Conference 2012

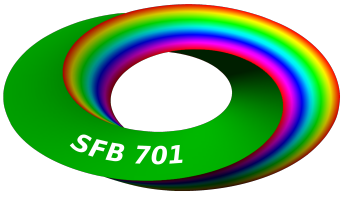
European Women in Mathematics — German Chapter

1 – 2 November 2012

Department of Mathematics
University of Bielefeld
Room V2–210/216

This conference is part of the conference program of the DFG-funded CRC 701
Spectral Structures and Topological Methods in Mathematics
at the University of Bielefeld

Organizers
Barbara Baumeister (Bielefeld)
Christine Bessenrodt (Hannover)
Andrea Blunck (Hamburg)
Evelyn Buckwar (Linz)
Barbara Gentz (Bielefeld)



http://www.math.uni-bielefeld.de/~gentz/pages/WS12/EWM12.html

Programme

Thursday, 1 November 2012

8:30 – 8:55	*Registration and coffee in V3–201*
8:55 – 9:00	*Welcome*
9:00 – 10:00	**Nina Gantert** (Technische Universität München) Random walks on percolation clusters
10:00 – 10:30	**Lisa Beck** (Rheinische Friedrich-Wilhelms-Universität Bonn) On the construction of non-unique minimal graphs
10:30 – 11:00	*Coffee break*
11:00 – 12:00	**Katrin Tent** (Universität Münster) Tits, Urysohn, Rado: simple groups on homogeneous structures
12:00 – 12:30	**Olga Chugreeva** (RWTH Aachen) Vortices in stochastically perturbed Ginzburg–Landau equations
12:30 – 14:00	*Lunch break* (Catered lunch, to be served in V3–201)
14:00 – 14:30	**Shelly-Erika Garion** (Universität Münster) Beauville surfaces and probabilistic group theory
14:30 – 15:00	**Margarita Spirova** (TU Chemnitz) Geometric approaches to the minimax problem in normed spaces
15:00 – 15:30	**Rebecca Waldecker** (Martin-Luther-Universität Halle-Wittenberg) Permutation groups where non-trivial elements have few fixed points
15:30 – 16:00	*Coffee break*
16:00 – 16:30	**Anda Degeratu** (Albert-Ludwigs-Universität Freiburg) Witten spinors and the Positive Mass Theorem
16:30 – 18:00	*Panel discussion* Christine Bessenrodt (Leibnitz Universität Hannover)
19:30 –	*Joint dinner in the city centre* Bernstein, Niederwall 2, 33602 Bielefeld, phone (0521) 9628750 (Please note: For the dinner, prior registration is required.)

Friday, 2 November 2012

8:45 – 9:00	*Coffee in V3–201*
9:00 – 10:00	**Caroline Lasser** (Technische Universität München) Semiclassics from a computational point of view
10:00 – 10:30	**Ilka Agricola** (Philipps-Universität Marburg) Old and new on Einstein spaces (with and without torsion)
10:30 – 11:00	*Coffee break*
11:00 – 12:00	**Sarah Rees** (University of Newcastle) When Artin groups are sufficiently large ...
12:00 – 12:30	**Darya Apushkinskaya** (Saarland University) Optimal regularity for solutions to the two-phase parabolic problem
12:30 – 14:00	*Lunch break* (Mensa, Cafeteria, Westend, snack bars, Univarza)
14:00 – 15:00	*Poster session and coffee in V3-201*
15:00 – 15:30	**Karin Halupczok** (Universität Münster) Results of modern sieve methods in prime number theory and more
15:30 – 16:00	**Bea Schumann** (Universität zu Köln) Kashiwara crystals from quiver representations
16:00 – 16:30	**Katharina Jochemko** (Freie Universität Berlin) Arithmetic of marked order polytopes and monotone triangle reciprocity
16:30	*Award for the best presentation*

Abstracts

Ilka Agricola (Philipps-Universität Marburg)

Old and new on Einstein spaces (with and without torsion)

An Einstein space is defined as a vacuum solution of Einstein's theory of general relativity with a cosmological constant, i.e. a manifold whose Ricci curvature is proportional to the scalar product. They play an important role not only in general relativity, but also in differential geometry. Recently, a generalisation of the classical setting became of interest: what can be said about Einstein spaces in the presence of torsion, i.e. with an "inner angular momentum", as first introduced by Elie Cartan? The motivation for this investigation stems from recent progress in holonomy theory (in mathematics) and problems from superstring theory (in theoretical physics).

In my talk, I will give an introduction into this field of research and present a few recent results obtained with Ana Cristina Ferreira from Portugal (see arXiv:1209.5886).

