

MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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Von Neumann Algebras and Ergodic Theory of Group Actions

Organised by
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ABSTRACT. The theory of von Neumann algebras has seen some dramatic advances in the last few years. Von Neumann algebras are objects which can capture and analyze symmetries of mathematical or physical situations whenever these symmetries can be cast in terms of generalized morphisms of the algebra (Hilbert bimodules, or correspondences). Analyzing these symmetries led to an amazing wealth of new mathematics and the solution of several long-standing problems in the theory.

Popa's new deformation and rigidity theory has culminated in the discovery of new cocycle superrigidity results à la Zimmer, thus establishing a new link to orbit equivalence ergodic theory. The workshop brought together world-class researchers in von Neumann algebras and ergodic theory to focus on these recent developments.

Mathematics Subject Classification (2000): 46L10.

Introduction by the Organisers

The workshop *Von Neumann Algebras and Ergodic Theory of Group Actions* was organized by Dietmar Bisch (Vanderbilt University, Nashville), Damien Gaboriau (ENS Lyon), Vaughan Jones (UC Berkeley) and Sorin Popa (UC Los Angeles). It was held in Oberwolfach from October 26 to November 1, 2008.

This workshop was the first Oberwolfach meeting on von Neumann algebras and orbit equivalence ergodic theory. The organizers took special care to invite many young mathematicians and more than half of the 28 talks were given by them. The meeting was very well attended by over 40 participants, leading senior researchers and junior mathematicians in the field alike. Participants came from

about a dozen different countries including Belgium, Canada, Denmark, France, Germany, Great Britain, Japan, Poland, Switzerland and the USA.

The first day of the workshop featured beautiful introductory talks to orbit equivalence and von Neumann algebras (Gaboriau), Popa's deformation/rigidity techniques and applications to rigidity in II_1 factors (Vaes), subfactors and planar algebras (Bisch), random matrices, free probability and subfactors (Shlyakhtenko), subfactor lattices and conformal field theory (Xu) and an open problem session (Popa). There were many excellent lectures during the subsequent days of the conference and many new results were presented, some for the first time during this meeting. A few of the highlights of the workshop were Vaes' report on a new cocycle superrigidity result for non-singular actions of lattices in $\text{SL}(n, \mathbb{R})$ on \mathbb{R}^n and on other homogeneous spaces (joint with Popa), Ioana's result showing that every sub-equivalence relation of the equivalence relation arising from the standard $\text{SL}(2, \mathbb{Z})$ -action on the 2-torus \mathbb{T}^2 is either hyperfinite, or has relative property (T), and Epstein's report on her result that every countable, non-amenable group admits continuum many non-orbit equivalent, free, measure preserving, ergodic actions on a standard probability space. Other talks discussed new results on fundamental groups of II_1 factors, L^2 -rigidity in von Neumann algebras, II_1 factors with at most one Cartan subalgebra, subfactors from Hadamard matrices, a new construction of subfactors from a planar algebra and new results on topological rigidity and the Atiyah conjecture. Many interactions and stimulating discussions took place at this workshop, which is of course exactly what the organizers had intended.

The organizers would like to thank the Mathematisches Forschungsinstitut Oberwolfach for providing the splendid environment for holding this conference. Special thanks go to the very helpful and competent staff of the institute.