<table>
<thead>
<tr>
<th>Date</th>
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<th>Event</th>
<th>Speaker(s)</th>
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<tr>
<td>Monday, January 11, 2021</td>
<td>2:00pm-3:50pm</td>
<td><strong>RTG Seminar on Number Theory</strong> -- Amadou Bah (University Paris-Saclay and IHES)</td>
<td>Variation of the Swan conductor of an $\mathbb{F}_\ell$-sheaf on a rigid disc</td>
<td>Virtual</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Midwest Dynamics and Group Actions</strong> -- Thomas Hille (Northwestern University)</td>
<td>Distribution of Values of Irrational Forms at Integral Points and Spherical Averages</td>
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<td>Tuesday, January 12, 2021</td>
<td>2:00pm-3:50pm</td>
<td><strong>RTG Seminar on Number Theory</strong> -- Christian Klevdal (University of Utah)</td>
<td>Integrality of G-local systems</td>
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<td>2:00pm-3:50pm</td>
<td><strong>RTG Seminar on Number Theory</strong> -- Allechar Serrano Lopez (University of Utah)</td>
<td>TBA</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Algebraic Geometry</strong> -- Ruijie Yang (Stony Brook University)</td>
<td>Decomposition theorem for semisimple local systems</td>
<td>4096 East Hall</td>
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<td>2:00pm-3:50pm</td>
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<td>Friday, January 15, 2021</td>
<td>2:00pm-3:50pm</td>
<td><strong>RTG Seminar on Number Theory</strong> -- Boya Wen (Princeton University)</td>
<td>A Gross-Zagier Formula for CM cycles over Shimura Curves</td>
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RTG Seminar on Number Theory
Monday, January 11, 2021, 2:00pm-3:50pm
Virtual
Amadou Bah (University Paris-Saclay and IHES)
Variation of the Swan conductor of an $\mathbb{F}_\ell$-sheaf on a rigid disc

Pre-talk for graduate students: 2pm
Introduction to Ramification Theory

Main talk: 3-3:50pm

Let $K$ be a complete discrete valuation field of residue characteristic $p>0$ and $\ell \neq p$ a prime number. To a finite dimensional $\mathbb{F}_\ell$-representation $M$ of the absolute Galois group $G_K$, the ramification theory of Abbes and Saito attaches a Swan conductor $\text{sw}(M)$ and a characteristic cycle $\text{CC}(M)$. Let $D$ be the rigid unit disc over $K$ and $\mathcal{F}$ a lisse sheaf of $\mathbb{F}_\ell$-modules on $D$. For $t \geq 0$, the normalized integral model $\mathcal{D}^{(t)}$ of the subdisc $D^{(t)}$ of radius $t$ is defined over some finite extension of $K$. The restriction $\mathcal{F}_{|D^{(t)}}$ defines, at the generic point $\mathfrak{p}^{(t)}$ of the special fiber of $\mathcal{D}^{(t)}$, a Galois representation $M_t$ over a complete discrete valuation field, thus yielding a Swan conductor $\text{sw}(M_t)$ and a characteristic cycle $\text{CC}(M_t)$. The goal of the talk is to explain how we connect earlier works, of Lütkebohmert on a discriminant function attached to a cover of $D$, and of Kato on the ramification of valuation rings of height 2, and prove that the function $t \mapsto \text{sw}(M_t)$ is continuous and piecewise linear with finitely many slopes which are all integers, and that its right derivative is $t \mapsto -\text{ord}_{\mathfrak{p}^{(t)}}(\text{CC}(M_t)) + \dim_{\mathbb{F}_\ell}(M_t/M_t^{(0)})$, where $\text{ord}_{\mathfrak{p}^{(t)}}$ is a normalized discrete valuation at $\mathfrak{p}^{(t)}$ extended to differentials and $M_t^{(0)}$ is the tame part of $M_t$. 
Let $Q$ be a non-degenerate indefinite quadratic form in $n$ variables. In the mid 80's, Margulis proved the Oppenheim conjecture, which states that if $n \geq 3$ and $Q$ is not proportional to a rational form, then the set of values of $Q$ at integral points is dense in $\mathbb{R}$. In some cases, homogeneous forms of higher degree exhibit the same behavior if the number of variables is large enough in terms of the degree and if the group preserving the form is large enough, then the set of values at integral points can be studied from the point of view of homogeneous dynamics.