Darya Apushkinskaya (Saarland University)

Optimal regularity for solutions to the two-phase parabolic problem

Consider the two-phase parabolic obstacle problem with non-trivial Dirichlet condition

$$\begin{aligned} \Delta u - \partial_t u &= \lambda^+ \chi_{\{u>0\}} - \lambda^- \chi_{\{u<0\}} \quad \text{in } Q = \Omega \times (0;T), \\ u &= \varphi \quad \text{on} \quad \partial_p Q. \end{aligned}$$

Here $T < +\infty$, $\Omega \subset \mathbb{R}^n$ is a given domain, $\partial_P Q$ denotes the parabolic boundary of Q, and $\lambda^{\pm}$ are non-negative constants satisfying $\lambda^+ + \lambda^- > 0$. The problem arises as limiting case in the model of temperature control through the interior.

In this talk we discuss the L^∞-estimates for the second-order space derivatives $D^2 u$ and the first-order time derivative $\partial_t u$ near the parabolic boundary $\partial_p Q$. Observe that the case of general Dirichlet data cannot be reduced to zero ones due to non-linearity and discontinuity at $u = 0$ of the right-hand side of the first equation.

The talk is based on works in collaboration with Nina Uraltseva.

Lisa Beck (Rheinische Friedrich-Wilhelms-Universität Bonn)

On the construction of non-unique minimal graphs

For a smooth function $u\colon \Omega \to \mathbb{R}$ the n-dimensional area of its graph over a bounded domain Ω is given by

$$\int_\Omega \sqrt{1+|Du|^2}\,dx\,.$$

A natural question is whether or not minimizers of this functional exist among all functions taking prescribed boundary values (one may think of minimizers as soap films realizing the least surface area among all surfaces spanned by a wire). In this talk we first review the concept of generalized solutions to the least area problem, where attainment of the prescribed boundary values is not mandatory, but non-attainment is penalized. We then discuss two examples due to Santi, Baldo and Modica for the construction of non-unique minimal graphs.

Olga Chugreeva (RWTH Aachen)

Vortices in stochastically perturbed Ginzburg–Landau equations

The Ginzburg-Landau energy functional introduced and investigated by F.Bethuel and al. in the '90s is an idealization of the original theory conceived by V.L.Ginzburg and L.D.Landau in the thermodynamic description of superconductivity. The main phenomenon is the emergence of topological point singularities (vortices) for minimizers or solutions of corresponding evolution equations. The main goal is to extract information about the behavior of these point singularities from the governing PDE. When a random forcing of a certain intensity is introduced, this general picture is preserved, but the classical tools fail.

In the talk, I discuss the Ginzburg-Landau equations with multiplicative noise. For this case an explicit (Itô) equation for the energy functional is derived, which enables us to make first steps towards the understanding of stochastic vortex dynamics.

Anda Degeratu (Albert-Ludwigs-Universität Freiburg)
Witten spinors and the Positive Mass Theorem

The physics of general relativity implies that the total mass of an isolated system is never negative, provided that the sources of the gravitational field consist of matter with nonnegative mass density and that the space time is asymptotically flat. In mathematics, this lead to the Positive Mass Theorem. In the context of Riemannian geometry, this theorem states that the total mass of an asymptotically flat n-dimensional manifold with positive scalar curvature is never negative. For manifolds of dimension between 3 and 7, it was proved by Schoen and Yau using minimal surfaces techniques. In the case when the manifold is spin, Witten gave another proof based on the properties of the Dirac operator. In this talk, I will show an approach towards extending Witten's proof to the case of nonspin manifolds.

It is well-known that any oriented manifold of dimension 3 is spin. However, a higher dimensional manifold need not be spin. On an oriented Riemannian manifold the obstruction to having a spin structure is given by the second Stiefel-Whitney class. I will show that even when this obstruction does not vanish, it is still possible to define a notion of singular spin structure and associated singular Dirac operator. Then, modeling on Witten's proof of the Positive Mass Theorem, I will define the notion of Witten spinor on an asymptotically flat nonspin manifold, show their existence and describe their properties.

Nina Gantert (Technische Universität München)
Random walks on percolation clusters

We give a survey on the study of random walks on percolation clusters and on Galton-Watson trees and explain some recent progress in the field. We also mention some open questions. The talks will be accessible for non-probabilists.

Shelly-Erika Garion (Universität Münster)
Beauville surfaces and probabilistic group theory

Beauville surfaces are certain complex algebraic surfaces, which can be described as quotients of products of two curves by a suitable action of a finite group. Bauer, Catanese and Grunewald have been able to intrinsically characterize the groups appearing in minimal presentations of Beauville surfaces in terms of the existence of a so-called "Beauville structure", and conjectured that all finite simple groups, except A5, admit such a structure.

