Report on the Hausdorff Trimester Program

Arithmetic and Geometry

January 2 - April 19, 2013


Topics

The main theme of the trimestre was the interplay of different methods used in modern number theory. H. Carayol lectured on his work relating to the algebraic properties of the Griffiths-Schmid varieties. The second theme was the recent work of M. Harris, Kai-Wen Lan, R. Taylor, and J. Thorne, who had constructed Galois representations associated to not necessarily self-dual automorphic representations. G. Harder lectured on Eisenstein cohomology. The main themes, relating to counting rational points on algebraic varieties, were local to global principles, Manin’s conjecture, developments of the Hardy-Littlewood method, and the determinant method. O. Lorscheid and A.L. Smirnov lectured on some aspects of geometry over ”the field of one element”. A.N. Parshin and D.V. Osipov lectured on two-dimensional Langlands correspondence. Several other topics were covered during the trimestre seminar session and at the research conference.

Goals

Our intention was to emphasise the new results and conjectures in arithmetic geometry, having direct bearing on the classical number-theoretic problems. The aim of the session on Serre’s conjecture was to report on recent works linked to that conjecture, in particular about Galois representations and automorphic representations. The aim of the session on counting rational points was to report on recent works on the existence, frequency and distribution of rational points on algebraic varieties.
**Organization**

We ran a seminar series meeting twice per week; the abstracts of the lectures at the seminar are on the HIM website. Two sessions had been organised: on the recently proved Serre conjecture from the 15th of January until the 14th of February (organisers: L. Dieulefait and J-P. Wintenberger) and on counting rational points on algebraic varieties from the 15th of March until the 14th of April (organiser: D.R. Heath-Brown). About twenty lectures were delivered at the final research conference from the 15th until the 19th of April.

**Results**

The breadth of the subject prevents us from going into any details, concerning the problems studied by the participants of the trimestre; those problems have been discussed in the individual reports. Let us mention, however, that in his recent work "On torsion in the cohomology of locally symmetric varieties" P. Scholze explicitly quotes our trimestre program. The proceedings volume of the trimestre [1] may be regarded as a more detailed report on the program; it contains about twenty papers, a list of the lectures given at our seminar during the session, the programs of the workshop on the Serre conjecture and of the final research conference. One may also consult the preprints submitted to the HIM by some of the participants of our trimestre.

**Acknowledgement**

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**References**