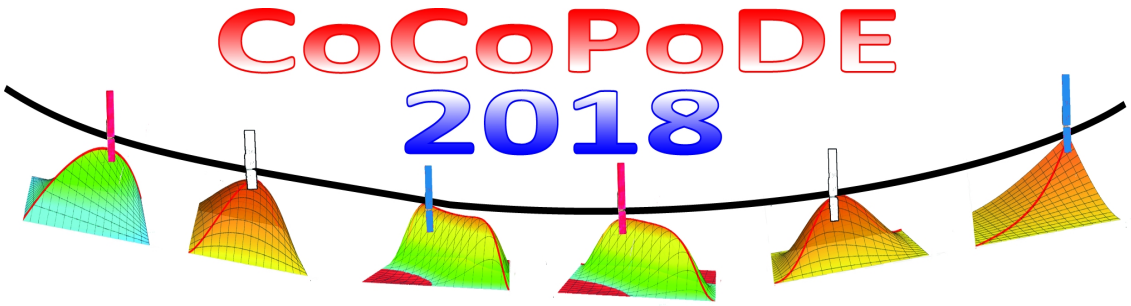


Cologne Conference on Positivity and Differential Equations

Conferentie ter ere van de 60ste verjaardag van Guido Sweers

Georganiseerd door Dirk Horstmann & Bernd Kawohl

May 22-25, 2018

DFG Deutsche Forschungsgemeinschaft

Universität zu Köln

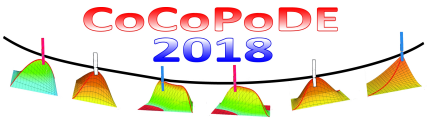
Schedule Cologne Conference on Positivity and Differential Equations (CoCoPoDE 2018)

	Tuesday/Dinsdag 22-5	Wednesday/Woensdag 23-5	Thursday/Donderdag 24-5	Friday/Vrijdag 25-5
09:15-10:00	Registration	Lecture by C. Bandle	Lecture by T. ter Elst	Lecture by A. Dall' Acqua
10:10-10:55	Opening, Lecture by H.-Ch. Grunau	Lecture by T. Weth	Lecture by S. Nicaise	Lecture by D. Bonheure
11:00-11:30	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:30-12:15	Lecture by P. Pucci	Lecture by F. Gazzola	Lecture by C. De Coster	Lecture by S. Nazarov
12:25-13:10	Lecture by M. van den Berg	Lecture by K. Stollenwerk	Lecture by F. Robert	Lecture by C. Nitsch
13:10-15:00	Lunch Break	Lunch Break	Lunch Break	Closing
15:00-15:45	Lecture by A. Stylianou	Lecture by W. Reichel	Lecture by Ph. Souplet	
15:55-16:40	Lecture by A. Farina	Lecture by A. Saldana	Lecture by B. Kawohl, Conference Photo	
16:45-17:15				
17:15-18:00			17:30: Social Program	
19:30 - ...			Conference dinner	

All lectures will take place in the 'Hörsaal' of the Mathematical Institute at Weyertal 86-90, 50931 Köln: second floor on the left.

Contents

- ▶ Registration and other technicalities 1
- ▷ Registration 1
- ▷ Equipment 1
- ▷ Internet 1
- ▶ Lectures on Tuesday 22-5 2
- ▶ Lectures on Wednesday 23-5 5
- ▶ Lectures on Thursday 24-5 9
- ▶ Lectures on Friday 25-5 12
- ▶ Lunch and dinner 14
- ▷ Local food 15
- ▷ Local beverage 15
- ▶ Map & Local transportation 16
- ▷ Map 16
- ▷ Local transportation 16
- ▶ Participants 17


CoCoPoDE
2018

▶ Registration and other technicalities/Registratie en andere technische details

▷ Registration/Registratie

On Tuesday morning from 9.15 am till 10.00 am the registration will be open in the room next to the lecture room in the 'Mathematical Institute', Weyertal 86-90. For the location see the map on page 16. The room is on the second floor.

▷ Equipment/Voorzieningen

The lecture room in the Mathematical Institute that we will use, is called Hörsaal. It contains nine blackboards as well as a beamer that uses a screen in front of the blackboards. To use the beamer, one may connect with one's own notebook but, when you prefer to travel light, just a memory stick with your pdf-file will do. One of our notebooks will be present.

▷ Internet

We are trying to organize access via WLAN to the internet in the Mathematical Institute. If you want to use this, you will need to bring your notebook. Furthermore, you can also use **Eduroam**. The information on these pages is also online. You may navigate to the conference's website

`http://www.mi.uni-koeln.de/CoCoPoDE/`

and use the link under **Program**.

