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Algebra, Geometry, Number Theory & Topology

– List of abstracts –

Non-local coefficients in the heat asymptotics for real powers of Laplacians

Cipriana Anghel-Stan

IMAR

Abstract: We prove that some of the heat coefficients in the small-time asymptotic expansion of $e^{-t\Delta^r}$ are non-local, where $r \in (0,1)$, and Δ is a Laplace-type operator over a compact Riemannian manifold.

The class of the Prym-Brill-Noether divisor

Andrei Bud

Humboldt Universität zu Berlin

Abstract: We study the moduli space $\mathcal{R}_g$ parametrizing pairs $[C,\eta]$ where C is a Riemann surface and η is a non-trivial 2-torsion line bundle on it. Such a pair $[C,\eta]$ is equivalent to an étale double cover $\pi\colon \widetilde{C} \to C$ which furthermore determines an involution $\iota\colon \widetilde{C} \to \widetilde{C}$. We study Prym-Brill-Noether loci of such pairs $[C,\eta]$, that is, loci of special line bundles on $\widetilde{C}$ that are "well-behaved" with respect to the involution ι. When the genus g is of the form $\frac{r(r+1)}{2}$, the non-emptiness of a specific Prym-Brill-Noether locus is a divisorial condition on $\mathcal{R}_g$. We compute the class of this divisor in the rational Picard group of $\overline{\mathcal{R}}_g$.

Dissipation of Correlations of Automorphic Forms

Petru Constantinescu

Max Planck Institute for Mathematics

Abstract: Mass equidistribution of eigenfunctions is a central topic in quantum chaos and number theory. In this talk we highlight a few important recent results in the area of Quantum Unique Ergodicity and showcase a generalisation for holomorphic cusp forms in the weight aspect. We show that correlations of masses coming from off-diagonal terms dissipate as the weight tends to infinity. This corresponds to classifying the possible quantum limits along any sequence of Hecke eigenforms of increasing weight.

Combinatorial Reid's Recipe for Dimer Models

Liana Heuberger

Université d'Angers

Abstract: Reid's recipe is an equivalent of the McKay correspondence in dimension three. It marks interior line segments and lattice points in the fan of G-Hilb, i.e. a crepant resolution of $\mathbb{C}^3/G$ for $G \subset SL(3,\mathbb{C})$, with certain nontrivial irreducible representations of GG. Our goal is to generalise this by marking the toric fan of a crepant resolution of any affine Gorenstein singularity, in a way that is compatible with both the G-Hilb case and its categorical counterpart known as Derived Reid's Recipe. The result is a combinatorial version of the Ried's recipe algorithm via consistent dimer models, whose key ingredient is adapting Nakamura's jigsaw transformations for G-Hilb to our context. This is joint work with Alastair Craw and Jesus Tapia Amador.

Special data in algebraic parametric optimization

Emil Horobet

Universitatea Sapientia

Abstract: In this talk, we consider parametric optimization problems from an algebraic viewpoint. The idea is to find all of the critical points of an objective function thereby determining a global optimum. For generic parameters (data) in the objective function, the number of critical points remains constant. This number is known as the algebraic degree of an optimization problem. In this talk, we go further by considering the inverse problem of finding parameters of the objective function so it gives rise to critical points exhibiting a special structure. For example, if the critical point is in the singular locus, has some symmetry, or satisfies some other algebraic property. Our main result is a theorem describing such parameters.

Quantization methods in the Yau-Tian-Donaldson program

Louis Ioos

University of Marburg

Abstract: A celebrated conjecture of Yau states that the existence of a Khler metric with constant scalar curvature on a projective manifold should be equivalent to a purely algebraic stability condition. Much progress has been done on this conjecture in the past decades, culminating in what is now called the Yau-Tian-Donaldson program. In this talk, I will explain the key role played by quantization methods in this program, and how they can be improved using a semiclassical estimate of the quantum noise of Berezin-Toeplitz quantization. This talk is based on a project in collaboration with Leonid Polterovich.

