Algebraic Analysis

in honor of Pierre Schapira's 75th birthday

Institut Henri Poincaré **April 9 – 11, 2018**

Abstracts

Damien Calaque
IMAG, Université de Montpellier

The Ext algebra of a quantized cycle

Abstract: In the talk we will survey some recent results, obtained with Julien Grivaux, on the Lie-theoretic study of formal neighborhoods. We will start with a review of the general context, and of the Lie structures (Lie algebras, Lie algebroids) involved in the geometric study of formal neighborhood. We will then explain a Lie-theoretic interpretation of a geometric condition, discovered by Shilin Yu, that involves the second formal neighborhood of a smooth subvariety X in an ambient smooth algebraic variety Y. If this condition (called "tame") is satisfied, then the Ext algebra $\mathcal{RH}om_{\mathcal{O}_Y}(\mathcal{O}_X, \mathcal{O}_X)$ is isomorphic to the universal enveloping algebra of the shifted normal bundle $N_{X/Y}[-1]$ endowed with a specific Lie structure. This strengthens earlier results obtained with Căldăraru and Tu. We also get a purely Lie-theoretic proof of Yu's result for the explicit calculation of the quantized cycle class in the tame case: it is the Duflo element of the Lie algebra object $N_{X/Y}[-1]$.

Mikhail Kapranov
Kavli IPMU, University of Tokyo

Gelfand-Fuks cohomology in algebraic geometry and factorization algebras

Abstract: Let X be a smooth algebraic variety over complex numbers and $T(X) = R\Gamma(X, T)$ the dgLie algebra of derived global vector fields on X. We study the Lie algebra cohomology of $T(X)$ using the approach of factorization algebras. It turns out that $H^\bullet(T(X))$ is governed by a factorization algebra $\mathcal{A}$ which is not locally constant but has a natural "approximation" which is. This approximation is $\phi(\mathcal{A})$, the covariant Verdier dual of $\mathcal{A}$ in the sense of Gaitsgory and Lurie. When X is affine, one can compare the factorization homology of $\mathcal{A}$ and $\phi(\mathcal{A})$, thus obtaining a description of $H^\bullet(T(X))$ in topological terms, similar to the classical results of Gelfand-Fuchs and Haefliger for C^∞-manifolds. Joint project with B. Hennion and A. Khoroshkin.

Masaki Kashiwara
RIMS, Kyoto University

Algebraic Analysis and Pierre Schapira

Maxim Kontsevich
IHÉS

An approach to Fukaya categories via contact geometry

Abstract: I'll sketch a definition of a version of Fukaya categories in which objects have "supports" on singular Lagrangian subsets. The technical problems with holomorphic discs are resolved using symplectic field theory by Eliashberg, Givental and Hofer. The new definition is complete in certain sense, and opens a way to formulate rigorously many conjectures.

PROJET FINANCÉ PAR L'ANR – PROJECT FUNDED BY THE ANR
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Kobi Kremnitzer
University of Oxford

Analytic geometry over the field with one element and a global FF curve

Abstract: I will describe an approach to analytic geometry over the field with one element. Using this I will show how to construct a global version of the Fargues-Fontaine curve. I will also discuss the notion of a global (phi,Gamma)-module.

Gilles Lebeau
Université de Nice

Spectral inequalities for the Schrödinger operator

Abstract: We will present sharp quantifications of the uncertainty principle for a Schrödinger operator

$$H_V := -\Delta_x + V(x), \qquad \text{in } \mathbb{R}^d, \quad d \geq 1,$$

where $V = V(x)$ is a potential function, possibly singular, which is not necessarily short range. Our approach relies on spectral inequalities adapted to the unbounded case, using holomorphic extension, spectral projections and suitable Carleman estimates. This is a joint work with Ivan Moyano, Centre for Mathematical Sciences, University of Cambridge.

