**Monday, December 02, 2019**

11:00am-11:50am **Representation Stability** -- Karthik Ganapathy (UM) *Topological Noetherianity of Polynomial Functors* -- 3866 East Hall

3:00pm-4:00pm **Student Dynamics** -- Konstantinos Tsouvalas (UM) *Bounds on the entropy of surface group representations* -- 3866 East Hall

3:00pm-4:00pm **Student Combinatorics** -- Shelby Cox (UM) *Enumerating Lattices* -- 3096 East Hall

3:00pm-4:00pm **RTG Seminar on Number Theory** -- Shizhang Li (University of Michigan) *Arithmetic periods* -- 4088 East Hall

4:00pm-5:00pm **Student Algebraic Geometry** -- Lukas Scheiwiller (UM) *Proof of the Weil conjectures for Abelian Varieties: a simplified Lefschetz-Trace formula for Abelian Varieties* -- B745 East Hall

4:00pm-5:00pm **Complex Analysis, Dynamics and Geometry** -- Joanna Furno (DePaul University) *More rational families converging to transcendental families* -- 3866 East Hall

4:10pm-5:00pm **Group, Lie and Number Theory** -- Bogdan Zavyalov (Stanford University / U(M)) *Almost Coherent Sheaves and Etale cohomology of Rigid spaces* -- 4088 East Hall

5:00pm-6:00pm **Student Analysis** -- *Bring Your Work to Work Day* -- 2866 East Hall

5:30pm-6:30pm **Chromatic Homotopy Theory** -- Attilio Castano (UM) *Morava Stablizer groups and Bousfield localization.* -- 3088 East Hall

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**Tuesday, December 03, 2019**

3:00pm-3:50pm **Student Commutative Algebra** -- Alapan Mukhopadhyay (University of Michigan Ann Arbor) *Relative Smoothness of Rings* -- 4088 East Hall

3:00pm-4:00pm **Student Geometry/Topology** -- Salman Siddiqi (UM) *Parallel transport and holonomy* -- 3866 East Hall

4:00pm-5:00pm **Colloquium Series** -- TBA (*) *On hold* -- 1360 East Hall

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**Wednesday, December 04, 2019**

3:00pm-4:00pm **Student Homotopy Theory** -- Attilio Castano (University of Michigan) *Morava Stabilizer group and Bousfield Localization II* -- 1372 East Hall

3:00pm-4:00pm **Student Arithmetic** -- Various speakers (UM) *Speed talks!* -- 3866 East Hall

4:00pm-5:20pm **Algebraic Geometry** -- Benjamin Bakker (University of Georgia) *o-minimal GAGA and applications to Hodge theory* -- 4096 East Hall

4:00pm-5:30pm **RTG Seminar on Geometry, Dynamics and Topology** -- Nicolas Tholozan (ENS) *Teichm"uller theory on moduli spaces of Anosov flows I: Reparametrizations of the geodesic flow* -- 170 Weiser Hall

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**Thursday, December 05, 2019**

3:00pm-4:00pm **Commutative Algebra** -- Juliette Bruce (University of Wisconsin-Madison) *Semi-Ample Asymptotic Syzygies* -- 4088 East Hall

4:00pm-5:30pm **Topology** -- Nicolas Tholozan (ENS) *Teichm"uller theory on moduli spaces of Anosov flows II: Diffeomorphisms of the circle* -- 1360 East Hall

4:00pm-5:30pm **Arithmetic Geometry Learning** -- Andrew Snowden (UM) *Globalization, II* -- 4096 East Hall
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<td>10:30am-11:30am</td>
<td><strong>Special Events</strong> -- Sanjana Kolisetty and Linh Le (UM) <em>Theoretical Computer Science Seminar: The Complexity of Finding S-factors in Regular Graphs</em> -- Computer Science Department, Beyster Building, 3725</td>
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<td>4:00pm-5:30pm</td>
<td><strong>Geometry</strong> -- Nicolas Tholozan (ENS) <em>Teichmüller theory on moduli spaces of Anosov flows III: Teichmüller space of the stable foliation</em> -- B844 East Hall</td>
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<td>4:00pm-6:00pm</td>
<td><strong>Junior Colloquium Series</strong> -- Felipe Perez (Layer 6 AI) <em>Research, contests, and production: the faces of ML in industry (Invitations to Industry Series)</em> -- 1068 East Hall</td>
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<td>4:00pm-5:30pm</td>
<td><strong>Preprint Algebraic Geometry</strong> -- Haoyang Guo (UM) <em>The integral Hodge conjecture for 3-folds of Kodaira dimension zero, following Totaro</em> -- 2866 East Hall</td>
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### Representation Stability

