<table>
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<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Tuesday, September 7</td>
<td>3:00pm-4:00pm</td>
<td><strong>Student Commutative Algebra</strong> -- Planning Meeting 2866 East Hall</td>
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<td><strong>RTG Seminar on Geometry, Dynamics and Topology</strong> -- Sayantan Khan (U Michigan) Introduction to Patterson-Sullivan theory (for hyperbolic surfaces) -- 3866 East Hall</td>
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<td>Wednesday, September</td>
<td>4:00pm-5:00pm</td>
<td><strong>Financial/Actuarial Mathematics</strong> -- Ali Kara (UM) Near-Optimality of Finite-Window Policies for POMDPs under Filter Stability and its Q-learning Convergence -- 1324 East Hall</td>
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<td>Thursday, September  9</td>
<td>12:00am-12:00am</td>
<td><strong>Commutative Algebra</strong> -- Melvin Hochster  No meeting this week East Hall</td>
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<td>4:00pm-5:30pm</td>
<td><strong>Arithmetic Geometry Learning</strong> -- Mircea Mustata (University of Michigan) An overview of non-Abelian Hodge theory and the P=W conjecture -- 4096 East Hall</td>
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<td>5:30pm-6:30pm</td>
<td><strong>Student Dynamics/Geometry Topology</strong> -- Planning Meeting 3866 East Hall</td>
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<td>Friday, September 10</td>
<td>3:00pm-4:00pm</td>
<td><strong>Applied Interdisciplinary Mathematics (AIM)</strong> -- John Wettlaufer (Yale University) From quantum field theory to the making of tea with Lord Rayleigh: A tour of the science of Charlie Doering -- ZOOM East Hall</td>
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<td>3:00pm-3:50pm</td>
<td><strong>Learning Seminar in Representation Stability</strong> -- Andrew Snowden (UM) TBA -- 1866 East Hall</td>
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<td>3:00pm-4:00pm</td>
<td><strong>Student Algebraic Geometry</strong> -- Shubhodip Mondal (UM) Algebraic de Rham Cohomology -- 2866 East Hall</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Preprint Algebraic Geometry</strong> -- Organizational meeting 4096 East Hall</td>
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Abstracts for the week of September 5th, 2021 - September 11th, 2021

Student Commutative Algebra
Tuesday, September 07, 2021, 3:00pm-4:00pm
2866 East Hall

Planning Meeting

In this meeting, we will schedule talks for the rest of the semester. Everyone is welcome to suggest topics and to volunteer to give talks!
Financial/Actuarial Mathematics  
**Wednesday, September 08, 2021, 4:00pm-5:00pm**  
1324 East Hall  
Ali Kara (UM)  

*Near-Optimality of Finite-Window Policies for POMDPs under Filter Stability and its Q-learning Convergence*

The talk focuses on partially observed Markov Decision processes (POMDPs). In POMDPs, existence of optimal policies has in general been established via converting the original partially observed stochastic control problem to a fully observed one on the belief space, leading to a belief-MDP. However, computing an optimal policy for this fully observed model using classical methods is challenging even if the original system has finite state and action spaces, since the state space of the fully observed belief-MDP model is always uncountable. We provide an approximation technique for POMDPs that uses a finite window history of past information variables. We establish near optimality of finite window control policies in POMDPs under filter stability conditions and the assumption that the measurement and action sets are finite (and the state space is real vector valued). We also establish a rate of convergence result which relates the finite window memory size and the approximation error bound, where the rate of convergence is exponential under the filter stability conditions, where filter stability refers to the correction of an incorrectly initialized filter for a partially observed stochastic dynamical system (controlled or control-free) with increasing measurements.

Finally, we establish the convergence of the associated Q learning algorithm for control policies using such a finite history of past observations and control actions (by viewing the finite window as a ‘state’) and we show near optimality of such limit Q functions under the filter stability condition.

While there exist many experimental results for POMDPs, (i) the near optimality with an explicit rate of convergence (in the memory size) and relations to filter stability, and (ii) the asymptotic convergence (to the approximate MDP value function) for such finite-memory Q-learning algorithms are results that are new to the literature, to our knowledge.

-Joint work with Serdar Yuksel (Queen's University)-.

**RTG Seminar on Geometry, Dynamics and Topology**  
**Wednesday, September 08, 2021, 4:00pm-5:30pm**  
3866 East Hall  
Sayantan Khan (U Michigan)  

*Introduction to Patterson-Sullivan theory (for hyperbolic surfaces)*

In this talk, we motivate the construction of Patterson-Sullivan measures using a natural orbit counting problem. The Patterson-Sullivan measures also let us construct a finite invariant measure for the geodesic flow on infinite volume surfaces. We will sketch a proof of the fact that the flow is mixing with respect to this measure, and use mixing to get more precise asymptotics on the orbit counting function. This talk will only assume very elementary knowledge of hyperbolic geometry.
Commutative Algebra
Thursday, September 09, 2021, 12:00am-12:00am
East Hall
Melvin Hochster ()
No meeting this week

Arithmetic Geometry Learning
Thursday, September 09, 2021, 4:00pm-5:30pm
4096 East Hall
Mircea Mustata (University of Michigan)
An overview of non-Abelian Hodge theory and the P=W conjecture

Student Dynamics/Geometry Topology
Thursday, September 09, 2021, 5:30pm-6:30pm
3866 East Hall
() Planning Meeting

Applied Interdisciplinary Mathematics (AIM)
Friday, September 10, 2021, 3:00pm-4:00pm
ZOOM East Hall
John Wettlaufer (Yale University)
From quantum field theory to the making of tea with Lord Rayleigh: A tour of the science of Charlie Doering
In this talk I take you on a tour of the life and work of <strike>Charles</strike> Charlie Rogers Doering, formerly the Nicholas D. Kazarinoff Collegiate Professor of Complex Systems, Mathematics and Physics, and the Director of the Center for the Study of Complex Systems. I begin with his graduate work, move on to his transition during the post doctoral years and then focus on his "convection obsession", its impact and relationship to the history of, and his important contribution to, the Geophysical Fluid Dynamics Summer Program in Woods Hole.

Learning Seminar in Representation Stability
Friday, September 10, 2021, 3:00pm-3:50pm
1866 East Hall
Andrew Snowden (UM)
TBA
Student Algebraic Geometry
Friday, September 10, 2021, 3:00pm-4:00pm
2866 East Hall
Shubhodip Mondal (UM)

Algebraic de Rham Cohomology

In this talk, we will define algebraic de Rham cohomology, which is a cohomology theory for algebraic varieties defined over any base field $K$. In particular, when $K$ is the field of complex numbers, we will compare de Rham cohomology with singular cohomology.

Preprint Algebraic Geometry
Friday, September 10, 2021, 4:00pm-5:00pm
4096 East Hall

Organizational meeting