

Workshop on Group Actions in Algebraic Geometry

October 14–16, 2026 · Peking University

Date and time	Speaker	Session
October 14, Wed 10:00–10:40	—	(Opening / Welcome)
11:00–11:40	Ivan Arzhantsev (HSE)	Borel subgroups and Borel subalgebras for automorphism groups
12:00–12:40	Cong Ding (Shenzhen Univ.)	On equivariant compactifications of some unipotent algebraic groups
12:40–14:00		Lunch break
14:00–14:40	Ivan Beldiev (HSE)	Additive actions and Hassett–Tschinkel correspondence
15:00–15:40	Shengyu Hou (AMSS)	Geometric Constructions of the McKay Correspondence
16:00–16:40	Sergei Gaifullin (HSE)	Invariants of affine varieties
17:30		Banquet
October 15, Thu 11:00–11:40	Hanlong Fang (Peking Univ.)	Toric orbits on cominuscule Grassmannians and modular compactifications
12:00–12:40	Mikhail Ignatev (HSE)	Infinite-dimensional locally nilpotent Lie algebras and their representations
12:40–14:00		Lunch break
14:00–14:40	Artem Lopatin (Campinas)	Polynomial Invariants of Three-Dimensional Algebras
15:00–15:40	Minseong Kwon (AMSS)	Sphericity of spaces of conics on rational homogeneous spaces
16:00–16:40	Anton Shafarevich (HSE)	Flexibility in algebraic geometry
October 16, Fri 10:00–10:40	Baohua Fu (CAS)	Heisenberg symmetric varieties
11:00–11:40	Yingqi Liu (IBS)	On isotrivial cone structures of highest weight type
12:00–12:40	Kirill Shakhmatov (HSE)	Radiant toric varieties
12:40–14:00		Lunch break

Speakers & Abstracts

Ivan Arzhantsev (HSE)

Borel subgroups and Borel subalgebras for automorphism groups

The talk is based on joint works with Mikhail Zaidenberg. In the first part we study Borel subgroups of automorphism groups of affine algebraic varieties. We show that the automorphism group of a non-degenerate affine toric surface contains Borel subgroups of two types; subgroups of the same type are always conjugate, and we give a criterion when two Borel subgroups of different types

are conjugate. The second part deals with Borel subalgebras in the tangent Lie algebra to the automorphism group. We define locally integrable Borel subalgebras and show that they are precisely the tangent algebras to Borel subgroups. Supported by RSF grant 25-11-00302.

Ivan Beldiev (HSE)

Additive actions and Hassett–Tschinkel correspondence

An additive action on X is an effective regular action of $(K, +)^n$ on X with an open orbit. One of the main tools is the Hassett–Tschinkel correspondence — a natural bijection between additive actions on projective spaces and local finite-dimensional unital algebras. We discuss this correspondence and its generalized version describing induced additive actions on projective subvarieties. Many geometric characteristics of X (e.g. the degree of a projective hypersurface) can be described in terms of the corresponding local algebras. Non-degenerate projective hypersurfaces correspond to Gorenstein local algebras.

Cong Ding (Shenzhen Univ.)

On equivariant compactifications of some unipotent algebraic groups

Unlike compactifications of reductive groups (e.g. toric varieties), equivariant compactifications of unipotent algebraic groups are less well understood. The simplest examples are vector groups and Heisenberg groups. We focus on: 1) which varieties could serve as equivariant compactifications, and 2) how many inequivalent equivariant structures exist for a given compactification. We report recent progress on this topic. Joint work with Baohua Fu and Zhijun Luo.

Hanlong Fang (Peking Univ.)

Toric orbits on cominuscule Grassmannians and modular compactifications

The study of tame compactifications for quotients of cominuscule Grassmannians by diagonal torus actions has significant implications for modular problems. We present recent joint works: on the one-dimensional torus action case (with Zhu, Wu, and Massarenti–Wu); on rank-2 higher-dimensional cases (with Zhang); and on higher-rank cases (with Schaffler and Wu). We conclude with several open questions.

