### Weekly Seminar & Events Bulletin
January 20th, 2019 - January 26th, 2019

#### Monday, January 21, 2019

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>10:00am-11:00am</td>
<td><strong>Student Homotopy Theory</strong> -- () Planning meeting -- 3088 East Hall</td>
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<tr>
<td>4:00pm-5:30pm</td>
<td><strong>Group, Lie and Number Theory</strong> -- No Talk () MLK day -- 4088 East Hall</td>
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<td>4:00pm-6:00pm</td>
<td><strong>Geometry &amp; Physics</strong> -- Jie Zhou (Tsinghua University) <em>Fukaya series and mock theta functions</em> -- 4096 East Hall</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Special Events</strong> -- Suzanne Weekes (Worcester Polytechnic Institute) <em>Marjorie Lee Browne Colloquium: Taking Your Place/Making More Space</em> -- 1360 East Hall</td>
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#### Tuesday, January 22, 2019

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<tr>
<td>11:30am-1:00pm</td>
<td><strong>IBL Workshops/Lectures</strong> -- () IBL Lunch -- 4866 East Hall</td>
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<tr>
<td>12:00pm-1:00pm</td>
<td><strong>Financial/Actuarial Mathematics</strong> -- Moumanti Podder (University of Washington) <em>Sofic and percolative entropies of Gibbs measures on regular infinite trees</em> -- 1866 East Hall</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Complex Analysis, Dynamics and Geometry</strong> -- Chaya Norton (Concordia) <em>Variational Formulas for the Period Matrix and Shimura-Teichmuller Curves (SPECIAL DAY AND TIME AND ROOM)</em> -- 4096 East Hall</td>
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<td>3:00pm-4:00pm</td>
<td><strong>Student Geometry/Topology</strong> -- Bradley Zykoski (University of Michigan) <em>An introduction to Morse theory</em> -- 1866 East Hall</td>
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<tr>
<td>3:00pm-3:50pm</td>
<td><strong>Student Commutative Algebra</strong> -- Gilyoung Cheong (University of Michigan) <em>Cohen-Lenstra distribution of modules</em> -- 3866 East Hall</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Colloquium Series</strong> -- Kartik Prasanna (University of Michigan) <em>Functoriality and Algebraic Cycles</em> -- 1360 East Hall</td>
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#### Wednesday, January 23, 2019

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<td>3:00pm-4:00pm</td>
<td><strong>Geometry &amp; Physics</strong> -- Yefeng Shen (University of Oregon) <em>An LG/LG mirror theorem between matrix factorizations and primitive forms.</em> -- 1866 East Hall</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Student Arithmetic</strong> -- Alex Horawa (University of Michigan) <em>Elliptic curve factorization</em> -- 3088 East Hall</td>
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<tr>
<td>5:00pm-6:00pm</td>
<td><strong>Working Group on Anderson Localization</strong> -- () Introductory Meeting: Logistics and Plan -- 4088 East Hall</td>
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<td><strong>Algebraic Geometry</strong> -- Alex Kuronya (Goethe-Universität Frankfurt) *Syzygies of homogeneous coordinate rings of abelian varieties (Joint w/ Commutative Algebra <em>NOTE UNUSUAL TIME/PLACE)</em> -- 3088 East Hall</td>
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<td><strong>Differential Equations</strong> -- Joe Conlon (UMich) <em>On global asymptotic stability for the LSW model</em> -- 4088 East Hall</td>
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<td><strong>Student Algebraic Geometry</strong> -- Attilio Castano (UM) <em>Quasicoherent sheaves</em> -- B735 East Hall</td>
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<td>12:00am-12:00am</td>
<td><strong>Geometry &amp; Physics</strong> -- FRG Workshop (Jan 25-27, 2019) Modular structures in Gromov-Witten theory and related topics -- 4096 East Hall</td>
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<td><strong>Geometry</strong> -- Maxime Scott (Indiana University) Teichmueller's Theorem for Topological Branched Covers -- 3866 East Hall</td>
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<td><strong>Applied Interdisciplinary Mathematics (AIM)</strong> -- Raymundo Navarrete (University of Arizona) Embedding and prediction of dynamical time series -- 1084 East Hall</td>
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<td><strong>Combinatorics</strong> -- Li Li (Oakland University) Frieze varieties of acyclic quivers -- 4088 East Hall</td>
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<td><strong>Student AIM Seminar</strong> -- Christiana Mavroyiakoumou (University of Michigan) The Ekman spiral and point vortex motion around boundaries -- 1084 East Hall</td>
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Monday, January 21, 2019, 10:00am-11:00am  
3088 East Hall  
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Planning meeting

