MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

Report No. 42/2008

Geometric Group Theory, Hyperbolic Dynamics and Symplectic Geometry

Organised by
Gerhard Knieper, Bochum
Leonid Polterovich, Tel-Aviv
Leonid Potyagailo, Lille

September 7th – September 13th, 2008

ABSTRACT. The workshop "Geometric Group Theory, Hyperbolic Dynamics and Symplectic Geometry" brought together experts in these different but close and interactive mathematical directions. The activities included talks by world renown experts and by graduate students on their recent achievements, as well as an open problem session. In addition to extended abstracts of the talks, the present report contains a list of open problems.

Introduction by the Organisers

The workshop "Geometric Group Theory, Hyperbolic Dynamics and Symplectic Geometry", organized by Gerhard Knieper, Leonid Polterovich and Leonid Potyagailo took place the second time in Oberwolfach. The general idea to organize a joint meeting of specialists belonging to three different but close and interacting fields turned out to be really fruitful. The aim of our workshop is to give a possibility to people working in the above fields to discuss their results and open problems from different points of view. We are sure that such conferences need to exist not only on the level of World or European Congresses but also in much less official and restrictive atmosphere inherent for Oberwolfach conferences.

Our last meeting brought together world renown senior experts in our fields as well as talented mathematicians in the beginning in their careers. Let us describe shortly the directions of the given talks. The presented talks were devoted to:

1. Hamiltonian diffeomorphisms and rigidity properties of symplectic manifolds (L. Butler, O. Cornea, M. Entov, S. Hohloch, V. Humiliere, G. Noetzel, F. Le Roux, E. Opshtein, F. Schlenk, F. Zapolsky)

2. Geometric group theory (D. Calegari, V. Gerasimov, G. Levitt, F. Dahmani, N. Peyerimhoff, R. Sharp)

3. Riemannian manifolds and their invariants (M. Burger, D. Burago, D. Kotschick).

4. Dynamical systems and ergodic theory (K. Fraczek, E. Glasmachers, A. Katok)

5. Subgroups of algebraic linear groups and their geometry (E. Breuillard, P.-E. Caprace, D. Witte Morris).

6. Probabilistic methods in group theory (A. Erschler, K. Fujiwara)

7. Spectral invariants and their asymptotics (A. Karlsson, I. Polterovich).

Historically, one of the motivating subjects being in the center of our joint interests was the theory of quasi-morphisms and bounded cohomology. In the present time there exist many other subjects which are in our common interests: study of groups of diffeomorphisms using methods of symplectic topology (e.g. the talk of F. Le Roux where he constructed a new candidate for a non-trivial normal subgroup of the group of area-preserving homeomorphisms); dynamical methods describing the geometry of the mapping class group and the group of outer automorphisms of free groups (G. Levitt); probabilistic methods in the geometric group theory (A. Erschler and K. Fujiwara); solving equations in free groups and diophantine geometry (F. Dahmani); strong Tits alternative for linear groups and its consequences: uniform exponential growth and uniform decay of return probability (E. Breuillard); spectral theory for combinatorial Laplacian of Cayley graphs of finite abelian groups (A. Karlsson) etc.

Another important issue of our meetings is that they attract many students working in these subjects. Several students (or recent students) gave 30 minutes talks during our informal evening sessions attended by all participants. The students have been actively participating in the discussions during the conference.

We continued our tradition by organizing the open problem session on Wednesday night successfully chaired by Anatole Katok. We enclose below the problems formulated during this session and hope that they will stimulate further research in our fields. We strongly believe that the tradition of such joint meetings representing several research directions should continue in Oberwolfach.