

Titles and abstracts

Clark Barwick : *Exodromy and pyknotic structures.*

Abstract : In work with Saul Glasman and Peter Haine, we showed that constructible sheaves on a scheme X can be identified with certain representations of a certain category $\text{Gal}(X)$ attached to X . This category is a refined étale homotopy type of X . Further still, we will discuss how to reconstruct the full étale topos as a certain representation of category of $\text{Gal}(X)$. To do this, we will need to use pyknotic (AKA condensed) structures.

Arnaud Beauville : *The Ceresa cycle.*

Abstract : Let C be a curve of genus ≥ 3 , embedded in its Jacobian JC . The cycle $[C] - [(-1)^*C]$ is cohomologous to zero in JC ; is it algebraically equivalent to zero? The answer is negative for C general (Ceresa, 1983) and for some very particular curves, and positive (trivially) for hyperelliptic curves. I will explain an example, obtained with C. Schoen, of a non-hyperelliptic curve C for which $[C] - [(-1)^*C]$ is torsion modulo algebraic equivalence.

Dario Beraldo : *Recent progress in Geometric Langlands.*

Abstract : I'll discuss some recent (and less recent) ideas that bring us close to the proof of the geometric Langlands conjecture, at least in the case of classical groups. Part of the talk is ongoing work with Arinkin-Chen-Gaitsgory-Raskin.

Clemens Berger : *Dold-Kan categories and Catalan monoids.*

Abstract : (joint work with Christophe Cazanave and Ingo Waschkie) The category of simplicial abelian groups is equivalent to the category of (non-negatively graded) chain complexes by a classical theorem of Dold and Kan. We propose an axiomatic setting where such categorical equivalences of Morita-type occur. In particular, as a new example, we show that abelian presheaves on the higher cell categories Θ_n of Joyal may be understood as arboreal chain complexes and that this perspective leads to interesting chain models for Eilenberg-Mac Lane spaces.

One of the combinatorial ingredients of our generalised Dold-Kan correspondence is the appearance of certain idempotent generated monoids sitting inside the endomorphism monoids and admitting a canonical presentation. Since in the simplex category the cardinalities of these submonoids are the Catalan numbers we call them Catalan monoids. They are quotients of the Kiselman monoids introduced by Kudryavtseva-Mazorchuk.

Denis-Charles Cisinski : *Microlocalization of motivic sheaves.*

Abstract : Beilinson's method to construct the singular support of an étale sheaf is robust enough to be transposed in Voevodsky's motivic world, at the price of speaking of dualizable objects in place of local systems. On the other hand, Takeshi Saito has constructed characteristic cycles of constructible étale sheaves which are supported on Beilinson's singular support. Since groups of algebraic cycle are representable in categories of motivic sheaves, it is tempting to try to produce such characteristic cycles in terms of microlocalization via some kind of Lefschetz-Verdier trace, following the lead of Kashiwara and Schapira in the analytic con-text. We will explain how far we can expect to go in this direction, thus exploring ramification theory with a new perspective. The talk will be based on an on going project with Adeel Khan, Massimo Pippi, Benedikt Preis, and Enlin Yang.

Ron Donagi : *Products of Matrices, Non-Abelian Hodge Theory, Integrable Systems, and Theories of Class S.*

Abstract : We will describe some unexpected connections between the Deligne-Simpson problem and Hitchin systems, motivated by work on SCF Theories of Class S and 3D mirror symmetry.

Philippe Eyssidieux : *Reshetikhin-Turaev representations as Kähler local systems.*

Abstract : From a joint work, partially in progress, with Louis Funar. In Orbifold Kähler Groups related to Mapping Class groups, arXiv :2112.06726, we constructed certain orbifold compactifications of the moduli stack of stable pointed curves labelled by an integer p such that the corresponding Reshetikhin Turaev representation of the mapping class group descends to a representation of the orbifold fundamental group. I will explain the construction of that orbifold and why it is uniformizable. I will then report on a work in progress on the uniformization of these orbifolds. I will sketch a proof of the steiness of its universal covering p odd large enough. An interesting new quantum topological consequence is that the image of the fundamental group of the smooth base of a non isotrivial complex algebraic family of smooth complete curves of genus greater than 2 by the Reshetikhin-Turaev representation is infinite (generalizing the Funar-Masbaum and the Koberda-Santharoubane-Funar-Lochak infiniteness theorems).

Jaya Iyer : *Regulators of canonical extension.*

Abstract : In this talk, we will discuss the various constructions of volume regulators of canonical extensions (of a flat connection) on a pair (X,D) , where X is a smooth variety and D is a normal crossing divisor. The triviality of these classes are obtained in some cases. This is work in progress with C. Simpson.

Ludmil Katzarkov : *Non Rationality and conformal field theory.*

Abstract : We propose a new approach to nonrationality based on ideas from theoretical physics. Examples will be considered.

Bruno Klingler : *Bi-algebraic geometry for abelian differentials and their periods.*

Abstract : An abelian differential is a smooth projective curve endowed with an algebraic 1-form. I will discuss the arithmetic and functional transcendence properties of abelian differentials and their periods, as seen in the format of “bi-algebraic geometry” recently developed in Hodge theory. Joint work with Leonardo Lerer.

