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ALGEBRA, GEOMETRY, NUMBER THEORY & TOPOLOGY
– LIST OF ABSTRACTS –

Heat Kernel Asymptotics for real powers of Laplacians

Cipriana Anghel

IMAR

Abstract: I will describe the small-time heat kernel asymptotics for real powers $r \in (0, 1)$ of a generalised Laplacian on sections of a vector bundle over a compact Riemannian manifold.

Maximal gonality on strata of differentials

Andrei Bud

Humboldt University Berlin

Abstract: We study the strata parametrizing pairs (C, ω) where C is a genus g curve and ω is a differential with prescribed multiplicities. In particular, we prove that for a generic such pair, the curve C has maximal gonality. As a consequence of this, we obtain uniruledness of such strata in genus 9, along several other applications regarding Weierstrass gap sequences and projections of such strata to the moduli space of curves. This is based on my paper “Maximal gonality on strata of differentials and uniruledness of strata in low genus”.

Fully Homomorphic Encryption

Anamaria Costache

Norwegian University of Science and Technology - NTNU

-- Talk Cancelled --

Abstract: Fully homomorphic encryption este un tip de criptare care permite manipularea datelor criptate pastrand securitatea acestora. Vom vorbi despre latici, si vom defini FHE. De asemenea, vom vorbi despre librarii FHE si despre relevanta FHE in lumea comerciala.

Nef classes on self-products of curves

Mihai Fulger

University of Connecticut

Abstract: The nef cone of a projective variety is an important invariant that measures all projective embeddings of the variety. Computing it in specific examples is a nontrivial problem already in dimension two. Here we focus on surfaces of type $C \times C$ where C is a smooth projective curve. This case is interesting also because of its connection to the Nagata conjecture. In joint work with Takumi Murayama we construct new examples of nef classes on $C \times C$. One of them is optimal, on the conjectural boundary of the nef cone.

Q-Fano constructions using Laurent inversion

Liana Heuberger

Université d'Angers

Abstract: Mirror symmetry conjecturally associates to a Fano orbifold a (very special type of) Laurent polynomial. Laurent inversion is a method for reversing this process, obtaining a Fano variety from a candidate Laurent polynomial. We apply this to construct previously unknown Fano 3-folds with terminal quotient singularities.

A Laurent polynomial f determines, through its Newton polytope P , a toric variety X_P , which is in general highly singular. Laurent inversion constructs, from f and some auxiliary data, an embedding of X_P into an ambient toric variety Y . In many cases this embeds X_P as a complete intersection of line bundles on Y , and the general section of these line bundles is the Q-Fano 3-fold that we wanted to construct, i.e. the mirror of f .

The critical curvature degree of an algebraic variety

Emil Horobet

Universitatea Sapiientia

Abstract: In this article, we study the complexity involved in the computation of the reach in arbitrary dimension and in particular the computation of the critical spherical curvature points of an arbitrary algebraic variety. We present properties of the critical spherical curvature points as well as an algorithm for computing them.

New criteria for nilpotency and solvability of a finite group

Mihai-Silviu Lazorec

Universitatea “Alexandru Ioan Cuza” din Iasi

Abstract: Our aim is to detect the nature (nilpotency, solvability, etc.) of a finite group G using the sum of element orders of G or other quantities related to it.

Counting pairs of curves over \mathbb{F}_q with a prescribed number of \mathbb{F}_q -intersection points

Vlad Matei

Tel Aviv University

Abstract: In joint work with Nathan Kaplan we study counts for the pairs of curves defined over \mathbb{F}_q , one of degree d and one of degree e , that intersect in k - \mathbb{F}_q points for each $0 \leq k \leq de$. We obtain formulas for the cases $(d, e) = (2, 2), (2, 3), (3, 3)$ and in ongoing work we produce counts for the general case $(2, e)$ and an asymptotic formula for the case $(3, e)$. To prove our results we employ tools from coding theory, algebraic geometry, modular forms and combinatorics.

Special non-Kähler metrics on solvmanifolds

Alexandra Otiman

University of Florence & IMAR

Abstract: We discuss old and new results about the existence of special Hermitian metrics (locally conformally Kähler, balanced, pluriclosed) on complex nilmanifolds and on Oeljeklaus-Toma manifolds. This latter class represents a generalization of Inoue-Bombieri surfaces in arbitrary complex dimension and its construction, based on algebraic number theory, will allow us to give a numerical interpretation of the existence of several Hermitian metrics of special type.