Group, Lie and Number Theory  
Monday, January 21, 2019, 4:00pm-5:30pm  
4088 East Hall  
No Talk ()  
MLK day

Geometry & Physics  
Monday, January 21, 2019, 4:00pm-6:00pm  
4096 East Hall  
Jie Zhou (Tsinghua University)  
Fukaya series and mock theta functions

The Fukaya category on the elliptic curve equipped with Lagrangians furnishes an A-infinity structure. The structure constants, given by the enumeration of holomorphic disks, are simple to write down (following Polishchuk-Zaslow) by virtue of the nice combinatorial nature of the uniformization of the elliptic curve and the Lagrangians. The resulting generating series from enumeration, called Fukaya series, are theta functions for indefinite lattices and are expected to belong to the larger class of the so-called mock theta functions. Establishing mock modularity of the A-infinity structure constants can then detect the global properties and symmetry of the latter, and can significantly help understand Fukaya category and moduli spaces of holomorphic maps themselves.

In this talk, I will talk about a joint work in progress with Kathrin Bringmann and Jonas Kaszián in which we compute and prove the mock modularity of some Fukaya series arising from this context. I will mainly try to explain what mock modularity is and why it shows up in geometric terms, as well as the connection to homological mirror symmetry.
Special Events
Monday, January 21, 2019, 4:00pm-5:00pm
1360 East Hall
Suzanne Weekes (Worcester Polytechnic Institute)
Marjorie Lee Browne Colloquium: Taking Your Place/Making More Space

One can only imagine what it was like for Marjorie Lee Browne as she pursued her PhD at the University of Michigan in 1950. As the first African-American woman to come through the doctoral program in Mathematics at U of M, she would have had to navigate and clear her own unique path to take her place at the table. Forty-five years later, the speaker earned a PhD from the same department and acknowledges that Dr. Browne’s achievements made space for her success.

This talk will give an overview of the speaker’s my professional life with a highlight on her work in building partnerships between universities and industry. She will also talk about the efforts to ensure that a more diverse generation of young people with a diverse range of interests take their rightful place in mathematics communities, and that there is welcoming space for them. A reception for the speaker will be held in the Mathematics Atrium immediately following the talk.

IBL Workshops/Lectures
Tuesday, January 22, 2019, 11:30am-1:00pm
4866 East Hall

IBL Lunch

IBL lunch from 11:30am to 1:00pm. It will take place in the faculty lounge (4866 EH), and you should feel free to come for any length of time. Lunch will be provided.
Consider a statistical physical model on the infinite $d$-regular tree $T_{d}$ described by a set of interactions $\Phi$. Let $\{G_{n}\}$ be a sequence of finite $d$-regular graphs with vertex sets $V_{n}$ that locally converge to $T_{d}$. From $\Phi$, one can construct a sequence of corresponding Gibbs measures $\left\{ \mu_{n}\right\} _{n \in \mathbb{N}}$ on the graphs $G_{n}$. Here we assume that $\left\{ \mu_{n}\right\} _{n \in \mathbb{N}}$ converges to some limiting Gibbs measure $\mu$ on $T_{d}$ in the local weak$^{*}$ sense. We show that the limit supremum of $|V_{n}|^{-1}H(\mu_{n})$ is bounded above by the percolative entropy $H_{perc}(\mu)$, a function of $\mu$ itself, and that $|V_{n}|^{-1}H(\mu_{n})$ actually converges to $H_{perc}(\mu)$ when $\Phi$ exhibits strong spatial mixing on $T_{d}$. When it is known to exist, the limit of $|V_{n}|^{-1}H(\mu_{n})$ is most commonly shown to be given by the Bethe ansatz. Percolative entropy gives a different formula, and we do not know how to connect it to the Bethe ansatz directly.

Joint work with Tim Austin, UCLA Mathematics

Complex Analysis, Dynamics and Geometry
Tuesday, January 22, 2019, 3:00pm-4:00pm
4096 East Hall
Chaya Norton (Concordia)

Variational Formulas for the Period Matrix and Shimura-Teichmuller Curves (SPECIAL DAY AND TIME AND ROOM)

We will introduce a parametric jump problem used to study how differentials degenerate at the boundary of the moduli space of Riemann surfaces in terms of plumbing parameters. In joint work with David Aulicino we are able to use these variational formulas to study Shimura-Teichmuller curves in genus 5. This is the only case left open in Moller’s work.