▶ Lectures in chronological order/Voordrachten in chronologische volgorde

▷ Tuesday/Dinsdag 22-5

10:10 - 10:55, Hans-Christoph Grunau (Otto-von-Guericke-Universität Magdeburg)

Title: Boggio's formula for fractional polyharmonic Dirichlet problems

Abstract: Boggio's explicit formula for Green functions in balls is known for integer-polyharmonic Dirichlet problems and for fractional Dirichlet problems with fractional parameter less than 1. In the integer-polyharmonic case this formula has served as a basis for many joint works with numerous coauthors and in particular with Guido Sweers, see [2].

I shall present a consistent formulation for fractional polyharmonic Dirichlet problems such that Boggio's formula in balls yields solutions also for the general fractional case. Hypergeometric series and estimates analogous to those developed jointly with Guido Sweers will play a key role in the proof.

This talk is based upon the joint work [1] with Serena Dipierro.

[1] S. Dipierro, H.-Ch. Grunau, *Boggio's formula for fractional polyharmonic Dirichlet problems*. Ann. Mat. Pura Appl. 196 (2017) 1327–1344.
[2] F. Gazzola, H.-Ch. Grunau, G. Sweers, *Polyharmonic boundary value problems*, Positivity preserving and nonlinear higher order elliptic equations in bounded domains, Springer Lecture Notes in Mathematics 1991, Springer-Verlag: Heidelberg etc., 2010.

11:30 - 12:15, Patrizia Pucci (Università degli Studi di Perugia – Italy)

Title: Existence and qualitative properties of solutions of degenerate Kirchhoff wave problems involving nonlocal integro–differential operators

Abstract: A great attention has been drawn to the study of fractional and nonlocal problems of Kirchhoff type, since they arise in a quite natural way in many different applications. In the first part of the talk we first present recent results concerning wave Kirchhoff problem driven by a nonlocal integro–differential operator, as global existence (even under critical initial conditions), vacuum isolating and blow up of solutions. The proof arguments combine the Galerkin method with the potential well theory, see [1].

The second part of the talk deals with the question of global and local asymptotic stability for nonlinear damped Kirchhoff systems, with homogeneous Dirichlet boundary, under fairly natural assumptions on the external force $f = f(t, x, u)$ and the distributed damping $Q = Q(t, x, u, u_t)$. In [2] the Kirchhoff coefficient M represents a nonlocal dissipative effect in the dynamical damping term, which models a frictional mechanism acting on the body.

All the results extend in several directions recent theorems and cover also the so–called *degenerate case*, that is the case in which the Kirchhoff function M is zero at zero. From a physical point of view, this represents the fact that the base tension of the string modeled by the equation is zero: a very realistic condition. To overcome the difficulties due to the degeneracy of the models we have to make use of different approaches. The conclusions also raise, and leave open, a number of other intriguing questions, which are briefly presented.

[1] N. Pan, P. Pucci and B. Zhang, *Degenerate Kirchhoff–type hyperbolic problems involving the fractional Laplacian*, J. Evol. Equ. (2017) DOI 10.1007/s00028-017-0406-2, pages 25.
[2] P. Pucci and S. Saldi, *Asymptotic stability for nonlinear damped Kirchhoff systems involving the fractional p–Laplacian operator*, J. Differential Equations 263 (2017) 2375–2418.

12:25 - 13:10, Michiel van den Berg (University of Bristol)

Title: Optimal inequalities for L^p norms of the torsion function

Abstract: Bounds are obtained for L^p norm of the torsion function v_Ω, i.e. the solution of $-\Delta v = 1$, $v \in H_0^1(\Omega)$ in terms of the Lebesgue measure of an open set $\Omega \subset \mathbb{R}^m$, and the principal Dirichlet eigenvalue $\lambda_1(\Omega)$ of the Dirichlet Laplacian acting in $L^2(\Omega)$. We show that these bounds are sharp for $1 \leq p \leq 2$.

Joint work with Thomas Kappeler, University of Zürich.

15:00 - 15:45, Athanasios Stylianou (University of Kassel)

Title: Regular patterns in systems in equilibrium: From ferrofluids to dipolar Bose-Einstein condensates

Abstract: The talk deals with patterns appearing in a system in thermodynamic equilibrium. One classical example, serving as our starting point, are patterns on the free surface of a ferromagnetic fluid placed in a vertical magnetic field, undergoing a so-called Rosensweig instability. We present some old results concerning existence and stability of periodic structures as well as a new existence theory for static solitons and

for the associated free boundary problem.

