

Abstract

Oberwolfach Workshop: **Cohomology Theories for Automorphic Forms and Enumerative Algebra**

Dates: **24 - 29 August 2025** (Code: 2535a)

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Cohomology theories have long proven to be powerful, unifying tools in numerous areas of mathematics, specifically in algebra, geometry, and number theory. Historically, the invention of the “right” cohomology theory often proved to be the key to uniform, conceptual proofs of conjectures and explanations of heuristic phenomena, bringing together seemingly unrelated mathematical areas. For instance, the explanatory power of ℓ -adic cohomology lies behind both Deligne’s proof of the Weil conjectures on zeta functions of algebraic varieties over finite fields and Deligne–Lusztig’s theory of representations of finite groups of Lie type.

This workshop will concentrate on the areas of automorphic forms and enumerative algebra, two fields in which cohomology theories already had a particular impact.

Indeed, classical Eichler–Shimura theory establishes an isomorphism between a certain group cohomology and certain spaces of modular (automorphic) forms. The cohomological theory for Maass wave forms, which was developed by Bruggeman, Lewis, and Zagier, has been complemented by a dynamic aspect, which relates Maass cusp forms to the geodesic flow by means of transfer operator techniques and cohomology. In discrete geometry, the proof of the Upper Bound Theorem for simplicial spheres relies on cohomological properties, viz. Cohen–Macaulayness, of certain algebro-combinatorial objects, namely Stanley–Reisner rings of simplicial complexes.

A central premise of the workshop is that the development and exploitation of cohomology theories—both new and existing—will lead to fundamental advances in the work on a number of central questions in automorphic forms and enumerative algebra. With this goal in mind, we want to bring together mathematicians from various areas, both junior and senior. This will facilitate the exchange of methodology and results, and also open up conjectures and research questions to previously unconnected research communities.