**Monday, December 02, 2019, 11:00am-11:50am**  
3866 East Hall  
**Karthik Ganapathy (UM)**  
*Topological Noetherianity of Polynomial Functors*

The talk will be based on the following paper of Draisma: arXiv:1705.01419. in which the author proves that any descending chain of $\text{GL}_{\infty}\text{-}\text{(infty)}$ stable closed subsets in various infinite dimensional spaces eventually stabilize. We will try to motivate the proof of this result.

### Student Dynamics

**Monday, December 02, 2019, 3:00pm-4:00pm**  
3866 East Hall  
**Konstantinos Tsouvalas (UM)**  
*Bounds on the entropy of surface group representations*

In this talk, we consider convex cocompact representations of surface groups into special linear groups. These representations can be thought of as generalizing discrete faithful embeddings of surface groups into $\text{PSL}(2,\mathbb{R})$. We are going to define entropy for these representations and discuss some upper bounds which are due to A. Sambarino.

### Student Combinatorics

**Monday, December 02, 2019, 3:00pm-4:00pm**  
3096 East Hall  
**Shelby Cox (UM)**  
*Enumerating Lattices*

The focus of the talk will be an algorithm for enumerating finite unlabelled (poset) lattices of size $n$. Starting from a naive algorithm, I will describe known strategies to order lattices to significantly cut down search time. I will start a brief introduction to posets and lattices, along with some elementary examples, so no background in lattices is required.
RTG Seminar on Number Theory  
Monday, December 02, 2019, 3:00pm-4:00pm  
4088 East Hall  
Shizhang Li (University of Michigan)  
Arithmetic periods

In this talk, I will try to motivate a construction towards Fontaine's ring of de Rham periods. Then I will state some p-adic Hodge comparison results obtained in the 90s by many profound mathematicians. In the unlikely event of having some remaining minutes, I will try to wrap up by stating a small open problem (tangentially) related to these thingamabobs.

Student Algebraic Geometry  
Monday, December 02, 2019, 4:00pm-5:00pm  
B745 East Hall  
Lukas Scheiwiller (UM)

Proof of the Weil conjectures for Abelian Varieties: a simplified Lefschetz-Trace formula for Abelian Varieties

André Weil proposed to solve his Conjectures on the number of points of varieties over finite fields using a suitable cohomology theory, where one could use an analogue of the Lefschetz-Trace formula to count points. We will see how this strategy proposed simplifies in the case of Abelian Varieties (basically analogous of abelian Lie groups) and then proceed to prove (the easy part) of the Weil conjectures for this special case. No prior knowledge of Abelian Varieties, Weil conjectures or étale cohomology is assumed.

Complex Analysis, Dynamics and Geometry  
Monday, December 02, 2019, 4:00pm-5:00pm  
3866 East Hall  
Joanna Furno (DePaul University)

More rational families converging to transcendental families

In joint work with Lorelei Koss, we study families of rational maps that converge uniformly on compact sets to families of entire maps. These families are similar to the ones studied in our joint work with Jane Hawkins. Through conjugation, these families are related to singularly perturbed rational maps and families of exponential maps. We use the convergence to relate known results for these two families and to fill in gaps in these results. Finally, we examine convergence in parameter space.
Etale cohomology groups of $F_p$-local systems do not behave nicely on general $p$-adic rigid-analytic spaces. For example, $F_p$ cohomology groups of an affinoid space are usually infinite. This happens even for nice spaces such as the one-dimensional closed unit ball.

However, it turns out the recent theory of perfectoid spaces, developed by P. Scholze, is very useful to understand $F_p$ cohomology groups for $p$-adic rigid-analytic spaces. For example, Scholze showed that proper rigid-analytic varieties do have finite cohomology groups for any $F_p$-local system.

I am going to introduce the concept of almost coherent sheaves, and show how it can be used (together with the theory of perfectoid spaces) to give a new proof of the finiteness theorem. It can be also used to prove Poincare Duality for $p$-torsion coefficients on smooth and proper $p$-adic rigid-analytic spaces.

This is work in progress.