SPECIAL DAY AND TIME AND ROOM: Tuesday Jan 22, 3-4pm, in EH 4096
A Morse function on a smooth manifold is a real-valued smooth function whose Hessian at every critical point is nonsingular. These functions can be used to give a CW decomposition of the manifold, with one cell of dimension k for each critical point of index k. I will follow sections 1-4 of Milnor's book on Morse theory fairly closely, and give an idea of how one proves the existence of this CW decomposition. Time permitting, we will discuss some further applications. I believe this talk should be accessible to anyone who has completed the first-year sequence in topology.

What is the probability that a finite m-torsion R-module H arises as the m-torsion of a "random" finite R-module?

For the case where R is a (Noetherian) non-singular domain of dimension 1, a celebrated work of Cohen and Lenstra essentially says that if a random finite module M is distributed with the probability inversely proportional to the size of its automorphism group Aut(M), then the probability in question is asymptotically equal to (1/#Aut(H))(1 - 1/q)(1/q^2)(1 - 1/q^3)..., where q = #(R/m). In this talk, I will survey several different ways to produce a distribution of R-modules when R = F_q[t], the polynomial ring over the finite field of q elements. Strikingly, all these different distributions produce the same answer to the above question. This is joint work with Yifeng Huang and Zhan Jiang.

If time permits, I will explain some enlightening approaches to answering why various distributions follow the same probability measure. This is by answering a version of "Hausdorff moment problem", and this is due to a combination of the works by Clancy-Kaplan-Leake-Payne-Wood, Ellenberg-Venkatesh-Westerland, and Fulman-Kaplan. If more time permits, I will also share some questions for the audience to think about (at home), which, in my best knowledge, are still open.

Any undergraduates are encouraged to attend!
The Langlands program is a vast generalization of classical reciprocity laws such as the law of quadratic reciprocity. One of the key aspects of the program is the principle of functoriality which predicts relations between spectra of arithmetic manifolds arising from different algebraic groups. When the arithmetic manifolds are actually algebraic varieties, it is natural to ask whether functoriality is given by an algebraic cycle (or correspondence). I will give some examples and then describe some recent work in this direction.

A few years ago, He-Li-Shen-Webb proved that the Fan-Jarvis-Ruan-Witten theory (LG A-model) of almost all invertible quasihomogeneous polynomials with maximal diagonal symmetries is equivalent to the Saito-Givental theory (LG B-model) of the mirror polynomials. The result is not known for some special chain type polynomials. We can remove the constraints by replacing the A-model with a reduced Cohomological Field Theory of matrix factorizations, constructed by Polishchuk and Vaintrob. This is a joint work in progress, with He, Polishchuk, and Vaintrob.

I will give a brief introduction to elliptic curves with the goal of presenting Lenstra’s elliptic curve factorization algorithm. To present the full strength of the algorithm, I will factor the number 35 using elliptic curves. No background will be assumed.
Commutative Algebra  
Thursday, January 24, 2019, 3:00pm-4:00pm  
4088 East Hall  
Alex Küronya (Goethe-Universität Frankfurt)  
*Syzygies of homogeneous coordinate rings of abelian varieties (Joint w/ Algebraic Geometry)*  

Joint talk with the Algebraic Geometry Seminar.

The topic of the talk is the study of syzygies of graded rings, more precisely homogeneous coordinate rings of algebraic varieties. These are special graded rings where the structure of the syzygy modules can be understood to some extent using a mixture of algebraic and geometric methods. The guiding question is how to guarantee that the first few syzygy modules will be as simple as possible, a line of research started in the case at hand by Green and Lazarsfeld thirty years ago. The concrete class of varieties we look at are complete group varieties, the methods will range from vanishing theorems to convex geometry (in the form of Newton-Okounkov bodies). If time permits we will mention results of similar flavour for moduli spaces of sheaves. This is an account of joint work with Victor Lozovanu und Yusuf Mustopa.

Algebraic Geometry  
Thursday, January 24, 2019, 3:00pm-3:50pm  
3088 East Hall  
Alex Kuronya (Goethe-Universität Frankfurt)  
*Syzygies of homogeneous coordinate rings of abelian varieties (Joint w/ Commutative Algebra *NOTE UNUSUAL TIME/PLACE)*

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Differential Equations
Thursday, January 24, 2019, 4:00pm-12:00am
4088 East Hall
Joe Conlon (UMich)
On global asymptotic stability for the LSW model

The LSW model, proposed independently around 1960 by Lifschitz-Slyozov and Wagner, is the simplest model for the phenomenon of Ostwald ripening. It is a first order PDE with a time varying parameter determined by a mass conservation law. There is a family of self-similar solutions, only one of which is considered to be physical. The talk will describe a recent result proving global asymptotic stability of the non-physical self-similar solutions. The proof involves methods from the theory of Volterra integral equations and optimal control theory. This is joint work with Mike Dabkowski.

