooled from above—is recognized as the simplest scenario in which to study such phenomena, and beyond its importance for applications this problem has served for a century as one of the primary paradigms of nonlinear physics, complex dynamics, pattern formation and turbulence. A central question about Rayleigh--Bénard convection is how the Nusselt number $\Nu$ depends on the Rayleigh number $\Ra$ and the Prandtl number $\Pr$—i.e., how heat flux depends on imposed temperature gradient and the ratio of the fluid’s kinematic viscosity to its thermal diffusivity—as $\Ra \to \infty$. Experiments and simulations have yet to rule out either ‘classical’ $\Nu \sim \Ra^{1/3}$ or ‘ultimate’ $\Nu \sim \Ra^{1/2}$ asymptotic scaling. Here we provide clear quantitative evidence suggesting that the ultimate regime might not exist. Our tactic is to study relatively simple time-independent states called rolls and compare heat transport by these rolls with that of turbulent convection. These steady rolls are not typically seen in large-$\Ra$ simulations or experiments because they are dynamically unstable. Nonetheless, they are part of the global attractor for the infinite-dimensional dynamical system defined by Rayleigh’s model, and recent results suggest that steady rolls may be one of the key coherent states comprising the ‘backbone’ of turbulent convection. By developing novel numerical methods, we compute steady rolls between no-slip boundaries for $\Ra \leq 10^{14}$ with $\Pr = 1$ and various horizontal periods. We find that rolls of the periods that maximize $\Nu$ at each $\Ra$ have classical $\Nu \sim \Ra^{1/3}$ scaling asymptotically, and they transport more heat than turbulent experiments or simulations at similar parameters. If turbulent heat transport continues to be dominated by steady transport asymptotically, it cannot achieve ultimate scaling.

Student Algebraic Geometry
Friday, November 20, 2020, 3:00pm-4:00pm

Jonghyun Lee ()
27 lines on a smooth cubic surface

In 1849 Arthur Cayley and George Salmon proved the celebrated result that a general cubic surface contains exactly 27 lines. In this talk, we will initiate you into the secret fellowship of the 27 lines (as Ravi Vakil would say), proving that every smooth cubic surface over an algebraically closed field contains exactly 27 lines. Time permitting, we will also show that every smooth cubic surface is the blowup of the projective plane at six points.

Preprint Algebraic Geometry
Friday, November 20, 2020, 4:00pm-5:00pm
Zoom East Hall
Shubhodip Mondal ()
Lyubeznik numbers of projective varieties depend on the embedding

Student AIM Seminar
Friday, November 20, 2020, 4:00pm-5:00pm
Zoom Virtual
Georg Hahn (Harvard University)

Quadratic unconstrained binary optimisation and recent advances in quantum annealing

This talk introduces NP-hard problems, some of their properties, and their formulation as an Ising or QUBO (quadratic unconstrained binary optimization) problem needed to implement them on the so-called D-Wave annealer, an emerging (maybe quantum or maybe not) technology to solve such problems. The talk presents a short study on the performance of D-Wave for a classical NP-complete problem (where the comparison was with respect to classical solvers).

This presentation is actually part of a series of 5 talks on NP-complete problems and D-Wave. The following two talks will focus again on a technical aspect -- What to do when the problems we want to solve do not fit onto the limited connectivity structure of around 2000 qubits offered by the device? As a solution, we look at how to divide up an NP-complete problem into two parts in such a way that (a) both parts are strictly smaller than the original input problem, and (b) solving both smaller problems to optimality allows us to construct the optimal solution of the full problem in polynomial time. Recursively applying such a method allows us to divide up an NP-complete problem until any desired size is reached, in particular until we can implement it on the D-Wave machine. The third talk is on how to peer into the annealing process of D-Wave with the aim to observe how a solution evolves during annealing. The fourth talk is theoretical again, though it focuses on a very practical problem: Suppose we get a good D-Wave solution, can we quantify how good it is? That is, how far away is it from optimality? That is a hard question, though it is possible to bound the distance of any D-Wave solution from the optimal one, which can be used as a measure of accuracy.