

Book of Abstracts

Atoms, Hodge Theory and MMP

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Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

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DISTINGUISHED LECTURES

Philip Engel (UIC)

Title: Matroids and the integral Hodge conjecture

Abstract: Associated to any regular matroid of rank g on k elements, one can associate a multivariable semistable degeneration of principally polarized abelian g -folds over a k -dimensional base. I will discuss joint work with de Gaay Fortman and Schreieder, proving that a combinatorial invariant of the matroid obstructs the algebraicity of the minimal curve class, on the very general fiber of the associated degeneration. Corollaries include the failure of the integral Hodge conjecture for abelian varieties of dimension ≥ 4 and the stable irrationality of very general cubic threefolds.

Jérémy Guéré (University of Grenoble)

Title: New Atomic Invariants

Abstract: In the first lecture, I will review the construction of atoms, beginning with an overview at the formal level before addressing the technical difficulties that necessitate the use of non-Archimedean fields. I will also discuss the behavior of the Hodge structure under Iritani's blow-up formula.

In the second lecture, I will introduce the new atomic invariant and provide the proof for the following theorem: if a smooth complex cubic fourfold is rational, then its primitive cohomology is isomorphic, as a Hodge structure, to the shifted middle cohomology of a projective K3 surface. The proof relies on explicit computations for surfaces that I will present.

TALKS

Leonardo F. Cavenaghi (ICMS-Sofia)

Title: Operadic WDVV equations

Abstract: We report on joint work in progress with L. Katzarkov and M. Kontsevich, where we explore operadic solutions to WDVV equations. This led to the definition of Gromov-Witten invariants, for example, in open varieties and non-Kähler manifolds. Eventually, this will allow us to speak about atoms in these contexts.

Leonardo F. Cavenaghi (ICMS-Sofia)

Title: G-equivariant atoms

Abstract: We present the extension of the theory of Hodge atoms to the G-equivariant setting, along with many applications in G-equivariant birational geometry. This is based on the joint work with L. Katzarkov and M. Kontsevich "Atoms meet symbols".

Giovane Galindo Neto (ICMS-Sofia)

Title: Flag Varieties as GKM Spaces and Equivariant Gromov-Witten Theory

Abstract: In this talk, we present flag varieties as GKM spaces and use their Lie-theoretic structure to describe the associated combinatorial data explicitly. This perspective enables

computations in equivariant cohomology, including the equivariant Gromov–Witten invariants. This will provide simpler atoms computations and lead to solving problems in G-equivariant birational geometry. This is based on ongoing joint work with Ludmil Katzarkov.

Roy Magen (ICMS-Sofia)

Title: Computing mixed Hodge numbers

Abstract: After giving a brief introduction to mixed Hodge structures and associated numerical invariants, I will compute some examples for quartic 3-folds and sextic double solids. This will have applications to singularity theory and rationality problems which will be explored further in Erik Paemurru’s talk.

Pedro Muniz Martins (IMECC and ICMS)

Title: The Cohomology of Solvmanifold SYZ Mirrors

Abstract: In this talk, we provide necessary and sufficient conditions for the existence of non-Kähler SYZ mirror pairs, in the sense of Lau, Tseng, and Yau, for solvmanifolds, following a construction proposed by Bedulli and Vannini. We further investigate the relationship between the cohomology of these pairs and, time permitting, propose new cohomological frameworks tailored to this setting. This is joint work in progress with L. Cavenaghi, L. Grama, and L. Katzarkov.

Alexander Novikov (ICMS-Sofia)

Title: Semiorthogonal Decompositions in Algebraic Geometry

Abstract: This is a survey talk on derived categories in algebraic geometry. I will review the formalism of semiorthogonal decompositions (SODs), focusing on the underlying adjunction functors and admissibility conditions that make them work. We will look at standard examples, including exceptional collections, and discuss how mutations of these components naturally give rise to braid group actions.

A main focus will be how SODs connect — or fail to connect — to classical geometric invariants. We will look at cases where the classical geometry breaks down, leaving behind non-commutative components or phantom categories that are invisible to standard additive invariants. I will finish with a discussion of some recent attempts and ongoing strategies to recover geometric meaning from these abstract triangulated structures.

Erik Paemurru (ICMS-Sofia)

Title: Degenerations of smooth Fano 3-folds, their Hodge theory and rationality

Abstract: I consider terminal Fano 3-folds as degenerations of smooth Fano 3-folds, with emphasis on quartics and sextic double solids. I give an overview of their rationality and Hodge theory.

Alexander Vitanov (ICMS-Sofia)

Title: Formal Deformation Quantization of Symplectic Singularities

Abstract: I will discuss joint work with Pavel Etingof on the deformation theory of symplectic singularities. It is well known that an algebraic symplectic global quotient orbifold $[X/G]$

admits a formal deformation quantization, realized as the G -invariant part of the G -equivariant Fedosov quantization of the underlying symplectic affine variety X . A hypothesis of Pavel Etingof and Vassily Dolgushev asserts that, for a smooth affine symplectic G -variety X , Fedosov's formal deformation quantization of $[X/G]$ admits a universal multi-parameter formal deformation, parametrized by the second Chen–Ruan cohomology group of $[X/G]$. I will outline an algebro-geometric approach to solving this conjecture.