Student Algebraic Geometry
Thursday, January 24, 2019, 4:00pm-5:00pm
B735 East Hall
Attilio Castano (UM)
Quasicoherent sheaves

In this talk, I'll introduce the notion of quasicoherent sheaves over a very general kind of geometric objects. The class of geometric objects we will be dealing with includes varieties and schemes, but also more general objects like the de rham space of a scheme. Time permitting we will investigate more closely the notion of a quasicoherent sheaf over the de rham space, which recovers the notion of D-modules.

Geometry & Physics
Friday, January 25, 2019, 12:00am-12:00am
4096 East Hall
FRG Workshop (Jan 25-27, 2019)
Modular structures in
Gromov-Witten theory and related topics

Conference webpage

https://pages.uoregon.edu/yfshen/modular-gw.html
Geometry  
Friday, January 25, 2019, 3:00pm-4:00pm  
3866 East Hall  
Maxime Scott (Indiana University)  
*Teichmueller's Theorem for Topological Branched Covers*

Given a homeomorphism $f$ between Riemann surfaces, Teichmueller's theorem states that there exists a unique quasiconformal map $h$, homotopic to $f$, which minimizes the quasiconformal dilatation. Moreover, there exists polygon representing the two Riemann surfaces such that $h$ is an affine map which stretches the polygon in one direction and contracts it in the other. In this talk, we will ask a similar question, given a topological branched cover $f$ between Riemann surfaces, does there exist a unique quasiregular map $h$ homotopic to $f$ which minimizes the quasiregular dilatation? To answer that question, we will rephrase the question in terms of Teichmueller geometry and study some particularly interesting subspaces of Teichmueller space.

Applied Interdisciplinary Mathematics (AIM)  
Friday, January 25, 2019, 3:00pm-4:00pm  
1084 East Hall  
Raymundo Navarrete (University of Arizona)  
*Embedding and prediction of dynamical time series*

In this talk, we overview two aspects of the analysis of time series generated from dynamical systems: state space reconstruction and time series prediction. First, state space reconstruction consists of constructing representations of the states of an unknown dynamical system using the observed time series. Delay-time coordinates are commonly used for this purpose and have been shown to produce faithful representations of the state space for generic observation mechanisms. Motivated by common usage of delay-time coordinates, we consider the more difficult situation where the observation mechanism is fixed and genericity is studied with respect to perturbations of the dynamical system. Second, prediction of dynamical time series with observational noise using kernel-based regression has been shown to be consistent for certain classes of discrete dynamical systems. Nonetheless, these methods are only optimal when noise in the reconstructed states cannot be reduced. For continuous-time dynamical systems, we show that the use of smoothing splines to reduce noise before using kernel-based regression results in increased prediction accuracy, and analyze a setting for which such method consistently learns the exact predictor based on the noiseless time series.
Combinatorics  
Friday, January 25, 2019, 3:00pm-4:00pm  
4088 East Hall  
Li Li (Oakland University)  
Frieze varieties of acyclic quivers

For each acyclic quiver Q we define a complex affine variety X(Q) called frieze variety. It is the Zariski closure of a set of points defined recursively. From a more conceptual viewpoint, the coordinates of these points are specializations of preprojective cluster variables in the cluster algebra associated to Q. In the talk I will explain the result that Q is representation finite, tame, or wild if and only if dim X(Q) is 0,1, or greater than 1, respectively.

Student AIM Seminar  
Friday, January 25, 2019, 4:00pm-5:00pm  
1084 East Hall  
Christiana Mavroyiakoumou (University of Michigan)  
The Ekman spiral and point vortex motion around boundaries

In this talk, I will present one of my favorite phenomena from geophysical fluid dynamics: the Ekman spiral. It can be thought of as a "spiral staircase down into the depths of the ocean". This is not only a fascinating oceanic phenomenon in itself, but also has far reaching effects on many coasts. The way the Ekman spiral transports water, known as upwelling, has a large influence on the life in the affected regions of the ocean. If time permits, I will also talk about vortex motion with boundaries (Kirchhoff-Routh theory) and extensions of this to multiply connected geometries.