

THE 15TH AMITSUR MEMORIAL SYMPOSIUM  
HEBREW UNIVERSITY, JERUSALEM, JULY 1-2, 2009.

**Speakers**

Yair Glasner (Ben Gurion),  
Fritz Grunewald (Duesseldorf),  
Danny Wise (McGill and Jerusalem),  
Mina Teicher (Bar Ilan),  
Avinoam mann (Jerusalem)  
Peter Storm (Indiana and Jerusalem),  
Agata Smoktunowicz (Edinburgh),  
Benjamin Klopsch (London),  
Gili Schul (Jerusalem),  
Michael Schein (Bar Ilan).

**programme**

Wednesday, 1 July  
9:30 - Grunewald  
10:30 - Coffee break  
11:00 - Mann  
12:00 - Glasner  
13:00 - Lunch break  
15:00 - Schul  
16:00 - Teicher

Thursday, 2 July  
9:30 - Smoktunowicz  
10:30 - Coffee break  
11:00 - Schein  
12:00 - Wise  
13:00 - Lunch break  
15:00 - Klopsch  
16:00 - Storm

## Titles and abstracts

### Y.Glasner: **Geometric methods in permutation representations of groups**

In its most general definition, representation theory studies groups - realizing them as symmetry groups of various algebraic, combinatorial, geometric or metric structures. Among these the study of permutation representations involves the least possible structure. I will demonstrate how the knowledge that we have accumulated about groups appearing in more structured representation theories (e.g. linear groups) yields a better understanding of their permutation representations.

In the talk I will discuss a few joint papers with: Abert, Gelander, Monod, Souto, Storm.

### F.Grunewald: **Dimensions of spaces of automorphic forms for imaginary quadratic number fields**

Formulas for the dimensions of spaces of classical modular forms are well known. There are many ways to derive them. The methods range from linear algebra or the theorem of Riemann-Roch to the Selberg trace formula. All these methods are much less powerful when the field of rational numbers is replaced by an imaginary quadratic number field. In my talk I will describe the state of our knowledge and also some conjectures in this case.

### D.Wise: **Baumslag's conjecture on the residual finiteness of one-relator groups with torsion**

In the late 60's it became clear that one-relator groups with torsion were better behaved than arbitrary one-relator groups, and to test this, Gilbert Baumslag conjectured that every one-relator group with torsion is residually finite. It turns out that stronger properties than residual finiteness hold for a much larger class of groups. We describe a proof of his conjecture and contextualize it within current developments in combinatorial group theory and 3-manifold topology.

### M.Teicher: **Fundamental groups related to K3 surfaces**

I will present the braid monodromy techniques on  $K3$  surfaces and will show an example of two  $K3$  surfaces with the same discrete invariants of branch curves and different fundamental groups of their complements.

( Joint work with M. Amram, C. Ciliberto , M. Friedmann, and R. Miranda)

### A.Mann: **Philip Hall's 'curious' formula for non-abelian groups**

In 1938 Hall published the following remarkable identity, which he described as 'rather curious'. Fix a prime  $p$ , and let  $G$  vary over all finite abelian  $p$ -groups. Then

$$\sum 1/|G| = \sum 1/|Aut(G)|.$$

Hall's proof is combinatorial. Several later proofs were given, combinatorial, group theoretical, and number theoretical. We will discuss identities of a similar type, which hold for families of non-abelian  $p$ -groups. It will be seen that Hall's identity is the simplest, and most striking, of infinitely many related results. These

identities were also anticipated by Hall, but he did not write them explicitly, nor gave proofs. A proof for Hall's form of the identities was published by J.Tappe in 1980. Our proof applies ideas and results of subgroup growth. We will also comment on other proofs of Hall's formula and its analogues.

**P.Storm: Maximal and pro-dense subgroups of lattices in  $\mathbf{SL}(2, \mathbb{C})$**

Given a lattice  $H$  in  $\mathbf{SL}(n, \mathbb{C})$ , Margulis and Soifer proved that there exist many maximal subgroups of  $H$ . Intuitively, one expects that a finitely generated maximal subgroup  $M$  of  $H$  should be of finite index. So far, this has been difficult to prove. Recent breakthroughs in 3-dimensional topology make it possible to prove this for  $\mathbf{SL}(2, \mathbb{C})$ . This is also related to pro-dense subgroups. This is joint work with Yair Glasner and Juan Souto.

**A.Smoktunowicz: Some questions and theorems of Amitsur**

In this talk we will mention some of Amitsur's questions and some of his theorems and discuss their influence in ring theory. We will concentrate on old and new results related to nil rings, infinite-dimensional algebraic algebras, Jacobson radical algebras, free subalgebras, simple algebras, prime rings, primitive rings etc.

**B.Klopsch: Deformations and Rigidity of Lattices in Soluble Lie Groups**

Let  $G$  be a simply-connected (real) Lie group. A lattice  $\Gamma$  in  $G$  is said to be rigid if every automorphism of  $\Gamma$  extends to an automorphism of  $G$ . Landmark results in the context of semisimple groups are the Mostow Rigidity Theorem and the Margulis Superrigidity Theorem.

In this talk I will report on ongoing joint work with Oliver Baues, concerning rigidity and non-rigidity of lattices in soluble Lie groups. I will start by discussing a classical theorem of Maltsev-Saitô, instructive examples given by Starkov and a result of Witte. Then I will explain our more recent approach towards a 'quantitative description' of the phenomenon of non-rigid lattices in soluble Lie groups.

**G.Schul, Words and mixing time in finite simple groups**

Let  $w \neq 1$  be a non-trivial group word, let  $G$  be a finite simple group, and let  $w(G)$  be the set of values of  $w$  in  $G$ . We show that, if  $G$  is large, then the random walk on  $G$  with respect to  $w(G)$  as a generating set has mixing time 2. This strengthens various known results, for example the fact that  $w(G)^2$  covers almost all of  $G$ . Joint work with Aner Shalev.

**M.Schein: Supersingular mod  $p$  representations of  $\mathbf{GL}_2$   
and the mod  $p$  local Langlands correspondence**

Let  $F$  be a finite extension of  $\mathbb{Q}_p$ . A "mod  $p$  local Langlands correspondence" between  $n$ -dimensional mod  $p$  representations of the absolute Galois group of  $F$  and certain mod  $p$  representations of  $\mathbf{GL}_n(F)$  is expected to exist. We will survey recent progress in this area by a number of mathematicians, emphasizing connections to generalizations of Serre's conjecture and constructions of representations of  $\mathbf{GL}_2(F)$  that may appear on the right-hand side of the correspondence..