On the Bott-Chern Cohomology of Vaisman manifolds

Nicolina Istrati

University of Marburg

Abstract: Vaisman manifolds are complex manifolds which can be endowed with a special type of a Hermitian structure, namely a locally conformally Khler metric with parallel Lee form. The geometry of Vaisman manifolds is closely related to Khlerian geometry, as these manifolds come endowed with a natural transversally Khler foliation. However, Vaisman manifolds do not satisfy the dd^c-lemma, therefore it is interesting to study their Bott-Chern cohomology, which is then a refined invariant. In this talk, I will explain how one can express this cohomology in terms of the basic cohomology with respect to the foliation, and in particular show that the numerical obstructions to the dd^c-lemma can be arbitrarily high. This is based on joint work with Alexandra Otiman.

On the average order of a finite group

Mihai-Silviu Lazorec

Universitatea “Alexandru Ioan Cuza” din Iasi

`-- Talk Cancelled --`

Abstract: Let $o(G)$ be the average of the element orders of a finite group G. A research topic concerning this quantity is understanding the relation between $o(G)$ and $o(H)$, where H is a subgroup of G. Let $\mathcal{N}$ be the class of finite nilpotent groups and let $L(G)$ be the subgroup lattice of G. We show that the set $\{\frac{o(G)}{o(H)} \mid G \in \mathcal{N}, H \in L(G)\}$ is dense in $[0, \infty)$. Other density results are also outlined.

Zagier's formula for multiple zeta values and its odd variant revisited

Cezar Lupu

Beijing Institute of Mathematical Sciences and Applications (BIMSA) & Yau Mathematical Sciences Center (YMSC), Tsinghua University

Abstract: In this talk, we revisit the famous Zagier formula for multiple zeta values (MZV's) and its odd variant for multiple t-values which is due to Murakami. Zagier's formula involves a specific family of MZV's which we call nowadays the Hoffman family,

$$H(a,b)=\zeta(\underbrace{2,2,\ldots,2}_{a},3,\underbrace{2,2,\ldots,2}_{b}),$$

which can be expressed as a $\mathbb{Q}$-linear combination of products $\pi^{2m}\zeta(2n+1)$ with $m+n=a+b+1$. This formula for $H(a,b)$ played a crucial role in the proof of Hoffman's conjecture by F. Brown, and it asserts that all multiple zeta values of a given weight are $\mathbb{Q}$-linear combinations of MZV's of the same weight involving 2's and 3's. Similarly, in the case of multiple t-values (the odd variant of multiple zeta values), very recently, Murakami proved a version of Brown's theorem (Hoffman's conjecture) which states that every multiple zeta value is a $\mathbb{Q}$-linear combination of elements $\{t(k_1,\ldots,k_r):k_1,\ldots,k_r\in\{2,3\}\}$. Again, the proof relies on a Zagier-type evaluation for the Hoffman's family of multiple t-values,

$$T(a,b)=t(\underbrace{2,2,\ldots,2}_{a},3,\underbrace{2,2,\ldots,2}_{b}).$$

We show the parallel of the two formulas for $H(a,b)$ and $T(a,b)$ and derive elementary proofs by relating both of them to a surprising cotangent integral. This is a joint work with Li Lai and Derek Orr.

Counting polynomials with a prescribed Galois group

Vlad Matei

Tel Aviv University

Abstract: An old problem, dating back to Van der Waerden, asks about counting irreducible polynomials degree n polynomials with coefficients in the box $[-H,H]$ and prescribed Galois group. Van der Waerden was the first to show that $H^n+O(H^{n-\delta})$ have Galois group S_n and he conjectured that the error term can be improved to $o(H^{n-1})$.

Recently, Bhargava almost proved van der Waerden conjecture showing that there are $O(H^{n-1+\varepsilon})$ non S_n extensions, while Chow and Dietmann showed that there are $O(H^{n-1.017})$ non S_n, non A_n extensions for $n\geq 3$ and $n\neq 7,8,10$. In joint work with Lior Bary-Soroker, and Or Ben-Porath we use a result of Hilbert to prove a lower bound for the case of $G=A_n$, and upper and lower bounds for C_2 wreath $S_{n/2}$. The proof for A_n can be viewed, on the geometric side, as constructing a morphism φ from $A^{n/2}$ into the variety $z^2=\Delta(f)$ where each φ_i is a quadratic form. For the upper bound for C_2

wreath $S_{n/2}$ we prove a monic version of Widmer's result four counting polynomials with imprimitive Galois group. Time allowing I will also discuss the case of A_4.