In this talk we will discuss the problem of effective and quantitative distribution of values of certain forms at integral points. A central and recurrent theme revolves around (asymptotic) estimates of certain spherical averages going back to the work of Eskin, Margulis and Mozes.

This talk is based on the one hand on joint work with P. Buterus, F. Götze and G. Margulis and on the other hand with E. Fromm and H. Oh.

Zoom link: https://iu.zoom.us/j/661711533?pwd=RTFVTjMrQ1pYTCTZz1vVGVvODV2QT09
password is 076877 if needed.
RTG Seminar on Number Theory  
Tuesday, January 12, 2021, 2:00pm-3:50pm  
Virtual
Christian Klevdal (University of Utah)  
*Integrality of G-local systems*

Pre-talk for graduate students: 2pm  
Moduli of G-local systems

Abstract: In this talk, I introduce the category of G-local systems on a complex variety X, for a reductive group G; and study the moduli space of G-local systems on X. I will show that cohomological rigidity of a G-local system $\rho$ is equivalent to the vanishing of the tangent space of the corresponding point on the moduli space.

Main talk: 3-3:50pm

Simpson conjectured that for a reductive group G, rigid G-local systems on a smooth projective complex variety are integral. I will discuss a proof of integrality for cohomologically rigid G-local systems. This generalizes and is inspired by work of Esnault and Groechenig for GL$_n$. Surprisingly, the main tools used in the proof (for general G and GL$_n$) are the work of L. Lafforgue on the Langlands program for curves over function fields, and work of Drinfeld on companions of $\ell$-adic sheaves. The major differences between general G and GL$_n$ are first to make sense of companions for G-local systems, and second to show that the monodromy group of a rigid G-local system is semisimple. All work is joint with Stefan Patrikis.

RTG Seminar on Number Theory  
Wednesday, January 13, 2021, 2:00pm-3:50pm  
Virtual
Allechar Serrano Lopez (University of Utah)  
*TBA*
Algebraic Geometry  
Wednesday, January 13, 2021, 4:00pm-5:00pm  
4096 East Hall  
Ruijie Yang (Stony Brook University)  
*Decomposition theorem for semisimple local systems*

In complex algebraic geometry, the decomposition theorem asserts that semisimple geometric objects remain semisimple after taking direct images under proper algebraic maps. This was conjectured by Kashiwara and is proved by Mochizuki and Sabbah in a series of very long papers via harmonic analysis and D-modules. In this talk, I would like to explain a simpler proof in the case of semisimple local systems using a more geometric approach. As a byproduct, we also recover a weak form of Saito's decomposition theorem for variation of Hodge structures. Joint work in progress with Chuanhao Wei.

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RTG Seminar on Number Theory  
Thursday, January 14, 2021, 2:00pm-3:50pm  
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Rakvi (Cornell University)  
*TBA*

Pre-talk for graduate students: 2pm  
Main talk: 3-3:50pm

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RTG Seminar on Number Theory  
Friday, January 15, 2021, 2:00pm-3:50pm  
Virtual  
Boya Wen (Princeton University)  
*A Gross-Zagier Formula for CM cycles over Shimura Curves*

Pre-talk for graduate students: 2pm  
Main talk: 3-3:50pm

In this talk I will introduce my thesis work in progress to prove a Gross-Zagier formula for CM cycles over Shimura curves. The formula connects the global height pairing of special cycles in Kuga varieties over Shimura curves with the derivatives of the L-functions associated to weight-2k modular forms. As a key original ingredient of the proof, I will introduce some harmonic analysis on local systems over graphs, including an explicit construction of Green's function, which we apply to compute some local intersection numbers.