**Student Analysis**  
Monday, December 02, 2019, 5:00pm-6:00pm  
2866 East Hall  

*Bring Your Work to Work Day*

This is your chance to bring in some idea or problem you are currently working on (which can be explained to the group in roughly 10 - 15 minutes). You will have a chance to present, and then there will be a short discussion period afterwards for people to ask questions and propose ideas. Your presentation doesn't have to be worked out in any great detail, and quick introductions to new topics are also welcome.

Bring your work to work days are intended to increase collaboration in the department so please feel free to attend even if you are only interested in working on other problems. If you have any questions or are interested in presenting something at the seminar tomorrow, please send an email to Lizbee Collins-Wildman or Anthony Della Pella so we can get a schedule started.

**Chromatic Homotopy Theory**  
Monday, December 02, 2019, 5:30pm-6:30pm  
3088 East Hall  
Attilio Castano (UM)  

*Morava Stablizier groups and Bousfield localization.*

Following lectures 19 and 20 from [http://www.math.harvard.edu/~lurie/252x.html](http://www.math.harvard.edu/~lurie/252x.html).
Student Commutative Algebra
Tuesday, December 03, 2019, 3:00pm-3:50pm
4088 East Hall
Alapan Mukhopadhyay (University of Michigan Ann Arbor)
Relative Smoothness of Rings

We will discuss about the notion of relative smoothness of rings. Then we shall prove that smoothness is equivalent to having some lifting property. No prerequisite will be assumed.

Student Geometry/Topology
Tuesday, December 03, 2019, 3:00pm-4:00pm
3866 East Hall
Salman Siddiqi (UM)
Parallel transport and holonomy

The holonomy group is a measurement of the non-triviality and path-dependence of parallel transport in a Riemannian manifold, and can be described in terms of the curvature tensor. I will discuss some classical results in this area, with some calculations if time permits.

Colloquium Series
Tuesday, December 03, 2019, 4:00pm-5:00pm
1360 East Hall
TBA ()
On hold

Student Homotopy Theory
Wednesday, December 04, 2019, 3:00pm-4:00pm
1372 East Hall
Attilio Castano (University of Michigan)
Morava Stabilizer group and Bousfield Localization II

I’ll discuss how the Morava Stabilizer group acts on different E-theories, and the appearance of profinite topologies in stable homotopy theory.
Student Arithmetic
Wednesday, December 04, 2019, 3:00pm-4:00pm
3866 East Hall
Various speakers (UM)

*Speed talks!*

The last seminar of the semester will be a speed talk session. There will be eight fun 4-minute talks with a prize at the end. The speakers:
David Schwein (Mersenne Primes),
Andy Gordon (Many Theorems about Fibonacci Numbers in not very Much Time),
Andy Odesky (TBA),
Harry Richman (The poset of almost-divisors),
Yiwang Chen (Homogeneity result on GL(1)),
Sridhar Venkatesh (Hensel's lemma and Newton's method),
Lukas Scheiwiller (Some Anabelian phenomena),
Alex Horawa (The NSA back door to NIST)

Algebraic Geometry
Wednesday, December 04, 2019, 4:00pm-5:20pm
4096 East Hall

**Benjamin Bakker (University of Georgia)**

*o-minimal GAGA and applications to Hodge theory*

For a complex projective variety, Serre's classical GAGA theorem asserts that the analytification functor from algebraic coherent sheaves to analytic coherent sheaves is an equivalence of categories. For non-proper varieties, however, this theorem easily fails. In joint work with Y. Brunebarbe and J. Tsimerman, we show that a GAGA theorem holds even in the non-proper case if one restricts to analytic structures that are "tame" in a sense made precise by the notion of o-minimality. This result has particularly important applications to Hodge theory, and we will explain how it can be used to prove a conjecture of Griffiths on the quasiprojectivity of the images of period maps. We will also discuss some applications to moduli theory.
RTG Seminar on Geometry, Dynamics and Topology  
Wednesday, December 04, 2019, 4:00pm-5:30pm  
170 Weiser Hall  
Nicolas Tholozan (ENS)  

N. Tholozan (ENS): Teichmüller theory on moduli spaces of Anosov flows I: Reparametrizations of the geodesic flow  

In the 90s, Sullivan introduced the idea of studying families of dynamical systems with hyperbolic properties as Teichmüller spaces of 2-dimensional foliations or laminations. In these lectures, we will develop this idea in the case of the family of reparametrizations of the geodesic flow of a hyperbolic surface, providing a framework in which we hope to understand better the geometry of higher Teichmüller spaces (such as Hitchin components).

In the first lecture, we introduce the space of reparametrizations of the geodesic flow of a hyperbolic surface and describe its natural geometry.