Representations of the Torelli group via the Heisenberg group

Martin Palmer-Anghel

IMAR

Abstract: One of the earliest interesting representations of the braid groups is the Burau representation. It is the $k = 1$ case of the family of Lawrence representations, defined topologically by thinking of the braid group as the mapping class group of the punctured disc, which acts naturally on the homology of certain infinite coverings of the k -point configuration space on the punctured disc. Famously, the Burau representation is almost never faithful, but the $k = 2$ Lawrence representation is always faithful.

I will describe recent joint work with C. Blanchet and A. Shaukat, where we construct analogues of the Lawrence representations for the Torelli groups of orientable surfaces. A notable feature of our construction is that the ground ring over which the representations are defined is non-commutative – it is the group-ring of a certain discrete Heisenberg group. This is important since any commutative analogue for the Torelli groups necessarily loses a lot of information (in a precise sense that I will explain).



A moduli space for pure slope-semistable sheaves

Mihai-Cosmin Pavel

University of Lorraine

Abstract: The study of moduli spaces of sheaves on a surface has attracted considerable interest due to its interaction with gauge-theory through the so-called Donaldson's invariants. It turns out the moduli space of slope-semistable sheaves on a smooth surface is closely related to the Donaldson-Uhlenbeck compactification of anti-selfdual connections over the underlying 4-dimensional real manifold. In the algebraic geometry setting, Huybrechts and Lehn constructed such a moduli space of sheaves over a smooth base surface. We aim to present a generalization of their construction over singular surfaces. In particular, we provide a type of Mehta-Ramanathan Restriction Theorem for pure semistable sheaves.



Vaisman's theorem for LCK complex spaces

Ovidiu Preda

IMAR

Abstract: Vaisman's theorem for LCK compact manifolds states that any locally conformally Kähler (LCK) metric on a compact complex manifold which admits a Kähler metric is, in fact, globally conformally Kähler (GCK). We extend this theorem to compact complex spaces with singularities and then use this generalization to obtain some results on the blow-ups of LCK complex spaces along closed complex subspaces.

Euler obstructions for the Lagrangian Grassmannian

Claudiu Raicu

University of Notre Dame

Abstract: I will discuss a positivity conjecture of Mihalcea-Singh, concerned with the local Euler obstructions associated to the Schubert stratification of the Lagrangian Grassmannian. Building on the work of Boe and Fu, I will explain how to interpret the local Euler obstructions combinatorially, as the solution to a counting problem. This in particular allows for an easy identification of when vanishing of Euler obstructions occurs. Joint work with Paul LeVan.

Disguised Toric Dynamical Systems

Miruna-Stefana Sorea

Scuola Internazionale Superiore di Studi Avanzati - SISSA

Abstract: We study families of polynomial dynamical systems inspired by biochemical reaction networks. We focus on complex balanced mass-action systems, which have also been called toric dynamical systems, by Craciun, Dickenstein, Shiu and Sturmfels. These systems are known or conjectured to enjoy very strong dynamical properties, such as existence and uniqueness of positive steady states, local and global stability, persistence, and permanence. We consider the class of disguised toric dynamical systems, which contains toric dynamical systems, and to which all dynamical properties mentioned above extend naturally. We show that, for some families of reaction networks, this new class is much larger than the class of toric systems. For example, for some networks we may even go from an empty locus of toric systems in parameter space to a positive-measure locus of disguised toric systems. We focus on the characterization of the disguised toric locus by means of real algebraic geometry. Joint work with Laura Brustenga i Moncusí and Gheorghe Craciun.

Selberg Trace Formula on compact Riemann surfaces

Rares Stan

IMAR

Abstract: The Selberg trace formula on compact hyperbolic surfaces is a classical result in mathematics. It relates closed trajectories of geodesics to the Laplacian spectra. I will briefly present the classical trace formula and then I shall talk about the trace formula for a larger class of operators, namely Dirac operators twisted with flat bundles.

Coverings of LCK complex spaces

Miron Stanciu

Universitatea din Bucuresti & IMAR

Abstract: We study the properties of coverings of locally conformally Kähler (LCK) spaces with singularities, by introducing a new approach through which we prove that a space is LCK if and only if its universal cover is Kähler, thereby generalizing a classical result from the smooth case. We then show that a complex space which projects over an LCK space with discrete fibers must also carry an LCK structure.