Joseph Landsberg : *Theoretical computer science, secant varieties, and the Quot scheme.*

Abstract : In 1968 V. Strassen discovered the usual way we multiply matrices is not the best possible and since then it has been a central question in computer science to determine just how efficiently matrices can be multiplied. In 1980 D. Bini proved a result that implies this question can be answered by studying membership in certain secant varieties of Segre varieties. After giving a brief history I will focus on recent developments that have led to the use of deformation theory in this problem.

Michael Larsen : *Geometry on simple algebraic groups via character estimates.*

Abstract : I will discuss some algebraic geometry problems which can be attacked by means of character theory on groups of Lie type and say something about upper bounds of character values on these groups.

Marco Maggesi : *Bicategories in Univalent Foundations.*

Abstract : We discuss the development of Bicategory Theory in Univalent Foundations and illustrate its implementation in the Coq proof assistant using the UniMath library.

Pranav Pandit : *2-categories in holomorphic symplectic geometry.*

Abstract : I will outline the construction of a 2-category associated to a holomorphic symplectic manifold. This is related to the 2-category of boundary conditions in Rozansky-Witten theory.

Tony Pantev : *Mirror symmetry, intersection of quadrics, and Hodge theory.*

Abstract : I will discuss a construction of the homological mirror correspondence on algebraic integrable systems arising as moduli of flat bundles on curves. The focus will be on non-abelian Hodge theory as a tool for constructing Hecke eigensheaves. I will discuss specific example of the construction building automorphic sheaves on moduli space of bundles that are realized as intersections of quadrics. This is a joint work with Ron Donagi and Carlos Simpson.

Marco Robalo : *Categorification of Donaldson-Thomas invariants.*

Abstract : Given a (-1) -shifted derived scheme X with a convenient orientation data (in the sense of Kontsevich-Soibelman), Brav-Bussi-Dupont-Joyce-Szendroi (BBDJS) constructed a perverse sheaf over X and whose Euler characteristic recovers Behrend's counting of Donaldson-Thomas invariants. The BBDJS construction uses a Darboux local form for (-1) -shifted symplectic schemes : locally they are all derived critical loci of a function f on a smooth scheme U and the DT-invariants are obtained from the Euler characteristic of the sheaf of vanishing cycles of f . In this talk I will describe an ongoing joint work with B. Hennion and J. Holstein where we propose a new strategy based on Toën-Vezzosi derived foliations, to glue over X a sheaf of 2-periodic dg-categories locally modelled on the categories of matrix factorisations $MF(U, f)$. In particular, our strategy allows us to recover the results of BBDJS.

Claude Sabbah : *Mixed twistor theory and Hodge numbers of some hypersurfaces.*

Abstract : We show how mixed twistor theory, as initiated by Carlos Simpson and further developed by Takuro Mochizuki, can help in computing Hodge numbers of some hypersurfaces. This computation is motivated by applications to arithmetic properties of symmetric power moments of Kloosterman sums. This is a joint work with Javier Fresán and Jeng-Daw Yu.

Mark Spivakovsky : *The problems of resolution of singularities and local uniformization in arbitrary characteristic.*

Abstract : The problem of resolution of singularities asks whether, given an algebraic variety X over a field, there exists a non-singular algebraic variety X' and a proper map $X' \rightarrow X$ which is one-to-one over the non-singular locus of X . If we cover X' by affine charts, the problem becomes one of parametrizing pieces of X by small pieces of the Euclidean space k^n . This local version of the problem, called Local Uniformization, is stated in terms of valuations, as follows. Let (R, M, k) be a local noetherian domain and R_ν be a valuation ring containing R and having the same field of fractions as R . The Local Uniformization Theorem asserts the existence a regular finite type R -algebra R' such that $R' \subset R_\nu$; it was proved by O. Zariski in 1940 in the case when $\text{char} k = 0$ and is one of the central open problems in the field when $\text{char} k = p > 0$. We will start out by recalling Zariski's valuative approach to the problem as well as Hironaka's (non-valuative) proof of resolution in characteristic zero. We will explain the difficulties arising in characteristic $p > 0$ and the idea for overcoming them using differential operators. At the end of the talk we will discuss two main technical tools of our program : key polynomials and universal Puiseux expansion in generalized power series with non-well-ordered support.

Gabriele Vezzosi : *An analog of Beilinson-Drinfeld Grassmannian for surfaces.*

Abstract : Fix an affine algebraic group G over the complex numbers, and a proper smooth complex surface X . We can attach to a family of flags of closed subschemes in X (parametrized by a scheme S) a generalization of Beilinson-Drinfeld Grassmannian of G -bundles. The union of flags induces a

simplicial structure that turns out to be 2-Segal, thus giving rise to a fusion monoidal structure on sheaves on this Grassmannian that also carries a flat connection and actions of suitable generalizations of the loop and positive loop groups. Time permitting, I will discuss the factorization property and some future directions. This is joint work with Benjamin Hennion, Valerio Melani and Mauro Porta.

Claire Voisin : *Compact Kähler manifolds with no projective specialization.*

Abstract : We show the existence of a compact Kähler manifold which does not fit in a proper flat family over an irreducible base with one projective (possibly singular) fiber. This strengthens our earlier counterexamples to the Kodaira algebraic approximation problem, where we considered only smooth families. Our main tool is the limit Hodge structure on cohomology as constructed by Steenbrink, which allows to study the singular fibers.