



ABCDE



Scientific Report

First name / Family name

Andrii Bondarenko

Nationality

UKR

Name of the *Host Organisation*

NTNU

First Name / family name
of the *Scientific Coordinator*

Kristian Seip

Period of the fellowship

01/05/2013 to 31/12/2014



I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

During the fellowship program we have studied various problems in Analysis and Discrete Mathematics.

We have achieved the following research goals:

1. In [1] we have proved new counterexamples for Borsuk's conjecture.
2. In [3] we have constructed well-separated spherical designs of asymptotically minimal cardinality.
3. In [6] we have proved a new K4-bound for strongly regular graphs. Then we used this result to prove that there is no strongly regular graph with parameters $(76,30,8,14)$.
4. In [2] we have proved a new inequality for GCD-sums
5. In [4] and [5] we have proved new results toward the Helson's conjecture.
6. In [7] we proved new inequalities for nondoubling weights.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

[1] A. Bondarenko, *On Borsuk's conjecture for two-distance sets*, Discrete and Computational Geometry, 51 (2014) 509-515.

Abstract: In this paper we answer Larman's question on Borsuk's conjecture for two-distance sets. We find a two-distance set consisting of 416 points on the unit sphere in the dimension 65 which cannot be partitioned into 83 parts of smaller diameter. This also reduces the smallest dimension in which Borsuk's conjecture is known to be false. Other examples of two-distance sets with large Borsuk's numbers will be given.

[2] A. Bondarenko, K. Seip, *GCD Sums and Complete Sets of Square-Free Numbers*, <http://arxiv.org/abs/1402.0249>, to appear in Bulletin of the London Mathematical Society

[3] A. Bondarenko, D. Radchenko, and M. Viazovska, *Well-separated spherical designs*, to appear in Constructive Approximation, <http://arxiv.org/abs/1303.5991>

[4] A. Bondarenko, K. Seip, *Helson's problem for sums of a random multiplicative function*, <http://arxiv.org/abs/1411.6388>, submitted

[5] A. Bondarenko, W. Heap, M. Radziwill, K. Seip, *An inequality of Hardy-Littlewood type for Dirichlet polynomials*, <http://arxiv.org/abs/1405.6516>, submitted

[6] A. Bondarenko, A. Prymak, D. Radchenko, *Non-existence of $(76,30,8,14)$ strongly regular graph and some structural tool*, <http://arxiv.org/abs/1410.6748>

[7] A. Bondarenko, S. Tikhonov, *Bernstein inequalities with nondoubling weights*, submitted, <http://arxiv.org/abs/1308.5818>

III – ATTENDED SEMINARS, WORKSHOPS, CONFERENCES

Conferences and workshops

- Algebraic Combinatorics Workshop, Hefei, China, November 26-29, 2014, plenary talk "On minimal spherical designs".
- Workshop on "Sphere Packings, Lattices, and Designs", Vienna, Austria, October 27-31, 2014, plenary talk "Strongly regular graph in metric



- geometry”.
- Workshop on “Optimal Point Configurations and Applications”, Vienna, Austria, October 13-17, 2014.
 - 2014 CMS Summer Meeting, Winnipeg, Canada, June 6-9, 2014, talk “On Borsuk's conjecture”.
 - Constructive Functions 2014, Nashville, TN, May 26 – 30, talk “On Borsuk's conjecture”.
 - Bogolyubov readings DIF-2013, Sevastopol, Ukraine, June 23-30, 2013, talk “Spherical designs”.

Seminar talks

- “On Helson’s conjecture”, NTNU, Analysis Seminar, November 10, 2014, Trondheim, Norway
- “On minimal spherical designs”, Universitat Politècnica de València February 18, 2014, Valencia, Spain
- “On Borsuk's conjecture and strongly regular graphs”, NTNU, Analysis Seminar, September 30, 2013, Trondheim, Norway
- “Spherical designs: proof of the Korevaar-Meyers conjecture and beyond”, Universitat Politècnica de Catalunya, June 6, 2013 Barcelona, Spain
- “Spherical designs: proof of the Korevaar-Meyers conjecture and beyond”, CAS Seminar talk, May 16, 2013, Oslo, Norway

IV – RESEARCH EXCHANGE PROGRAMME (REP)

1. Universitat Politècnica de Catalunya, Spain, June 5-16, 2013. Local scientific coordinator: Oriol Serra, Departament de Matemàtica Aplicada 4.

We have discussed a few important results on application of Combinatorics in Metric Geometry. I also gave a lecture on the seminar “SEMINARI COMBINATORIA, TEORIA DE GRAFS I APLICACIONS”.

2. Universitat Politècnica de València, Spain, February 14-22, 2014. Local scientific coordinator: Pablo Sevilla, Institute for Pure and Applied Mathematics, UPV.

We have discussed the method of the Bohr lift for different problems in number theory such as GCD-sums and inequalities for Dirichlet polynomials. We have also discussed spherical designs and quadrature formulas. I gave a seminal talk at the UPV on the last topic.