PhD Thesis Proposal 2025 in Mathematics- MESR

Real algebraic cycles on real horospherical Fano varieties

[Cycles algébriques réels sur les variétés horosphériques de Fano réelles]

Key-words: Real and complex algebraic geometry, algebraic groups, algebraic cycles, algebraic topology, motivic homotopy.

Context and objectives of the scientific project:

Horospherical algebraic varieties form a special class of algebraic varieties characterized by the property of admitting certain actions of reductive algebraic groups possessing an open orbit with the structure of a torus bundle over a flag variety. Toric varieties and flag varieties themselves are elementary examples of horospherical varieties. In the complex case, due to this particular structure, the geometry, the topology as a complex analytic variety, and algebraic cycles on these varieties can be largely described via combinatorial data.

Real quasi-projective horospherical varieties admit, through techniques of Galois descent, an analogous description in terms of Galois equivariant combinatorial data which has been described and classified in recent works. In this context, the main objectives of the thesis are firstly to describe the topology of the real loci of smooth projective real horospherical varieties in terms of their Galois equivariant combinatorial data, and secondly to study real algebraic cycles and the properties of various topological and motivic real cycle class maps on these varieties within the general framework of the real Hodge conjecture, with a particular focus on the subclass of smooth real Fano horospherical varieties.

Prerequisites and essential skills:

- Master degree in Mathematics

- Background on real and complex algebraic geometry, algebraic groups and their actions on algebraic varieties, notions of classical algebraic topology and/or motivic homotopy.

Supervisors:

- Boris Pasquier http://www-math.sp2mi.univ-poitiers.fr/~bpasquie/
- Adrien Dubouloz https://dubouloz.perso.math.cnrs.fr/

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