Against standard physical intuition, a similar phenomenon has been observed in dipolar Bose-Einstein condensates. Placing a condensate in a magnetic field forces spontaneous transition from an unstructured state of the superfluid to an ordered arrangement of droplets. These structures (triangular, rectangular of hexagonal) exhibit an unexpectedly long life-time. It is strongly believed by the physical community, that quantum fluctuations are responsible for stabilizing these structures. We present the current state of mean-field modeling that aims to capture this phenomenon and recent results of the corresponding mathematical analysis.

This is joint work with M. Groves (Saarbrücken), P. Kevrekidis (UMass), H. Knüpfer (Heidelberg), D. Lloyd (Surrey), Y. Luo (Kassel) and E. Parini (Marseille).

[1] D. Baillie, R. M. Wilson, R. N. Bisset, and P. B. Blakie. *Self-bound dipolar droplet: A localized matter wave in free space*. Phys. Rev. A **94** (2016) 021602(R).
[2] M. D. Groves, D. J. B. Lloyd, and A. Stylianou. *Pattern formation on the free surface of a ferrofluid: Spatial dynamics and homoclinic bifurcation*, Physica D: Nonlinear Phenomena 350 (2017) 1–12.
[3] H. Kadau, M. Schmitt, M. Wenzel, C. Wink, T. Maier, I. Ferrier-Barbut, and T. Pfau. *Observing the Rosensweig instability of a quantum ferrofluid*, Nature, 530 (2016) 194–197.
[4] Y. Luo and A. Stylianou. *An extended dipolar Gross-Pitaevskii equation: self-bound states and orbital stability*, in preparation (2018).
[5] E. Parini and A. Stylianou. *A free boundary approach to the Rosensweig instability of ferrofluids*, Z. Angew. Math. Phys. (2018) 69:32

15:55 - 16:40, Alberto Farina (Université de Picardie J. Verne, Amiens, France)

Title: A sharp Bernstein-type theorem for entire minimal graphs

Abstract: We consider entire solutions u to the minimal surface equation in $\mathbb{R}^N$, with $N \geq 8$, and we prove the following sharp result : *if $N-7$ partial derivatives $\frac{\partial u}{\partial x_j}$ are bounded on one side (not necessarily the same), then u is necessarily an affine function.*

▷ Wednesday/Woensdag 23-5

09:15 - 10:00, Catherine Bandle (University of Basel)

Title: Positive solutions of semilinear elliptic equations with a Hardy potential

Abstract: In this talk we discuss problems with a Hardy potential which is singular at the boundary. The existence of positive solutions depends on the Hardy constant. The singularity of the Hardy potential forces the solutions either to blow up or to vanish on the boundary. In this talk we discuss various types of solutions.

[1] C. Bandle, V. Moroz and W. Reichel, *'Boundary blowup' type sub-solutions to semilinear elliptic equations with Hardy potential*, J. London Math. Soc. 77 (2008) 503–523.
[2] C. Bandle, M. A. Pozio, *Sublinear elliptic problems with a Hardy potential*, Nonlinear Analysis 119 (2015) 149–166.
[3] C. Bandle, M. Marcus and V. Moroz, *Boundary singularities of solutions of semilinear elliptic equations in the half-space with a Hardy potential*, Israel J. Math. 222 (2017) 487–514.

10:10 - 10:55, Tobias Weth (Goethe-University Frankfurt)

Title: Serrin's overdetermined problem on the sphere

Abstract: In this talk, I will discuss Serrin's overdetermined boundary value problem

$$-\Delta_{S^N} u = 1 \quad \text{in } \Omega, \qquad u = 0,\ \partial_\eta u = \text{const} \quad \text{on } \partial\Omega$$

in subdomains Ω of the round unit sphere $S^N \subset \mathbb{R}^{N+1}$, where Δ_{S^N} denotes the Laplace-Beltrami operator on S^N. We call a subdomain Ω of S^N a Serrin domain if it admits a solution of this overdetermined problem. In our main result, we construct Serrin domains in S^N, $N \geq 2$ which bifurcate from symmetric straight tubular neighborhoods of the equator. By this we complement recent rigidity results for Serrin domains on the sphere.

This is joint work with M.M.Fall and I.A.Minlend (AIMS Senegal).

