

GROUPS, PROBABILITY, DYNAMICS

A conference on the occasion of the 50th birthday of Tullio Ceccherini-Silberstein
Rome, February 22-24, 2017



Conference dinner on Thursday, the 23rd at 8pm
Ristorante SU NURAGHE Via Imperia, 68.

TRAVEL INFORMATION

The Department of Basic and Applied Sciences for Engineering(S.B.A.I.)
is located in Via Scarpa 16, 00161 Rome - Italy.

If you take the subway, the closer station is Policlinico (Line B).

From Termini Station, take bus 310 and get off at viale Ippocrate.

From Fiumicino and Ciampino Airport you can reach Stazione Termini
by train or shuttle bus.

PROGRAM**Wednesday, 22 February**

9:20- 9:50 Opening: Ghinelli, Figà-Talamanca, Machì.

9:50-10:40 Grigorchuk - *An interesting example of computation of spectrum of certain group of intermediate growth.*

10:40-11:10 Coffee break.

11:10-12:00 Naghibeda - *Group actions, subshifts and spectra.*

12:10-12:40 D'Adderio - *The sandpile model on complete bipartite graphs.*

14:30-15:20 Bufetov - *Conditional measures of determinantal point process and the Lyons-Peres conjecture.*

15:30-16:00 D'Angeli - *Wreath Product of Matrices.*

16:00-16:30 Coffee break.

16:30-17:20 Coornaert - *Surjectivity of algebraic dynamical systems.*

17:30-18:00 de Giovanni - *Groups of large cardinality.*

Thursday, 23 February

9:20- 9:50 Rodaro - *Automaton (semi)groups: on the undecidability of problems related to the freeness and finiteness.*

10:00-10:40 Georgakopoulos - *On the expected size of a patriarchal society with Poisson distributed collaborations.*

10:40-11:10 Coffee break.

11:10-12:00 Valette - *Box spaces: bridging geometric and asymptotic group theory.*

12:10-12:40 Radulescu - *Endomorphisms of spaces of virtual vectors fixed by a discrete group.*

14:30-15:00 Frenkel - *Free-constructible groups.*

15:10-16:00 Schmidt - *Periodic and homoclinic points of algebraic Z^d -actions.*

16:00-16:30 Coffee break.

16:30-17:00 Cavaleri - *The universal sofic action.*

17:10-18:00 Smirnov - *A few things about the self avoiding walk in the plane.*

Friday, 24 February

9:20- 9:50 Rosenmann - *Properties resulting from the arboresque structure of free groups and free group algebras.*

10:00-10:30 Manara - *A class of unitary representations of surface groups.*

10:30-11:00 Coffee break.

11:00-11:50 Kaimanovich - *L -amenable actions.*

12:00-12:30 Woess - *Isotropic random processes on ultrametric spaces.*

12:30-12:40 Concluding words.

TALKS

Alexander I. Bufetov (CNRS-Steklov-IITP-HSE-Chebyshev Lab.)
Conditional measures of determinantal point process and the Lyons-Peres conjecture.

Abstract: Determinantal point processes arise in many different problems: spanning trees and Gaussian zeros, random matrices and representations of infinite-dimensional groups. How does the determinantal property behave under conditioning? The talk will first address this question for specific examples such as the sine-process, where one can explicitly write the analogue of the Gibbs condition in our situation. We will then consider the general case, where, in joint work with Yanqi Qiu and Alexander Shamov, proof is given of the Lyons-Peres conjecture on completeness of random kernels.

The talk is based on the preprint arXiv:1605.01400 as well as on the preprint arXiv:1612.06751 joint with Yanqi Qiu and Alexander Shamov.

Matteo Cavaleri (Institute of Mathematics of the Romanian Academy Bucharest) *The universal sofic action.*

Abstract: We present the action of the universal sofic group on the Loeb space and its relation with soficity. In particular we characterize two subgroups of the universal sofic group, whose quotient contains all countable groups.

Michel Coornaert (Univ. de Strasbourg) *Surjectivity of algebraic dynamical systems.*

Abstract: A dynamical system is called surjunctive if every injective continuous self-mapping of the phase space commuting with the dynamics is surjective. I will present sufficient conditions under which an algebraic dynamical system, that is, a compact metrizable group equipped with an action of a countable group by continuous group automorphisms, is surjunctive.

Michele D'Adderio (Univ. Libre de Bruxelles) *The sandpile model on complete bipartite graphs.*

Abstract: We discuss algorithmic and enumerative results about the rank introduced by Baker and Norine on the sandpile model on complete bipartite graphs.