In the talk I will describe two results. The first is a joint work with Michael Larsen and Alex Lubotzky, showing that the conjecture of Bauer, Catanese and Grunewald holds for almost all finite simple groups of Lie type. The second is a joint work with Matteo Penegini on Beauville structures of alternating groups, based on results of Liebeck and Shalev. The proofs rely on probabilistic group-theoretical methods and character estimates in finite simple groups.

Karin Halupczok (Universität Münster)

Results of modern sieve methods in prime number theory and more

After a short introduction in some of the basic ideas of sieve theory, we give some current results in prime number theory, arithmetic geometry and probabilistic Galois theory. A small exemplary application in group theory is explained (we answer the question "For how many $n \leq x$ is any group of order n cyclic?").

Further, we give a short explanation of the so-called large sieve inequality. Together with combinatorial identities, it provides results being so strong that they compete with the consequences of the Riemann Hypothesis.

Katharina Jochemko (Freie Universität Berlin)

Arithmetic of marked order polytopes and monotone triangle reciprocity

A map f from a poset P into a poset Q is order preserving if $f(p) <= f(q)$ in Q whenever $p < q$ in P, and $f(p) = f(q)$ is prohibited for strict order preservation. Stanley considered the problem of counting order preserving maps from a finite poset P into the chain of length n and showed that many problems in combinatorics can be cast into this form, for example counting graph colorings. He showed that for a fixed poset P the number of these maps is given by a polynomial in the positive integer n and gave an interpretation for evaluating this polynomial at negative integers in terms of strictly order preserving maps. We consider the more general problem: Given a finite poset P, a subposet A which contains all minimal and maximal elements of P, and a map f from A into the integers. What is the number of integral valued order preserving maps with domain P extending f? By passing to real-valued maps we were able to show that the function counting integral valued extensions is a piecewise polynomial in the values of f and we can give an interpretation for evaluation at order reversing maps. These results can be applied to give a geometric proof of a combinatorial reciprocity for monotone triangles due to Fischer and Riegler (2011).

This is joined work with Raman Sanyal.

Caroline Lasser (Technische Universität München)

Semiclassics from a computational point of view

We discuss evolution equations in semiclassical scaling with the molecular Schrödinger equation as our guiding example. Our main focus is on approximations by operator splitting and on the numerical computation of unitarily evolved observables by Hamiltonian ordinary differential equations.

Sarah Rees (University of Newcastle)

When Artin groups are sufficiently large ...

An Artin group is a group with a presentation of the form

$$\langle x_1, x_2, \cdots, x_n \mid \overbrace{x_i x_j x_i \cdots}^{m_{ij}} = \overbrace{x_j x_i x_j \cdots}^{m_{ij}}, i, j \in \{1, 2, \cdots, n\}, i \neq j \rangle$$

for $m_{i,j} \in \mathbb{N} \cup \infty, m_{ij} \geq 2$, which can be described naturally by a Coxeter matrix or graph.

This family of groups contains a wide range of groups, including braid groups, free groups, free abelian groups and much else, and its members exhibit a wide range of behaviour. Many problems remain open for the family as a whole, including the word problem, but are solved for particular subfamilies. The groups of finite type (mapping onto finite Coxeter groups), right-angled type (with each $m_{ij} \in \{2, \infty\}$), large and extra-large type (with each $m_{ij} \geq 3$ or 4), FC type (every complete subgraph of the Coxeter graph corresponds to a finite type subgroup) have been particularly studied.

After introducing Artin groups and surveying what is known, I will describe recent work with Derek Holt and (sometimes) Laura Ciobanu, dealing with a big collection of Artin groups, containing all the large groups, which we call "sufficiently large". For those Artin groups we have elementary descriptions of the sets of geodesic and shortlex geodesic words, and can reduce any input word to either form. So we can solve the word problem, and prove the groups shortlex automatic. For many of those groups we can deduce the rapid decay property and verify the Baum–Connes conjecture. I'll explain some background for these problems, and outline their solution.

Bea Schumann (Universität zu Köln)

Kashiwara crystals from quiver representations

The combinatorics of representations of complex semi-simple Lie algebras is in part controlled by Kashiwara crystals. We will present a nice realization of those using the representation of quivers which was established by Markus Reineke using the Ringel–Hall algebra. We were able to relate his model to a geometric one given by Kashiwara and Saito. In this talk we will consider the example of the type A_n in order to keep things simple.