11:30 - 12:15, Filippo Gazzola (Politecnico of Milan, Italy)

Title: Linear and nonlinear equations for beams and plates with double piers

Abstract: The final goal of this talk is to discuss the role of intermediate piers in the

instability of suspension bridges. This analysis needs a sound variational setting based on classical principles of functional analysis and basic theory of linear differential equations. The variational formulation of the linear stationary problem requires the introduction of new functional spaces. The deck of the bridge is modeled as a degenerate plate consisting of a beam with cross section free to rotate around the beam. The modeling and the functional setting are quite involved and we need first to tackle the case of a simple beam divided in three parts separated by two internal piers. It turns out that the stability results are strongly influenced by the relative lengths of the side spans.

Based on a joint work with Maurizio Garrione (Politecnico of Milan).

12:25 - 13:10, Kathrin Stollenwerk (RWTH Aachen University)

Title: Optimal shape of a domain that minimizes the buckling load of a clamped plate

Abstract: We discuss a shape optimization problem due to Polya and Szegö. They conjectured in 1951 that among all clamped plates of the same area subjected to a lateral compression, the disk has minimal buckling load. We prove the existence of an optimal domain, which minimizes the buckling load among all bounded domains with given measure. Instead of treating this constrained variational problem, we will use a formulation due to Alt and Caffarelli [1] and introduce a penalized problem ([3]). Assuming that a smooth optimal domain exists, we show that this domain must be a ball (joint work with A. Wagner [2]).

[1] H. W. Alt and L. A. Caffarelli, *Existence and regularity for a minimum problem with free boundary*, J. Reine Angew. Math. 325 (1981) 105–144
[2] K. Stollenwerk and A. Wagner, *Optimality conditions for the buckling of a clamped plate*, J. Math. Anal. Appl. 432 (2005) 254–273
[3] K. Stollenwerk, *Optimal shape of a domain which minimizes the first buckling eigenvalue*, Calc. Var. Partial Differential Equation 55 (2016) 1–29

15:00 - 15:45, Wolfgang Reichel (Karlsruhe Institute of Technology)

Title: Equilibrium distributions in the Born-Infeld electrostatic theory

Abstract: This talk reports on joint work with D. Bonheure (Univ. Libre de Bruxelles), P. d'Avenia (Politecnico di Bari) and A. Pomponio (Politecnico di Bari). Within the Born-Infeld electrostatic theory the electrostatic potential generated by a probability measure ρ on the boundary $\partial\Omega$ of a domain $\Omega \subset \mathbb{R}^3$ is the unique minimizer ϕ_ρ of

the Born-Infeld electrostatic action (with $b > 0$ a positive constant)

$$\mathcal{I}_\rho(\phi) = \int_{\mathbb{R}^3} \left(b^2 - b\sqrt{b^2 - |\nabla\phi|^2} \right) dx - \oint_{\partial\Omega} \phi d\rho.$$

Here ϕ runs through the set $\mathcal{X}$ of all $D^{1,2}(\mathbb{R}^3)$ functions with Lipschitz-constant less or equal b, cf. [2]. For each electrostatic potential ϕ_ρ we can consider the Born-Infeld electrostatic energy $\mathcal{E}$

$$\mathcal{E}(\phi_\rho) := -\mathcal{I}_\rho(\phi_\rho).$$

Among all possible charge distributions one can search for those distributions ρ^*, which create least-energy potentials. Such a distribution ρ^* (provided it exists) is called *equilibrium distribution*. The corresponding minimizer ϕ_{ρ^*} is called an *equilibrium potential*. The main purpose of this talk is to provided the existence and the properties of the equilibrium disitribution and the equilibrium potential. The three most important results are:

(i) equilibrium distributions exist

(ii) the equilibrium potential ϕ_{ρ^*} is unique and takes a constant value λ^* in $\overline{\Omega}$

(iii) if $\partial\Omega \in C^{2,\alpha}$ then also the equilibrium distribution ρ^* is unique and the equilibrium potential is a weak solution of the Euler-Lagrange equation associated with $\mathcal{I}_\rho$.

Fundamental regularity principles from [1] are used. Similar results can be achieved for approximated electrostatic actions, where the action integrand $b^2 - b\sqrt{b^2 - |\xi|^2}$ (with ξ a placeholder for $\nabla\phi$) is replaced by its Taylor-polynomial.

[1] R. Bartnik and L. Simon, *Spacelike hypersurfaces with prescribed boundary values and mean curvature*, Comm. Math. Phys. 87 (1982) 131–152.
[2] D. Bonheure, P. d'Avenia, A. Pomponio, *On the electrostatic Born-Infeld equation with extended charges*. Comm. Math. Phys. 346 (2016) 877–906.

15:55 - 16:40, Alberto Saldaña (Karlsruhe Institute of Technology)

Title: Explicit solutions and positivity preserving properties for arbitrary positive powers of the Laplacian.