Daniele D'Angeli (TUGraz) *Wreath Product of Matrices.*

Abstract: Inspired by the wreath product of groups we define a new product of matrices that reproduces, under certain condition, the adjacency matrix of the wreath product of graphs. We will show an application to the so called Lamplighter random walk.

This is a joint work with Alfredo Donno.

Elizaveta Frenkel (Moscow State University) *Free-constructible groups.*

Abstract: A class of free-constructible groups can be obtained with a help of two elementary operations: free product with amalgamation and HNN-extension of free groups. In my talk I'll describe some properties of this class that might be interesting from the algorithmic point of view.

Francesco de Giovanni (Univ. Napoli Federico II) *Groups of large cardinality.*

Abstract: The mutual influence between small and large subgroups in groups of large cardinality is described.

Agelos Georgakopoulos (Univ. of Warwick) *On the expected size of a patriarchal society with Poisson distributed collaborations.*

Abstract: Consider a network evolving in (continuous or discrete) time with the following rules. When a (Poisson) clock ticks, nodes split into two. When a node x splits into two nodes x', x'' , each of its existing edges gets inherited by x' or x'' independently with probability a half. Moreover, a Poisson(k)-distributed number of new edges are added between x' and x'' .

As time goes to infinity, the distribution of the component (society) of a designated vertex converges. Is the component in the limit distribution finite or infinite? If it is finite, is its expected size finite or infinite? If finite, how does it depend on k ?

This talk is about geometric random graphs, and more specifically about "Group-Walk Random Graphs" [<http://arxiv.org/abs/1506.02697>] on trees.

Rostislav I. Grigorchuk (Texas A&M) *An interesting example of computation of spectrum of certain group of intermediate growth.*

Abstract: I will explain the computation of the spectrum of the Cayley graph of a group of intermediate growth constructed by me in 1980. It is based on the use of the spectrum of the associated Schreier graph and on the computation of a joint spectrum of a pencil of operators associated with the regular representation of the infinite dihedral group. This talk is based on joint results of the speaker and Artem Dudko and Rongwei Yang.

Vadim Kaimanovich (Univ. of Ottawa) *L-amenable actions.*

Abstract: The notion of amenability was first extended from groups to transitive group actions by Greenleaf (1969) by requiring that there exist an invariant mean on the action space. However, shortly thereafter this notion was eclipsed by Zimmer's definition (which is in a sense complementary to Greenleaf's one) and remained almost forgotten until fairly recently.

Amenability of a transitive action of a finitely generated group is equivalent to amenability of the associated Schreier graph, and the growing interest in properties of Schreier graphs has made Greenleaf's definition popular again during the last decade.

Inspired by a recent paper by Juschenko and Zheng on the Liouville property for Schreier graphs, I will introduce yet another version of amenability for actions and discuss its basic properties.

Elia Manara (Milano Bicocca) *A class of unitary representations of surface groups.*

Abstract: Some years ago, M.G. Kuhn and T. Steger introduced a class of unitary representations of finitely generated free group which they called multiplicative. These representations are tempered (i.e., weakly contained in the regular representation). Is it possible to define similar representations for hyperbolic groups? The case of virtually free groups was treated by A.Iozzi, M.G.Kuhn and T.Steger. An example of non-virtually free groups is provided by surface groups (fundamental groups of an orientable surface of genus $g \geq 2$), whose standard presentation is

$$\Gamma_g = \langle a_1, b_1, \dots, a_g, b_g \mid [a_1, b_1] \cdots [a_g, b_g] \rangle.$$

We give some ideas of how to define multiplicative representations for Γ_g and how to prove that they are tempered. We can extend these representations to $*$ -representations of a certain C^* -algebra $\Gamma \rtimes C(\delta\Gamma)$, called the crossed product, where $\delta\Gamma$ is the Gromov boundary of Γ and $C(\delta\Gamma)$ denotes the continuous functions on it. For an appropriate choice of the parameters in the definition, this extension is irreducible as a C^* -algebra representation.

This is a joint work with with M.G.Kuhn and T.Steger.

Tatiana Nagnibeda (Univ. de Genève) *Group actions, subshifts and spectra.*

Abstract: We will discuss a recently discovered connection between the spectral theory of Schrödinger operators whose potentials exhibit aperiodic order, and that of Laplacians associated with certain interesting group actions, as, for example, the action of Grigorchuk's group of intermediate growth on the boundary of the infinite binary tree. The connection goes through a subshift associated with the action; in many cases it is given by a substitution over a finite alphabet that defines the group algebraically, via a recursive presentation by generators and relators. Our results allow us to apply methods from the theory of aperiodic order to deduce information about the spectra of the Laplacians. We then study the dependence of the subshift, the Laplacians and their spectra on the group, as a point in the space of marked groups. The talk is chiefly based on a joint work with R. Grigorchuk and D. Lenz.

