

Scientific report of OTKA Grant PD 109731

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The project has finished after six months (instead of 3 years), i.e. it has run 09/2013-02/2014 (instead of 09/2013-08/2016). The PI continues the project using the support of the Marie Curie International Incoming Fellowship Grant BAG (no. 627476). Hence the results of this half year are more moderate than those in the research proposal planned to finish in 3 years. Manuscripts and submitted papers will also be mentioned. Every manuscript (but [1]) is available on the PI's homepage <http://www.renyi.hu/~kungabor/> and either on arxiv or on ECCC.

Results

The most important theorem proved by the PI in this half year research period is a positive answer to a question of Lewis Bowen: the Benjamini-Schramm (sofic) approximation of a group with Kazhdan Property (T) is essentially a disjoint union of expanders [1]. (Groups with Kazhdan property (T) play an important role in group theory from the theory of Lie groups to finite simple groups and had many combinatorial applications since the works of Margulis, too.) The motivation behind the question is to find a tool to show the existence of a nonsofic group. (This would disprove the Aldous-Lyons conjecture, Problem 3 of the proposal.) The PI managed to answer a problem of Fields Medallist's Freedman on 1-dimensional retracts of large subcomplexes 2-dimensional complexes negatively using this theorem. The PI still works on this research line, but the proved results seem already enough to submit this work to a prestigious journal like GAFA (Journal of Geometric and Functional Analysis).

The PI had given an alternative proof to the famous Gaboriau-Lyons result on the dynamical version of the von Neumann problem, and strengthened it by a Lipschitz condition. Recently, the PI also managed to apply this extra condition to answer two questions of Monod on geometric random subgroups: he proved that a group is non-amenable if and only if it admits F_2 as a geometric random subgroup [2]. He submitted this stronger paper to GAFA.

The PI continued his work on the measurable Lovász Local Lemma. The recent work of Achlioptas and Iliopoulos (complemented with the celebrated Moser-Tardos result) using random walks to find solution to the Local Lemma seems to provide an excellent tool to attack Problem 2 of the project. The PI's elder results on the measurable Local Lemma are proved and used in [2].

Abért, Csikvári, Frenkel and the PI studied the relationship between local properties and the number of matchings in sparse graphs [3]. They submitted their paper to a strong journal, the Transactions of the AMS, and this has already been accepted for publication.

The PI's paper on Constraint Satisfaction Problems restricted to relational structures with large girth has been published in Combinatorica [4]. (This solves a fundamental question about subclasses of NP defined by local obstructions derandomizing a result of Feder and Vardi.)

The paper of the PI and Mario Szegedy on an analytic view to Constraint Satisfaction Problems has also recently been accepted by the European Journal of Combinatorics [5].

The paper of Dadush and the PI has been accepted by Theoretical Computer Science, a strong journal in its field [6].

References

- (1) Gabor Kun: Sofic approximation of groups with property (T), in preparation,
- (2) Gabor Kun: "Expanders admit a Lipschitz subgraph with large girth", GAFA, submitted,
- (3) Miklos Abert, Peter Csikvari, Peter Frenkel and Gabor Kun, "Matchings in Benjamini-Schramm convergent graph sequences", Transactions of the AMS, accepted,
- (4) Gabor Kun: "Constraints, MMSNP and expander relational structures", Combinatorica, 33 (3), 335–347, 2013,
- (5) Gabor Kun and Mario Szegedy: "A new line of attack on the dichotomy conjecture", European Journal of Combinatorics, accepted,
- (6) Gabor Kun and Daniel Dadush: "Lattice sparsifiers and the approximate closest vector problem", Theoretical Computer Science, accepted,