Baohua Fu (Chinese Academy of Sciences)

Heisenberg symmetric varieties

Joint work with Jun-Muk Hwang. We define Heisenberg symmetric varieties as an analogue of Euler symmetric varieties. Particular interesting examples consist of adjoint varieties, which is the central object of our study.

Sergei Gaifullin (HSE)

Invariants of affine varieties

Makar-Limanov (1996) introduced an invariant equal to the intersection of all kernels of locally nilpotent derivations, proving the Koras–Russell cubic and affine 3-space non-isomorphic. Derksen (1997) introduced another such invariant. We discuss methods for calculating both invariants and their applications to distinguishing varieties, describing automorphism groups, and the Zariski Cancellation Problem. We also introduce new invariants defined in terms of locally nilpotent derivations.

Shengyu Hou (AMSS)

Geometric Constructions of the McKay Correspondence

The McKay correspondence relates nontrivial irreducible representations of finite subgroups of $SL_2()$ to exceptional curves on the minimal resolution of the quotient singularity. We review its progressive understanding: Gonzalez-Sprinberg/Verdier (geometric construction), Ito/Nakamura (G-Hilbert scheme), Kapranov/Vasserot (Fourier–Mukai transform), Bridgeland/King/Reid (higher dimensions). We conclude with an application to the Slodowy correspondence.

Mikhail Ignatev (HSE)

Infinite-dimensional locally nilpotent Lie algebras and their representations

The orbit method classifies primitive ideals in $U(\mathfrak{g})$ by coadjoint orbits for finite-dimensional nilpotent Lie algebras. We generalize to locally nilpotent Lie algebras (direct limits of finite-dimensional nilpotent algebras), e.g. the Heisenberg algebra with countably many generators. For arbitrary locally nilpotent Lie algebra $\mathfrak{n}$, there is a homeomorphism between primitive ideals in $U(\mathfrak{n})$ and primitive Poisson ideals in $S(\mathfrak{n})$.

Minseong Kwon (AMSS)

Sphericity of spaces of conics on rational homogeneous spaces

Given a rational homogeneous space $X=G/P$ of Picard number one, the space of lines on X is G -homogeneous iff P is associated to a long simple root. We prove the parallel theorem for conics: the space of conics on X is G -spherical iff P is associated to a long simple root. Joint work with Nicolas Perrin.

Yingqi Liu (IBS)

On isotrivial cone structures of highest weight type

Hwang and Li introduced cone structures with characteristic conic connections, partially generalizing VMRT structures. For isotrivial cone structures with fiber Z , they established a projective-geometric criterion on Z ensuring torsion-free connections on the associated G -structures. We classify rational homogeneous varieties Z satisfying their criterion and apply to VMRT structures, generalizing results for adjoint varieties.

Artem Lopatin (State University of Campinas)

Polynomial Invariants of Three-Dimensional Algebras

For various classes of three-dimensional algebras (Lie, Leibniz, Jordan, associative, and evolution algebras), we describe the polynomial invariants of m -tuples under automorphism group actions. We also present algebraic invariants distinguishing some of these algebras modulo isomorphism.

Anton Shafarevich (HSE)

Flexibility in algebraic geometry

We survey flexibility of affine varieties. For an irreducible affine variety X of $\dim \geq 2$, the following are equivalent: (1) tangent space at each smooth point is spanned by G -orbit vectors; (2) $\mathrm{SAut}(X)$ acts transitively on X_{reg} ; (3) $\mathrm{SAut}(X)$ acts infinitely transitively. Flexible varieties include nondegenerate affine toric varieties, cones over flag varieties, certain del Pezzo cones, and more. We present a recent result establishing flexibility of nondegenerate affine spherical varieties.

Kirill Shakhmatov (HSE)

Radiant toric varieties

A complete toric variety X is radiant if a maximal unipotent subgroup of $\mathrm{Aut}(X)$ acts on X with an open orbit. We study Demazure roots of X , describe the structure of maximal unipotent subgroups of $\mathrm{Aut}(X)$, and introduce a graph describing the central series of unipotent subgroups acting with open orbit and normalized by the torus. Joint work with Ivan Arzhantsev and Alexander Perepechko.