Emanuele Rodaro (Politecnico Milano) *Automaton (semi)groups: on the undecidability of problems related to the freeness and finiteness.*

Abstract: In this talk, we consider algorithmic problems for automaton semigroups and automaton groups of the freeness and finiteness kind. In dealing with these problems we exhibit also some connections with the dynamics on the boundary, showing an intriguing connection with the algebraic structure of such (semi)groups. We first show that checking whether an automaton group has empty set of positive relations is undecidable, this property is interesting when dealing with groups having all trivial stabilizers in the boundary already considered in a previous work. Moreover, in this talk we show that the emptiness of the set of positive relations is equivalent to the dynamical property of having all the orbital graphs centred at the non-singular points which are acyclic. We also settle the problem of checking the freeness for the semigroup defined by an automaton group by proving that such problem is undecidable. In the second part of this talk we extend the result of Gilbert by showing the undecidability of the finiteness problem even if we restrict this problem to the class of automaton semigroups defined by transducers that are bireversible and inverse deterministic (but in general not complete). As an immediate consequence of the aforementioned result, we obtain that the finiteness problem for automaton subsemigroups of inverse automaton semigroups is also undecidable. Finally, motivated by the finiteness problem, we consider the issue whether the infiniteness of automaton semigroup is equivalent to the existence of an infinite orbital graph. We conjecture that for automaton groups this is the case. As a partial support to this conjecture, we show that for reversible automaton groups this holds true.

This is joint work with D. D'Angeli and J-P. Wächter.

Florin Radulescu (Univ. Roma Tor Vergata) *Endomorphisms of spaces of virtual vectors fixed by a discrete group.*

Amnon Rosenmann (TUGraz) *Properties resulting from the arboresque structure of free groups and free group algebras.*

Abstract: We will examine some properties of subgroups of finitely generated free groups F and their analogues in right ideals of free group algebras KF , K a field. These properties stem from the arboresque (tree-like), or self-similar, structure. They include: the finite-codimensional topology in KF , analogous to the profinite topology in groups, and the resulting Gabriel localization of KF , which lacks unique rank; M. Hall property; Howson property and the rank of intersection of subgroups and right ideals; Algorithm for constructing Schreier-Groebner bases in KF vs the Nielsen-Schreier algorithm in F .

Klaus Schmidt (Univ. Wien) *Periodic and homoclinic points of algebraic Z^d -actions.*

Abstract: Homoclinic and periodic points of expansive algebraic actions of discrete amenable groups are understood quite well and play an important role in dynamical contexts like entropy formulae or specification properties. Recently, Ceccherini-Silberstein and Coornaert observed that they also play a very useful role in proving surjectivity of such systems. In the absence of expansiveness, questions about existence or abundance of periodic and homoclinic points of such actions become quite difficult and are partly unresolved even for very basic examples. In this talk I am planning to discuss these problems for nonexpansive algebraic Z^d -actions.

Stanislav Smirnov (Univ. de Genève) *A few things about the self avoiding walk in the plane.*

Abstract: Paul Flory, a famous chemist, proposed to study random non-self-intersecting curves on a lattice as a model for a position of a polymer molecule in a dilute solution. The model turned out to be very interesting, as well as very challenging. We will discuss the few things known about it.

Alain Valette (Univ. de Neuchâtel) *Box spaces: bridging geometric and asymptotic group theory.*

Abstract: Which information about a finitely generated group can be recovered from a sequence of finite quotients? One way to attack the question geometrically is to consider the box space, i.e. the coarse disjoint union of the given quotients. We will discuss results obtained in joint work with Ana Khukhro:

- If box spaces of residually finite groups G, H are coarsely equivalent, then G and H are quasi-isometric.
- For $n \geq 2$, the group $SL(n, \mathbb{Z})$ has uncountably many pairwise coarsely inequivalent box spaces.

Wolfgang Woess (TUGraz) *Isotropic random processes on ultrametric spaces.*

Abstract: The family of hierarchical Laplacians on an ultrametric space is introduced and the associated isotropic semigroups of Markov transition operators are displayed. Focussing on the space-homogeneous situation, typical classes of such processes and operators are studied in more detail, where the return probabilities exhibit periodic oscillations. This comprises the operator fractional derivative (Taibleson Laplacian) on the p -adic numbers and random walks on locally finite groups such as the infinite sum of copies of a finite group and the infinite symmetric group. This is joint work with Alexander Bendikov (Wroclaw) and Wojciech Cygan (Wroclaw and Graz).