Summary of the research statement

My research project is dedicated to motives and cohomology theories; its main subject areas are algebraic geometry and homological algebras, yet certain relations with number theory and algebraic topology could possibly be studied.

Cohomology is crucial for modern mathematics, whereas several successes and challenges in modern algebraic geometry are closely related with motives. A very important milestone in this area was the definition of the triangulated categories of motives (by Voevodsky, Levine, Hanamura, Cisinski, and Deglise). This is related with the famous proofs of Milnor and Bloch-Kato conjectures (by Voevodsky). One of the open problems for the theory of motives was the introduction of certain 'weights' for them; it was solved by the applicant in quite a satisfactory (though rather unexpected) way. The main tool was a new concept of a weight structure; it also could be applied for the study of coniveau spectral sequences, mixed complexes of sheaves and weights for them, and spectral and cellular filtration for them. An important tool of studying Voevodsky's motives is the weight complex functor. It was defined by Gillet and Soule for varieties, and extended to motives by Bondarko; it takes values in the homotopy category of complexes of ('the classical') Chow motives. Note that this functor is important for the theory of motivic integration.

The applicant plans to study various motivic categories and weight structures for them further. Using his previous results, applicant plans to relate those with: the study of the relations between coniveau and weight spectral sequences, mixed motivic sheaves and weights for them, perverse sheaves and intersection cohomology, motivic integration, crystalline and other p-adic cohomology of varieties. The results could shed light on standard motivic conjectures and on the Gersten conjecture. The project will surely yield several functoriality results for spectral sequences and the corresponding filtrations, as well as further development of the theories of weight structures and t-structures.