Celebrating the Consortium IMSAC

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Titles and Abstracts

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Andras Szenes, University of Geneva

Title: ***Residues and the topology of moduli spaces of bundles on curves***

Abstract: I will review some recent and not so recent results on the calculus of iterated residues and the topology of moduli spaces of stable bundles and stable Higgs bundles on curves.

Anna Maria Fino, University of Torino, Italy

Title: ***Strong HKT geometry on hypercomplex manifolds***

Abstract: A hyperhermitian manifold (M, J_1, J_2, J_3, g) is said to be strong HKT if the Bismut connections associated to the three Hermitian structures (J_i, g), $i = 1, 2, 3$, coincide, and the common Bismut torsion 3-form is closed.

In the talk I will first discuss some general properties of strong HKT manifolds, including a non-existence result on solvmanifolds. Then I will focus on the geometry of compact, simply connected strong HKT manifolds in real dimension eight. This talk is based on a joint work with Beatrice Brienza, Gueo Grantcharov, and Misha Verbitsky.

Caucher Birkar, Beijing Institute of Mathematical Sciences and Applications, China

Title: ***The rich world of Fano geometry***

Abstract: In this talk I discuss the world of Fano's from different perspectives. I will mention some results from recent years and some open problems.

Ernesto Lupercio, Institute of Mathematics and Informatics, Sofia, and Cinvestav-IPN, Mexico

Title: *Moduli of Quantum Toric Stacks and Their Compactifications*

Abstract: Classical toric geometry provides a remarkably explicit link between combinatorics and algebraic geometry, with moduli spaces governed by secondary fans and wall–crossing phenomena. In

joint work with our student Tristan Boivin, we extend this paradigm to the *quantum* (irrational) and analytic–stack setting, developing a complete moduli theory for quantum toric stacks.

For fixed dimension, number of generators, and combinatorial type, we show that the corresponding moduli space is a global quotient of a semi–algebraic domain by a finite group of symmetries, and carries a universal family. We then construct a canonical Grassmannian–type compactification by adding controlled degenerations along its boundary. This construction is generalized beyond the simplicial case, enabling the use of secondary fans in the quantum context and allowing wall–crossing between distinct chambers. Gluing all chambers along their boundaries yields a global *augmented moduli space*, a compact stack fibering over each chamber compactification.

The resulting picture unifies the algebraic and non–algebraic toric worlds in a single geometric–combinatorial framework, with potential applications to birational geometry, mirror symmetry, and the study of non–Kähler analytic spaces.

Based on work by Katzarkov, L., Meersseman, Verjovsky and Boivin.

Fabrizio Catanese, University of Bayreuth, Germany

Title: ***Fake homology quadrics, Surfaces isogenous to a Product, numerically and cohomologically trivial automorphisms***

Abstract: Hirzebruch asked about the existence of even fake quadrics, that is, surfaces homeomorphic to $F_0 = P^1 x P^1$ which are not rational (hence of general type). Similarly, odd fake quadrics would be minimal non rational surfaces homeomorphic to the blow up F_1 of the plane P^2 in one point. Fake homology quadrics are the minimal surfaces of general type with the same Q-homology as F_0, F_1, namely the minimal surfaces with $K^2 = 8, p_g = q = 0$.

There are 4 types known: the SIP= surfaces isogenous to a product (quotients of a product of curves) and the irreducible quotients of the bidisk, and, in each class, those with even, respectively odd intersection form.

I will first show that the class of fake odd Q-homology quadrics is non empty, using surfaces isogenous to a product. I will later sketch some arguments suggesting that the answer to Hirzebruch's question is negative. It is also conjectured that fake homology quadrics are exactly the surfaces whose universal covering is the bidisk.

An automorphism of a $cKMX$ is said to be numerically trivial (in $Aut_Q(X)$) if it acts trivially on rational cohomology, and cohomologically trivial (in $Aut_Z(X)$) if it acts trivially on integral cohomology.

I shall recall the known results on automorphisms with some topological triviality, especially in the case of surfaces, and

1) recent results with Matthias Schuett and Wenfei Liu on properly elliptic surfaces: for $\chi > 0$ we show that all 2-generated abelian groups appear as $Aut_Q(S)$, contradicting previous results of other authors..

2) work in progress with Davide Frapporti on the case of general type, exhibiting a record $|Aut_Q = 192$ for some fake quadrics which are SIP.

It is puzzling that, in the case $Aut^0(S) = 0$, we have only examples with $Aut_Z(S)$ of order 2,3, and one can ask whether 4 is an upper bound.

Jacob Kryczka, Beijing Institute of Mathematical Sciences and Applications (BIMSA)

Title: ***Derived and Homotopical Methods in the Geometry of PDEs***

Abstract: Homological methods play an important role in the study of systems of differential equations. They capture structures such as infinitesimal symmetries, conservation laws, recursion operators and characteristic classes of solutions through cohomological invariants. Classical tools like the variational bicomplex and Vinogradov's C-spectral sequence encode deep geometric information, forming the basis of the theory known as Secondary Calculus, that is roughly speaking, a formal analogue of differential geometry on the infinite-dimensional space of solutions to a PDE.