Commutative Algebra  
Thursday, December 05, 2019, 3:00pm-4:00pm  
4088 East Hall  
Juliette Bruce (University of Wisconsin-Madison)  
Semi-Ample Asymptotic Syzygies  

I will discuss the asymptotic non-vanishing of syzygies for products of projective spaces, generalizing the monomial methods of Ein-Erman-Lazarsfeld. This provides the first example of how the asymptotic syzygies of a smooth projective variety whose embedding line bundle grows in a semi-ample fashion behave in nuanced and previously unseen ways.

Topology  
Thursday, December 05, 2019, 4:00pm-5:30pm  
1360 East Hall  
Nicolas Tholozan (ENS)  

Teichmüller theory on moduli spaces of Anosov flows II: Diffeomorphisms of the circle  

In the second lecture introduce a space of Anosov representations of a surface group into the group of diffeomorphisms of the circle, which can be viewed (to some extent) as an infinite dimensional space of maximal representations. We construct a map from this space to the space of reparametrizations and explain how to (almost) construct an inverse map, following Margulis’s construction of the invariant measure of maximal entropy.

Arithmetic Geometry Learning  
Thursday, December 05, 2019, 4:00pm-5:30pm  
4096 East Hall  
Andrew Snowden (UM)  
Globalization, II
**Special Events**

**Computer Science Department, Beyster Building, 3725**

**Sanjana Kolisetty and Linh Le (UM)**

*Theoretical Computer Science Seminar: The Complexity of Finding S-factors in Regular Graphs*

A graph $G$ has an S-factor, if there exists a spanning subgraph $F$ of $G$ such that for all $v \in V$: $\deg_F(v) \in S$. The simplest example of such factor is a 1-factor, which corresponds to a perfect matching in a graph. In this talk we will discuss the computational complexity of finding S-factors in regular graphs. Our techniques combine some classical as well as recent tools from graph theory.

Based on joint work with Ilya Volkovich and Mihalis Yannakakis

**Applied Interdisciplinary Mathematics (AIM)**

**Friday, December 06, 2019, 3:00pm-4:00pm**

**1084 East Hall**

**Anna Vainchtein (University of Pittsburgh)**

*Strictly supersonic solitary waves in lattices*

We consider a nonlinear mass-spring chain with first and second-neighbor interactions and show that there is a parameter range where solitary waves in this system are strictly supersonic. In these regimes standard quasicontinuum theories, targeting long-wave limits of lattice models, are not adequate since even weak strictly supersonic solitary waves are of envelope type and crucially involve a microscopic scale in addition to the mesoscopic scale of the envelope. To capture this effect in a continuum setting it is necessary to employ unconventional, higher-order quasicontinuum approximations carrying more than one length scale. This talk is based on recent joint work with Lev Truskinovsky (ESPCI).

**Geometry**

**Friday, December 06, 2019, 4:00pm-5:30pm**

**B844 East Hall**

**Nicolas Tholozan (ENS)**

*Teichmüller theory on moduli spaces of Anosov flows III: Teichmüller space of the stable foliation*

N. Tholozan (ENS): Following Sullivan, we finally introduce the Teichmüller space of the weakly stable foliation of the geodesic flow. We explain why it is (more or less) in bijection with the space of reparametrizations. If time allows, we will discuss preliminary results on the relation between the pressure and Weil-Petersson metrics.
Machine learning has promised a new way to gain understanding and value in many industries; yet most companies are still learning how to correctly use and design ML models. The main obstacles come from many different sources, which include the inherent complexity of ML models, extracting economic value from data, deployment, integration, legacy models and innovation. At layer 6 we approach these problems from a different perspective: by engaging in research we are able to produce high impact papers as well as keep ourselves updated with the state-of-the-art approaches, by doing competitions we tune our skills into the challenges of real world data, and by working in use-cases we deal with the complexities of a large organization. In this talk I will share what is to work in this environment as well as what are the main skills that are needed to work in the ML industry.

Felipe Perez, UM Math PhD 2015, is now a Machine Learning Research Scientist at Layer 6 AI. Our Invitation to Industry Series is run in collaboration with the Erdos Institute.

Preprint Algebraic Geometry
Friday, December 06, 2019, 4:00pm-5:30pm
2866 East Hall
Haoyang Guo (UM)

The integral Hodge conjecture for 3-folds of Kodaira dimension zero, following Totaro

https://arxiv.org/abs/1907.08670