

Yifei Chen. Kawamata–Kodaira canonical bundle formula and an application

We discuss Kawamata–Kodaira canonical bundle formula, which is a higher-dimension analogue of Kodaira bundle formula for surfaces. We also introduce a conjecture related by Kawamata and Shokurov. As an application, we shall prove that, if $f : X \rightarrow Y$ is a smooth surjective morphism between smooth projective varieties over the field of complex numbers, then $-K_X$ is semi-ample implies that $-K_Y$ is semi-ample (it is conjectured by Fujino and Gongyo). This is a joint work with Caucher Birkar.

Baohua Fu. On automorphism groups of smooth projective varieties

We shall show that the continuous part and the discrete part of the automorphism group of a smooth projective variety X cannot be both infinite unless X is an abelian variety or a fibration. This is a joint work with De-Qi Zhang.

Sergey Gorchinskiy. Parameterized differential Galois theory

Classical Galois theory studies symmetry groups of solutions of algebraic equations. Differential Galois theory studies symmetry groups of solutions of linear differential equations. We discuss a so-called parameterized differential Galois theory which studies symmetry groups of solutions of linear differential equations with parameters. The groups that arise are linear differential groups given by differential equations (not necessarily linear) on functions in parameters. We also discuss in this connection derivations on abelian categories and differential Tannakian categories.

Maxim Korolev. On the small values of the Riemann zeta-function on the critical line

The main goal of the talk is to describe some recent results of the speaker concerning the existence of very small values of the Riemann zeta-function on the sequence of Gram points on the critical line. In particular, the following result will be discussed:

$$\liminf_{n \rightarrow +\infty} \left| \zeta\left(\frac{1}{2} + it_n\right) \right| e^{A\sqrt{\ln \ln n}} = 0,$$

where A is an arbitrary large positive number.

Viktor Kulikov. Covering semigroups and irreducible components of Hurwitz spaces

In the talk, I'll introduce a semigroup structure on the set of marked degree d coverings of oriented surfaces (spheres with handles) with a given Galois group embedded into the symmetric group S_d . As an application, the number of irreducible components of Hurwitz space of marked degree d coverings of a projective curve with fixed ramification type will be counted in terms of the Galois group and the set of local monodromies of coverings if the number of branch points of the coverings is big enough.

Yurii Nesterenko. Algebraic independence of numbers

We plan to give a survey of recent results about irrationality, transcendence and algebraic independence of values of analytic functions. We specially discuss values of polylogarithms and modular functions in connection to Riemann zeta-values. Some open problems and directions of future work will be presented.

Denis Osipov. Unramified two-dimensional Langlands correspondence and noncommutative reciprocity laws

We will describe the local unramified Langlands correspondence for two-dimensional local fields (following an approach of M. Kapranov). We will construct the categorical analog of principal series representations of general linear groups over two-dimensional local fields, describe the properties of the construction, and discuss some hypothesis. The main ingredients of the construction are some central extensions of these groups (these groups are defined over two-dimensional local fields or over adelic rings of two-dimensional arithmetic schemes). We will prove reciprocity laws for these central extensions, i.e., splittings of these central extensions over some subgroups defined over semilocal rings constructed by means of points and one-dimensional subschemes of a two-dimensional arithmetic scheme.

Alexey Parshin. A new kind of functoriality in the Langlands theory

We consider abelian Langlands correspondence for algebraic surfaces fibred over an algebraic curve and defined over a finite field. In the smooth case, we introduce automorphic induction and base change which connect this correspondence with the classical Langlands correspondence on the curve.

Irina Rezvyakova. Zeros of linear combinations of Hecke L -functions on the critical line

Let us consider a linear combination of Hecke L -functions associated with the characters of the ideal class group of the imaginary quadratic field $\mathbb{Q}(\sqrt{-D})$. In general, such linear combinations have many non-trivial zeros outside the critical line. Nevertheless, under certain natural conditions we shall show that the critical line is an exceptional set, which contains a large proportion of their non-trivial zeros.

Ilya Shkredov. Applications of some operators to problems of Number Theory

In the talk a family of operators (finite matrices) with interesting properties will be discussed. This family appeared during attempts to give a simple proof of Chang's theorem from Combinatorial Number Theory. At the moment our operators have found several applications in the area connected with Chang's result as well as another problems of Number Theory as:

- dual Chang's theorem,
- bounds for the additive energy of multiplicative subgroups and convex sets,
- structural results for set with small higher energy,
- estimates of Heilbronn's exponential sums and distribution results of Fermat quotients.

Binyong Sun. Conservation relations for local theta correspondence

I will introduce Kudla–Rallis conjecture on first occurrences of local theta correspondence, and explain the idea of its proof. This is a report of a joint work with Chen-Bo Zhu.

Ye Tian. Congruent Numbers and Heegner Points

In this talk, for any given positive integer k , we construct infinitely many square-free congruent numbers with exactly k prime divisors.

Song Wang. Local vs. Global Conjugacy

Let H and H' be two subgroups of a connected reductive group G , and assume that they are element-wise conjugate (or locally conjugate). One asks whether they are conjugate. When $G = GL(n, \mathbb{C})$, the answer is yes and the

reason is exactly the character theory. How about the other group? Moreover, the discrepancy between local and global conjugacy reflects somewhat one important feature of the automorphic representations of G , namely the multiplicity.

In this talk, we will review the local-global issue, and its relation to the multiplicities. We will address some recent results on local-global conjugacy issue and multiplicities for $SO(2N)$.

Dasheng Wei. Brauer groups and rational points

A class of geometrically integral varieties defined over a number field k satisfies Hasse principle if a variety in this class has a k -rational point as soon as it has rational points in all the completions k_v of the field k . For example, quadrics, Severi–Brauer varieties are known to satisfy this principle. However, counterexamples to Hasse Principle are also known even in the class of rational varieties.

In 1970, Manin showed that an obstruction based on the Brauer group of varieties, now referred to as the Brauer–Manin obstruction, can often explain failures of Hasse principle. However, is the Brauer–Manin obstruction the only one for the existence of rational points? Some Conjectures have been given on it (e.g. Colliot-Thélène’s conjecture). In this talk, we will explain this obstruction and some known results. We will also discuss a joint work about Colliot-Thélène’s conjecture (with Derenthal and Smeets).

Weizhe Zheng. Enhanced six operations on Artin stacks

Analogues of Grothendieck’s six operations for étale cohomology of Artin stacks have been considered by Behrend, Laszlo, Olsson and others. In a recent joint work with Yifeng Liu, we give a general construction of the six operations and prove the base change theorem. After recalling some background, I will explain how higher category theory plays an essential role in our work.