Margarita Spirova (TU Chemnitz)

Geometric approaches to the minimax problem in normed spaces

Let there be given a bounded set K (possibly finite) in a normed space $(\mathbb{R}^n, \|\cdot\|)$. The *minimax problem* asks for those points in $\mathbb{R}^n$ which minimize the maximal distance to points from K. Every solution of the minimax problem for a given set K is called a *Chebyshev center* of K, and the union of all Chebyshev centers of K is the *Chebyshev set* of K. Using new properties of ball operators in normed spaces we describe how Chebyshev sets, ball intersections, ball hulls, and completions of bounded sets are related to each other. We investigate also the so-called *critical set* for a given Chebyshev center and clarify the connection between critical sets and basic notions from the combinatorial geometry of convex bodies (e.g., the notion of inner illuminating system).

The talk is based on a joint work with Pedro Mártin (Badajoz, Spain) and Horst Martini (Chemnitz).

Katrin Tent (Universität Münster)

Tits, Urysohn, Rado: simple groups on homogeneous structures

I will explain a general criterion for establishing the simplicity of certain isometry groups.

Rebecca Waldecker (Martin-Luther-Universität Halle-Wittenberg)

Permutation groups where non-trivial elements have few fixed points

Problems in complex analysis or algebraic geometry often lead to questions about permutation groups. In this talk I will give an example and discuss the motivation as well as the group theoretic problem that needs to be solved.

Posters

Maryna Bibik (Universität Hamburg)
Morphismen von Kettengeometrien

Tolulope Fadina (Universität Bielefeld)
Fourier methods for pricing early-exercise options under Lévy dynamics

Nina Ovcharova (Universität der Bundeswehr München)
Regularization techniques for hemivariational inequalities with a maximum superpotential

Jacinta Perez Gavilan (Universität zu Köln)
Jordan algebras, exceptional Lie algebras and geometry

Lea Renner (Georg-August-Universität Göttingen)
Non-orderable torsion-free groups

Anna Reshetenko (Universität Bielefeld)
Asymptotic Approximations in the CLT in Free and Classical Probability

Elke Rosenberger (Universität Potsdam)
Tunneling for a class of difference operators

Imke Toborg (Martin-Luther-Universität Halle-Wittenberg)
A Theorem of $Z3^*$-type

Registered participants

Ilka Agricola	(Philipps-Universität Marburg)
Darya Apushkinskaya	(Universität des Saarlandes)
Mina Aquilino	(Universität Bielefeld)
Barbara Baumeister	(Universität Bielefeld)
Lisa Beck	(Rheinische Friedrich-Wilhelms-Universität Bonn)
Christine Bessenrodt	(Leibnitz Universität Hannover)
Maryna Bibik	(Universität Hamburg)
Laura Bigalke	(Universität Bielefeld)
Luise Blank	(Universität Regensburg)
Andrea Blunck	(Universität Hamburg)
Evelyn Buckwar	(Johannes Kepler Universität Linz)
Olga Chugreeva	(RWTH Aachen)
Anda Degeratu	(Albert-Ludwigs-Universität Freiburg)
Tolulope Fadina	(Universität Bielefeld)
Wafaa Fakiek	(Universität Bielefeld)
Nina Gantert	(Technische Universität München)
Shelly-Erika Garion	(Universität Münster)
Barbara Gentz	(Universität Bielefeld)
Karin Halupczok	(Universität Münster)
Katharina Jochemko	(Freie Universität Berlin)
Diana Kämpfe	(Universität Bielefeld)
Katarzyna Jankiewicz	(Rheinische Friedrich-Wilhelms-Universität Bonn)
Caroline Lasser	(Technische Universität München)
Katharina von der Lühe	(Universität Bielefeld)
Nora Müller	(Universität Bielefeld)
Thien Thu Nguyen Dang	(Rheinische Friedrich-Wilhelms-Universität Bonn)
Nina Ovcharova	(Universität der Bundeswehr München)
Jacinta Perez Gavilan	(Universität zu Köln)
Irene Pieper-Seier	(Carl von Ossietzky Universität Oldenburg)
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Lea Renner	(Georg-August-Universität Göttingen)
Rebecca Reischuk	(Universität Bielefeld)
Anna Reshetenko	(Universität Bielefeld)
Elke Rosenberger	(Universität Potsdam)
Julia Sauter	(University of Leeds)
Bea Schumann	(Universität zu Köln)
Petra Schwer	(Universität Münster)
Marina Sertić	(Universität Bielefeld)
Margarita Spirova	(Technische Universität Chemnitz)
Dorothea Strauer	(Philipps-Universität Marburg)
Katrin Tent	(Universität Münster)
Imke Toborg	(Martin-Luther-Universität Halle-Wittenberg)
Rebecca Waldecker	(Martin-Luther-Universität Halle-Wittenberg)
Anita Winter	(Universität Duisburg-Essen)
Eva Zerz	(RWTH Aachen)

(as of 30 October 2012)