François Loeser
Sorbonne Université

Non-archimedean integrals as limits of complex integrals

Abstract: Chambert-Loir and Ducros have recently developed a theory of real differential forms, integration and currents on Berkovich spaces which is parallel to the classical theory on complex spaces. We will report on joint work with Antoine Ducros and Ehud Hrushovski, showing that such non-archimedean forms and integrals arise naturally as limits of their archimedean counterparts when one studies the asymptotic behavior of families of complex varieties on the punctured disk.

Sophie Morel
Princeton University

The Grothendieck six operations on derived categories of mixed perverse sheaves

Abstract: For a variety over a finite field, Beilinson has shown that the derived category of the category of l-adic mixed perverse sheaves is equivalent to the category of mixed constructible complexes, hence inherits all the sheaf operations from the category of l-adic constructible complexes. However, over a more general base field, we might want to work with subcategories of mixed perverse sheaves (like those admitting a weight filtration or those of geometric origin) whose derived category does not identify with a full subcategory of the usual category of constructible complexes. In this talk, I want to explain how to define these categories, why they are interesting, and how to construct and characterize the sheaf operations on them, using ideas of Beilinson, Voedvodsky and Ayoub.

Alexandru Oancea
Sorbonne Université

Sheaves and Liouville manifolds

Abstract: Microlocal sheaf theory developed by Kashiwara and Schapira has been rejuvenated in recent years through its relation with symplectic topology, initially discovered by Tamarkin. From cotangent bundles, which constitute the original geometric framework of the theory, and following ideas of Kontsevich and Nadler, the attention is currently shifting towards Weinstein manifolds, seen as generalized cotangent bundles of their Lagrangian skeleta. A further generalization of the geometric setup is to consider Liouville manifolds and cobordisms. I will discuss functorial properties of symplectic homology in this context and interpret them as evidence for the existence of a sheaf theory.

François Petit
Université du Luxembourg

Towards a tempered GAGA theorem

Abstract: Comparing complex algebraic and complex analytic geometry is a classical question. In the case of proper algebraic varieties, the question has been settled by Serre's famous GAGA theorem. In the non-proper case, this theorem does not hold but some comparison results between analytic and algebraic objects have been obtained when the properness assumption is replaced by a growth condition on the analytic functions considered. In this talk, we will present an approach based on the theory of tempered holomorphic functions which allows to obtain algebraization results in the non-proper case.

Mauro Porta
Université de Strasbourg

HKR theorems in analytic geometry

Abstract: In this talk I will survey recent advances in derived geometry that led to the proof of the multiplicative and S^1-equivariant Hochschild-Kostant-Rosenberg (HKR) theorem in both complex and non-archimedean analytic geometry. I will start by outlining a more geometric proof in the algebraic setting, where the theorem has originally been proven by B. Toën and G. Vezzosi. Later, I will explain how this proof can be adapted to the analytic setting. This is joint work with J. Antonio and F. Petit.

Vivek Shende
UC Berkeley

Sheaf quantization of the exact symplectic category

Abstract: I will explain how, using microlocal sheaf theory, one can associate categories to exact symplectic manifolds, objects to exact lagrangians, and functors to exact lagrangian correspondences. Time permitting I will also discuss comparison with the Fukaya category, and applications to homological mirror symmetry.

Dmitry Tamarkin
Northwestern University

The axiomatic microlocal category

Abstract: I will talk on my work in progress on associating an infinity, 1-category to a compact symplectic manifold via imposing a natural list of axioms.

Bertrand Toën
CNRS, Université de Toulouse

Derived and symplectic structures on moduli of connections on higher dimensional open varieties

Abstract: This is a report on a joint work with Tony Pantev. We study a moduli functor for (possibly irregular) connections with fixed formal structure at infinity on a given smooth variety. The construction is based on the notion of the formal neighborhood at infinity as recently studied by Ben-Bassat-Temkin, Efimov and Hennion-Porta-Vezzosi. We present three main results: representabilty of the derived moduli functor, existence of a Poisson structure and construction of its symplectic leaves.

Claude Viterbo
École normale supérieure

Sheaf quantization and Floer cohomology

Abstract: TBA