Group actions, Birational geometry and geometric structures

Description for General Public

Pure mathematics can be seen as an immense castle of ideas. Created from the fruit of our thoughts and imagination it takes source in Plato's world of ideas. Lucky are those who manage to shed light and reveal certain glimpses of this castle, where aesthetics and elegance rule.

My project, originates in the beautiful interaction between algebraic geometry, algebraic topology and certain aspects of mathematical physics. This synergy gave birth to some of the most spectacular developments of the last 50 decades in pure mathematics. In particular new paths were explored; new areas of research have emerged and a new vision in the modern mathematics has been shaped. This has also left deep open problems, which present a stimulating source of inspiration.

One result of this interaction was the creation of the theory of quantum cohomology, its connections to the world of birational geometry and the subsequent discovery of its connections with one of the central objects of number theory: the Galois group of the field of all algebraic numbers. Frobenius algebras and Frobenius manifolds, also emerged from this synergy and present different facets of one big problem.

Open problems where it is question of Grothendieck—Teichmuller groups, Multiple Zeta Values, configuration spaces, duality patterns an intersection of birational cycles are a motivation for this research proposal.

The picture below metaphorically presents two different sides of a problem: one side presents our comfort zone. The other one is illustrated by the reflection in the water, where a sort of modified world arises. Are we ready to dive beyond, into an exciting new world?