

Report No. 44/2008

Discrete Geometry

Organised by
Martin Henk (Magdeburg)
Jiří Matoušek (Praha)
Emo Welzl (Zürich)

September 21st – September 27th, 2008

ABSTRACT. A number of remarkable recent developments in many branches of discrete geometry have been presented at the workshop, some of them demonstrating strong interactions with other fields of mathematics (such as harmonic analysis or topology). A large number of young participants also allows us to be optimistic about the future of the field.

Mathematics Subject Classification (2000): 52Cxx.

Introduction by the Organisers

Discrete Geometry deals with the structure and complexity of discrete geometric objects ranging from finite point sets in the plane to more complex structures like arrangements of n -dimensional convex bodies. Classical problems such as Kepler's conjecture and Hilbert's third problem on decomposing polyhedra, as well as classical works by mathematicians such as Minkowski, Steinitz, Hadwiger and Erdős are part of the heritage of this area. By its nature, this area is interdisciplinary and has relations to many other vital mathematical fields, such as algebraic geometry, topology, combinatorics, computational geometry, convexity, and probability theory. At the same time it is on the cutting edge of applications such as geographic information systems, mathematical programming, coding theory, solid modelling, computational structural biology and crystallography.

The workshop was attended by 40 participants. There was a series of 12 survey talks giving an overview of developments in Discrete Geometry and related fields:

- Keith Ball: *A sharp discrete geometric version of Vaaler's Theorem*
- Marcus Schaefer: *Hanani-Tutte and related results*
- Frank Vallentin: *Fourier analysis, linear programming and distance avoiding sets in \mathbb{R}^n*

- Nathan Linial: *What is high-dimensional combinatorics?*
- Gábor Tardos: *Conflict free coloring of rectangles*
- Matthias Beck: *Recent results on Ehrhart series of lattice polytopes*
- Assaf Naor: *Embeddings of discrete groups and the speed of random walks*
- János Pach: *Beyond planarity—Geometric intersection patterns*
- Günter M. Ziegler: *On the number of simplicial 4-polytopes and 3-spheres with N facets*
- Alex Iosevich: *Discrete geometry and Fourier analysis in discrete, continuous and finite field settings*
- Alexander Barvinok: *Random matrices with prescribed row and column sums*
- Jesús De Loera: *How to integrate a polynomial over a polytope*

In addition, there were 18 shorter talks and an open problem session chaired by János Pach on Wednesday evening—a collection of open problems resulting from this session can be found in this report. The program left ample time for research and discussions in the stimulating atmosphere of the Oberwolfach Institute.