In this talk, I will present a modern derived enhancement of this framework, using tools from derived algebraic geometry and higher category theory. This perspective provides a natural dg-enhancement of the variational bicomplex, allowing for new constructions such as shifted Poisson structures and differential refinements via Deligne–Beilinson cohomology. Time permitting I will describe how this framework fits within Clausen–Scholze's Condensed mathematics, offering new insights into questions of (formal) integrability in the sense of Cartan–Kähler–Kuranishi, suggesting moduli-theoretic interpretations of classical geometric PDE invariants.

This is based on joint works with A. Sheshmani, V. Rubtsov and S.-T. Yau.

Jaqueline Mesquita, Universidade Estadual de Campinas, Brazil

Title: ***General concept of periodicity for any time scales***

Abstract: In this talk, we will present a general concept of periodicity for any time scales and some applications. This is a joint work with Martin Bohner and Sabrina Streipert.

John Morgan, Columbia University, USA

Title: ***Donaldson Invariants of Ellliptic Surfaces***

Abstract: We will review the definition of the Donaldson Invariants and the relationship of those invariants for complex surfaces with algebro-geometric invariants. We will then give computations for elliptic surfaces concentrating on the case of $p_g = 1$.

(Dolgachev surfaces) where complete explicit descriptions are possible.

Kenji Fukaya, Beijing Institute of Mathematical Sciences and Applications, China

Title: ***Monotone A infinity category in gauge theory and symplectic geometry***

Abstract: I will explain in the situation of Instanton Floer homology (gauge theory) and Lagrangian Floer homology of monotone Lagrangians, we can put a certain structure so that filtration gives a certain extra information.

I will also explain such structure is expected to be preserved by Atiyah-Floer conjecture. This is a work in progress with A. Daemi.

Kyoung-Seog Lee, Pohang University of Science and Technology POSTECH, South Korea

Title: ***Hodge polynomials of non-Kahler complex manifolds***

Abstract: Hodge theory is one of the most important tools to understand cohomology of complex algebraic/Kahler manifolds. In this talk, I will discuss how to extend some of the classical results of Hodge theory to the realm of non-Kahler complex manifolds. This talk is based on joint works with Ludmil Katzarkov, Ernesto Lupercio and Laurent Meersseman.

Leonardo Francisco Cavenaghi, Institute of Mathematics and Informatics, Sofia, and University of Miami, USA

Title: ***Theory of Atoms***

Abstract: We introduce theory of atoms. Many applications are considered.

Leonid Polterovich, Tel Aviv University

Title: ***Courant, Bezout, and persistence***

Abstract: I'll discuss an approach to studying oscillations of functions based on ideas of topological data analysis. Applications include generalizations of two classical results, Courant's nodal domain theorem in spectral geometry and Bezout's theorem in algebraic geometry. Joint with Lev Buhovsky, Jordan Payette, Iosif Polterovich, Egor Shelukhin, and Vukašin Stojisavljević.

Lino Grama, University of Campinas - UNICAMP

Title: ***Recent contributions Bulgaria-Miami-Campinas Collaboration***

Abstract:

Mohammed Abouzaid, Stanford University, USA

Title: ***Normal invariants of nearby Lagrangians***

Abstract: A nearby Lagrangian is a closed exact Lagrangian in a cotangent bundle. Floer theory has shown that such Lagrangians are always homotopy equivalent to the base. This implies that there is an associated normal invariant which measures the difference between their tangent bundle as the tangent bundle of the base. I will explain that this invariant is always 2-torsion. This is joint work with Alvarez-Gavela, Courte, and Kragh.

Ron Donagi, University of Pennsylvania, USA

Title: ***The intersection of three quadrics in P^7 revisited***

Abstract: We show that the natural nc-space attached to an intersection of three quadrics in P^7 is truly non-commutative. In particular, its associated numerical K-lattice is not isomorphic to the K-lattice of any smooth projective surface, so the relevant derived category is not equivalent to the derived category of any smooth projective surface. Using the new KKPY theory of Hodge atoms, this reproves the irrationality of a very general intersection of three quadrics in P^7.

Umut Varolgunes, Boğaziçi University, Istanbul

Title: ***Contact big fiber theorems***

Abstract: Entov-Polterovich's celebrated symplectic big fiber theorem says that any smooth map from a closed symplectic manifold to an Euclidean space with Poisson commuting components has at least one Hamiltonian non-displaceable fiber. I will discuss contact analogues of this theorem that we proved with Yuhan Sun and Igor Uljarevic using symplectic cohomology with support. Unlike the symplectic case, the validity of the statements require conditions on the closed contact manifold. One such condition is to admit a Liouville filling with non-zero symplectic cohomology. In the case of Boothby-Wang (pre-quantization) contact manifolds, we prove the result under the condition that the Euler class of the circle bundle is not an invertible element in the quantum cohomology of the base symplectic manifold. I will also explain how to obtain Givental's Legendrian rigidity result in the standard contact real projective spaces as an application.

Yan Soibelman, Kansas State University, USA

Title: ***Generalized Riemann-Hilbert correspondence: an overview***

Abstract: Generalized Riemann-Hilbert correspondence (GRHC for short) is an important part of our joint program with Maxim Kontsevich which we started more than 10 years ago and called "Holomorphic Floer Theory". Roughly, GRHC claims (derived) equivalence of the category of holonomic modules over the quantized algebra of functions on a complex symplectic manifold and the Fukaya category of this manifold. There are local and global versions of GRHC.

In this talk I am going to give an informal overview of the more mysterious global GRHC and illustrate it in several non-trivial examples. In the upcoming talk at the conference in Burgas I plan to discuss the local version.