Workshop VARIETIES WITH MANY RATIONAL POINTS
Lodha Mathematical Sciences Institute, Mumbai
Organizers : Jean-Louis Colliot-Thélène and Alexei Skorobogatov
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CAO Yang (online)
Cohomological obstruction to rational points on symmetric powers
For a general quasi-projective smooth variety over a number field, the best cohomological obstruction for local-global principles is much stronger than the classical Brauer-Manin obstruction. In this talk, we study the cohomological obstructions on higher-degree symmetric powers of such varieties, and compare them with the cohomological obstruction to zero cycles.

Brendan CREUTZ
Brauer-Manin for subvarieties of abelian varieties with infinitely many rational points
Let X be a subvariety of an abelian variety over a global field. It is conjectured that the rational points of X are dense in the Brauer set of X. I will discuss this conjecture with a focus on the case that X has infinitely many rational points, and outline a proof of the conjecture when A is non-isotrivial and has finite Tate-Shafarevich group.

Damián GVIRTZ-CHEN
Non-unirational Hilbert Irreducibility and Galois Realisations of $PSL2(p^2)$
We establish non-unirational versions of Hilbert Irreducibility for all Hilbert modular surfaces which are of K3 type. The proof uses the multiple fibration method in combination with Shimura theory. As an application we prove new instances of the regular Inverse Galois Problem for the simple groups $PSL2(p^2)$ subject to congruence conditions on p. This is joint work with Julian Demeio.

Diego IZQUIERDO
Cohomological and Diophantine properties of fields
In this survey talk, we will explore relations between the Galois cohomological properties and the Diophantine properties of fields. We will mainly focus on how rational points and zero-cycles behave on low-degree hypersurfaces over fields with low cohomological dimension. Starting with some classical notions and results due to Tsen, Artin and Lang, we will finish by overviewing several recent results that Gambardella, Kartas, Lucchini Arteche, Shaw and myself have obtained in this context.

Julian LYCZAK
Counting quadratic points on Fano varieties
I will present a general framework for counting quadratic points of bounded height on a Fano variety X. If X is a surface, the outcome of this counting problem is predicted by the Manin-Peyre conjecture for the symmetric square of X. I will explain how the framework can be used to verify this conjecture for the infinite family of symmetric squares of non-split quadric surfaces. This talk is based on joint work with Francesca Balestrieri, Kevin Destagnol, Jennifer Park and Nick Rome.

Subhadip MAJUMDER
The Brauer–Manin pairing and ramification filtrations in positive characteristic
In this talk, I will discuss some results concerning the Brauer–Manin pairing for smooth projective varieties over local fields of positive characteristic which extend known results from the mixed characteristic case. For a smooth projective variety over a local field, Manin defined a pairing between the Brauer group and the Chow group of zero-cycles. We study the left kernel and the right cokernel of this pairing, thereby extending a result of Saito-Sato to positive characteristic. Our approach is based on a functorial description of Kato's ramification filtration and a comparison with the evaluation filtration on the Brauer group. This comparison extends a recent work of Bright and Newton to positive characteristic. We obtain further applications, including an extension of Lichtenbaum-Kai duality to positive characteristic. This is joint work with Amalendu Krishna.

Adam MORGAN

Jacobians of hyperelliptic curves with rank 1

I will discuss recent work with Peter Koymans studying the rank of Jacobians of hyperelliptic curves over number fields. By combining descent techniques with additive combinatorics (via a result of Kai), we show in particular that, for each positive integer g and number field K, there exists an absolutely simple abelian variety over K with dimension equal to g and rank equal to 1. This generalises work of Koymans–Pagano and Zywina which treated the case of elliptic curves.

Rachel NEWTON

Wild Brauer classes via prismatic cohomology

Let X be a smooth proper variety over a p-adic field with good reduction. Under a mild assumption on the behaviour of Hodge numbers under reduction modulo p, we show that the existence of a non-zero global 2-form on X implies, after a finite extension of the base field, the existence of Brauer classes with non-constant evaluation map. This implies that any smooth proper variety over a number field which satisfies weak approximation over all finite extensions has no non-zero global 2-form. The proof uses a prismatic interpretation of Brauer classes with eventually constant evaluation. This is joint work with Emiliano Ambrosi and Margherita Pagano.

NGUYEN Manh Linh

The descent conjecture for torsors under connected linear algebraic groups

The descent method is one of the approaches to study the Brauer?Manin obstruction to the local?global principle and to weak approximation on varieties over number fields, by reducing the problem to "descent varieties". In recent lecture notes by Wittenberg, he formulated a "descent conjecture" for torsors under linear algebraic groups. We present a proof of this conjecture in the case of connected groups, generalizing the toric case from the previous work of Harpaz–Wittenberg. As an application, we deduce directly from Sansuc's work the theorem of Borovoi for homogeneous spaces of connected linear algebraic groups with connected stabilizers. When the set of rational points is replaced by the Chow group of zero-cycles, an analogue of the above conjecture for arbitrary linear algebraic groups is proved.

Nicholas ROME

Counting solublility of conics

In this talk, I will discuss several results from the last few years on the theme of how often fibres in conic bundles have a rational point. In particular, I want to emphasise joint work with Peter Koymans and Stephanie Chan which makes explicit the way in which the 'subordinate Brauer group' affects the analytic methods of counting.

Alexei SKOROBOGATOV

Formal Brauer group and the Brauer-Manin obstruction in positive characteristic

In a joint work in progress with Chris Lazda we show the triviality of the Brauer-Manin obstruction over global function fields of positive characteristic for constant varieties whose formal Brauer group has finite height and the geometric Picard group is torsion-free. There also exist non-isotrivial, finite height K3 surfaces such that no place of good reduction is potentially relevant to the Brauer-Manin obstruction. In contrast, recent work of Domenico Valloni shows that for supersingular K3 surfaces (where the formal Brauer group has infinite height) the Brauer-Manin set can be very small, in particular, not open in the adelic space. I will try to explain his strategy based on representations of Brauer classes by differential forms.

Samuel STREETER

Hilbert property for del Pezzo surfaces of degree one

I will report on recent work with Julian Demeio and Rosa Winter in which we provide the first examples of non-thinness of rational points (the Hilbert property) in certain families of del Pezzo surfaces of degree one and Picard rank one.