Programme on

"Measured Group Theory"

January 18 - March 18, 2016

organized by

Miklos Abért (Hungarian Academy of Sciences, Budapest), Goulnara Arzhantseva (U Vienna), Damien Gaboriau (ENS Lyon), Thomas Schick (U Göttingen), Andreas Thom (TU Dresden)

Conference

February 15 – 19, 2016

- **Thursday, February 18, 2016**

  09:30 – 10:30 **Alessandro Sisto**
  A central limit theorem for acylindrically hyperbolic groups

  10:30 – 11:00 *coffee / tea break*

  11:00 – 12:00 **Rostislav Grigorchuk**
  Totally non-free actions, random subgroups and factor representations

  12:00 – 14:30 *lunch break*

  14:30 – 15:00 **Tim de Laat**
  Obstructions to coarse embeddability of expanders into Banach spaces This parallel session takes place

  in the Boltzmann Lecture Hall

  14:30 – 15:00 **Agnes Backhaus**
  On the eigenvectors of random regular graphs and invariant random processes on the infinite tree
  This parallel session takes place in the Schrödinger Lecture Hall

  15:15 – 15:45 **Swiatoslaw Gal**
  Order preserving actions, full topological groups, and uniform simplicity

  16:15 – 16:45 **Lukasz Grabowski**
  Borel Local Lemma
  This parallel session takes place in the Boltzmann Lecture Hall

  16:15 – 16:45 **Alexandre Martin**
  The geometry of the Higman group
  This parallel session takes place in the Schrödinger Lecture Hall

  17:00 – 18:00 **Alex Lubotzky**
  Erwin Schrödinger Lecture: Ramanujan complexes and topological expanders

All talks take place at the ESI, Boltzmann Lecture Hall, except the parallel sessions, that will take place at the ESI, Schrödinger Lecture Hall!

Note: The talks for the following days will be announced each day before on the programme webpage http://www.uni-math.gwdg.de/schick/ESI16/esi16_7.html

see Page 2 and 3 for the abstracts of the talks

Abstracts

Alessandro Sisto
A central limit theorem for acylindrically hyperbolic groups

Acylindrically hyperbolic groups form a very large class of groups that includes non-elementary (relatively) hyperbolic groups, mapping class groups, $\mathrm{Out}(F_n)$, many groups acting on CAT(0) spaces, small cancellation groups, etc. I will discuss the behaviour of random walks on such groups, and in particular the fact, encoded by the "deviation inequalities", that random paths tend to stay close to geodesics in Cayley graphs. I will then present a few consequences of the deviation inequalities, most notably a central limit theorem for the distance from the identity of the random walk. Joint with Pierre Mathieu.

Rostislav Grigorchuk
Totally non-free actions, random subgroups and factor representations

I will explain why countable branch groups have at least countably many totally non free actions, and hence at least countably many ergodic IRS, indecomposable characters, and factor representations of the type II1. Joint result with Artem Dudko.

Tim de Laat
Obstructions to coarse embeddability of expanders into Banach spaces

Expanders are sequences of finite sparse graphs with strong connectivity properties. The explicit construction of expanders is one of the major applications of Kazhdan's property (T). It is an important open problem whether the expanders coming from higher rank lattices admit a coarse embedding into certain Banach spaces. I will explain a joint work with Mikael de la Salle, in which we prove that given a Banach space satisfying certain conditions on its geometry, we can find a minimal rank such that all expanders constructed from lattices of at least this rank do not admit a coarse embedding into the given Banach space. The methods to prove this give rise to certain essentially different rigidity phenomena, which I will also comment on.

Agnes Backhaus
On the eigenvectors of random regular graphs and invariant random processes on the infinite tree

We present a rigidity result, stating that an invariant random process on a regular tree that is supported on vectors satisfying a fixed eigenvalue equation and that can be simulated on random graphs must have a joint Gaussian distribution. As a consequence, it follows that delocalized eigenvectors of random regular graphs are close to Gaussian. Joint work with Balazs Szegedy.

Swiatoslaw Gal
Order preserving actions, full topological groups, and uniform simplicity

A group is called N-uniformly simple if for every nontrivial conjugacy class C, $(C^{\pm})^{leqN}$ covers the whole group. Every uniformly simple group is simple. It is known that many group with geometric or dynamical origin are simple. In the talk we prove that, in fact, many of them are uniformly simple.

The result are due to the speaker, Kuba Gismatullin, and Nir Lazarovich.

Lukasz Grabowski
IBorel Local Lemma

Lovasz' Local Lemma is one of the most widely used tools in combinatorics and its applications. Given a graph G let us fix for each vertex v of G a set B(v) of local forbidden colorings", i.e. B(v) is a set of 0/1 colorings of the neighbourhood of v. The local lemma gives a condition under which a "good coloringöf the vertices of G exists, i.e. a coloring f such that for each vertex v the restriction of f to the neighbourhood of v is not forbidden.

We prove a Borel version of the local lemma: when G is a Borel graph of subexponential growth and the sets

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B(v) of forbidden configurations are chosen in a Borel way, then there exists a good coloring which is a Borel function. If G is a graphing associated to a p.m.p. action of a finitely generated amenable group then we are able to show somewhat less: there exists a good coloring which is a measurable function. The main tool which we develop, which is of independent interest, is a new version of the Moser-Tardos algorithm, where random bits used to resample a coloring no longer need to be chosen independently. Joint work with E. Cska, A. Mth, O. Pikhurko and K. Tyros.

Alexandre Martin
The geometry of the Higman group

The Higman group was the first instance of a finitely presented infinite group without non-trivial finite quotients, and its exotic algebraic properties make it a potential candidate for being a non-sofic group, as mentioned earlier this week. On the geometric side however, I will show that this group has a surprisingly rich and beautiful geometry. I will survey recent results about the action of the Higman group on an CAT(0) square complex associated to its standard presentation, emphasizing unexpected similarities with the action of the mapping class group on its curve complex.

Alex Lubotzky
Erwin Schrödinger Lecture: Ramanujan complexes and topological expanders

Expander graphs in general, and Ramanujan graphs, in particular, have played a major role in computer science in the last 4 decades and more recently also in pure mathematics. In recent years a high dimensional theory of expanders is emerging. A notion of topological expanders was defined by Gromov who proved that the complete d-dimensional simplical complexes are such. He raised the basic question of existence of such bounded degree complexes of dimension $d > 1$. This question was answered recently (by T. Kaufman, D. Kazdhan and A. Lubotzky for d=2 and by T. Kaufman and S. Evra for general d) by showing that the d-skeleton of (d+1)-dimensional Ramanujan complexes provide such topological expanders