Research statement

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Research interests: algebraic geometry, algebraic groups, representation theory.

Specific research interests include: geometry of reductive groups and of spherical varieties, topology of algebraic subvarieties in reductive groups and in spherical homogeneous spaces, Chern classes and cohomology ring of spherical varieties, extension of the theory of Newton polytopes to spherical varieties.

Recent results include:

• Explicit combinatorial formulas for the Euler characteristic of all complete intersections in arbitrary complex reductive groups. These formulas extend the results of D.Bernstein, Khovanskii and Kouchnirenko (all complete intersections in a complex torus) and of Kazarnovskii and Brion (zero dimensional complete intersections in any reductive group).

• For regular (smooth toroidal) compactifications of reductive groups, explicit formulas for the intersection indices of the Chern classes with hypersurfaces.

• Another proof of the Brion–Kazarnovskii formula for the intersection indices of hypersurfaces in reductive groups. The proof also works in a more general setting (e.g. for the Chern classes of reductive groups).

• Construction of "Chern classes" for reductive groups and an adjunction formula for the Euler characteristic of complete intersections in any complex reductive group. This provides an explicit answer for the genus and Euler characteristic of a complete intersection of dimension one.

• Proof of Kapranov's conjecture for the Euler characteristic of constructible complexes on reductive groups. The result implies nonnegativity of the Euler characteristic of any perverse sheaf equivariant under the adjoint action.

Current work: computation of the intersection indices of divisors on algebraic varieties with a group action using polytopes

Future plans: description of the cohomology ring of spherical varieties using weight polytopes and Gelfand-Zetlin polytopes