Primality of polyomino ideals

Francesco Navarra

University of Messina

Abstract: In 2012 A.A. Qureshi connected the polyominoes to Commutative Algebra, linking to each polyomino the inner 2-minor ideal, called polyomino ideal. In the study of its primality, an interesting conjecture has recently emerged, which intends to characterize the primality of the polyomino ideal with the non-existence of zig-zag walks in the polyomino. However, it seems that it is a very difficult challenge to give a complete characterization of the primality of these ideals.

Homological stability for asymptotic monopole moduli spaces

Martin Palmer-Anghel

IMAR

Abstract: Magnetic monopoles were introduced by Dirac in 1931 to explain the quantisation of electric charges. In his model, they are singular solutions to an extension of Maxwell's equations allowing non-zero magnetic charges. An alternative model, developed by 't Hooft and Polyakov in the 1970s, is given (in the BPS limit) by smooth solutions to a different set of equations, the Bogomolny equations. The moduli space of all solutions has connected components M_k indexed by positive integers k (the "magnetic charge"). These have been intensively studied, notably by Donaldson (an interpretation in terms of rational self-maps of $\mathbb{CP}^1$), Segal (the homotopy type of M_k "stabilises" as k goes to infinity) and Cohen-Cohen-Mann-Milgram (describing the homology of M_k in terms of braid groups). A compactification of M_k has recently been proposed by Fritzsch-Kottke-Singer, whose boundary strata we call asymptotic monopole moduli spaces. I will describe ongoing joint work with U. Tillmann in which we study stability patterns in the homology of these spaces.

Decompositions of Matrices by using Commutators

Cristian-Aurel Rafiliu

Babes-Bolyai University of Cluj-Napoca

Abstract: We present a decompositions of 3×3 matrices that are obtained using commutators. These are used to prove a decomposition for endomorphisms of free modules of infinite rank and for a decomposition of matrices whose traces are sums of commutators.

An Introduction to NeutroHX-Groups

Andromeda Sonea

Universitatea de Stiintele Vietii "Ion Ionescu de la Brad" din Iasi

Abstract: In this talk, we introduce the concept of NeutroHX-Group. Using the HX-groups associated with the dihedral group, we obtain the Chinese hypergroup associated with them. We present some examples to illustrate situations when the NeutroHX-Groups and AntiHX-Groups are obtained. Also, we determine a way to obtain commutative hyperstructure, considering the set of all HX-Groups with the dihedral group as support.

Multinomial staged tree models and polytopes with rational linear precision

Miruna-Stefana Sorea

Scuola Internazionale Superiore di Studi Avanzati (SISSA)

Abstract: We introduce a new family of lattice polytopes with rational linear precision. For this purpose, we define a new class of discrete statistical models that we call multinomial staged tree models. We prove that these models have rational maximum likelihood estimators (MLE) and give a criterion for these models to be log-linear. Our main result is then obtained by applying Garcia-Puente and Sottile's theorem that establishes a correspondence between polytopes with rational linear precision and log-linear models with rational MLE. This is based on joint work with Isobel Davies (Univ. Magdeburg), Eliana Duarte (Univ. do Porto), Irem Portakal (TU Munich).

Modifications of locally conformally Khler spaces

Miron Stanciu

University of Bucharest & IMAR

Abstract: We define locally conformally Khler (lcK) spaces with possible singularities and talk about a few recent results obtained on them, chiefly the existence of a type of Vaisman Theorem about the compatibility of an lcK and a Khler structure. We then define generalized lcK metrics and use them to show that even though modifications of lcK spaces are not always lcK, they are generalized lcK. This is a joint work with O. Preda.

On the sup-norm of automorphic forms

Radu Toma

Universität Bonn

Abstract: We give an introduction to the sup-norm problem for automorphic forms. This is motivated by the theory of quantum chaos and, in the arithmetic case, has connections to the theory of L-functions. Using spectral theory and the combinatorics of Hecke operators, the study of large values of automorphic forms reduces to number theoretical counting problems. Sharp counting results can then produce bounds for the sup-norm that are stronger than generic bounds given by local analysis.

Counts of secant planes to varieties, Virasoro algebras, and universal polynomials

Mara Ungureanu

University of Freiburg

Abstract: For a curve in projective space, the count of varieties parametrising its secant planes is among the most studied problems in classical enumerative geometry. We shall start with a gentle introduction to secant varieties and then explore the connection between their enumerative geometry and Virasoro algebras on one side, and tautological integrals on the other.