Abstract: Green functions and Poisson kernels for the Laplacian are well-known concepts used to construct explicit solutions to boundary value problems. In this talk, we see how these ideas can be extended to *any* positive power of the Laplacian, where fractional powers larger than one are specially interesting and require a careful (pointwise) definition of the differential operator and a new notion of Dirichlet-type boundary

conditions. We present several applications of these explicit formulas; in particular, that positivity preserving properties do not hold in general for any power larger than 1.

[1] N. Abatangelo, S. Jarohs, and A. Saldaña, *On the maximum principle for higher-order fractional Laplacians*, arXiv:1607.00929, 2016.
[2] N. Abatangelo, S. Jarohs, and A. Saldaña, *Positive powers of the Laplacian: from hypersingular integrals to boundary value problems*, Comm. Pure Appl. Anal. (to appear) 2018.
[3] N. Abatangelo, S. Jarohs, and A. Saldaña, *Integral representation of solutions to higher-order fractional Dirichlet problems on balls*, Comm. Contemp. Math. (to appear) 2018.

▷ Thursday/Donderdag 24-5

09:15 - 10:00, Tom ter Elst (University of Auckland)

Title: The Dirichlet problem without the maximum principle

Abstract: Consider the Dirichlet problem with respect to an elliptic operator

$$A = -\sum_{k,l=1}^{d} \partial_k \, a_{kl} \, \partial_l - \sum_{k=1}^{d} \partial_k \, b_k + \sum_{k=1}^{d} c_k \, \partial_k + c_0$$

on a bounded Wiener regular open set $\Omega \subset \mathbb{R}^d$, where $a_{kl}, c_k \in L_\infty(\Omega, \mathbb{R})$ and $b_k, c_0 \in L_\infty(\Omega, \mathbb{C})$. Suppose that the associated operator on $L_2(\Omega)$ with Dirichlet boundary conditions is invertible. Then we show that for all $\varphi \in C(\partial\Omega)$ there exists a unique $u \in C(\overline{\Omega}) \cap H^1_{\rm loc}(\Omega)$ such that $u|_{\partial\Omega} = \varphi$ and $Au = 0$.

In the case when Ω has a Lipschitz boundary and $\varphi \in C(\overline{\Omega}) \cap H^{1/2}(\overline{\Omega})$, then we show that u coincides with the variational solution in $H^1(\Omega)$.

This is joint work with Wolfgang Arendt.

10:10 - 10:55, Serge Nicaise (University of Valenciennes)

Title: Comparing variational methods for Kirchhoff plates with corners

Abstract: The Kirchhoff plate model correponds to a fourth order elliptic differential equation. To close the system some boundary conditions have to be imposed. Here we consider either Dirichlet boundary conditions (see [1]) or hinged ones (see [2]). By Riesz' representation theorem the existence and uniqueness of a weak solution is quite direct. The problem that we are interested in appears when one is looking for constructive approximations of a solution. Numerical methods using for example finite elements, prefer systems of second equations to fourth order problems. Hence, in this talk, considering domains with non smooth boundaries (namely having corners), different variational settings will be discussed and compared. Moreover, as was observed in the so-called Saponzhyan-Babushka paradox, domains with reentrant corners need special care. In that case, a variational setting for a second order equivalent system needs an augmented solution space in order to find a solution in the appropriate Sobolev-type space.

This talk is based on joint works with C. De Coster and G. Sweers.

[1] C. De Coster, S. Nicaise and G. Sweers, *Solving the biharmonic Dirichlet problem on domains with corners*, Math. Nachr., 288 (2015) 854–871.
[2] C. De Coster, S. Nicaise and G. Sweers, *Comparing variational methods for the*

hinged Kirchhoff plate with corners, preprint.

11:30 - 12:15, Colette De Coster (University of Valenciennes)

Title: Spectral analysis of a generalized buckling problem on balls

Abstract: In this talk we are interested in the following fourth order eigenvalue problem coming from the buckling of thin films on liquid substrates:

$$\begin{cases} \Delta^2 u + \nu u = -\lambda \Delta u & \text{in } B_1, \\ u = \partial_r u = 0 & \text{on } \partial B_1, \end{cases}$$

where B_1 is the unit ball of $\mathbb{R}^N$, $N \geq 2$. More precisely, we are interested in the multiplicity of the first eigenvalue and in the shape of the first eigenfunction. In fact we will show that, for ν negative, or, positive small enough, the first eigenvalue is simple and the first eigenfunction, which gives the shape of the film for small displacements, is positive. However, when ν increases, we will show that the situation changes completely.

[1] C. De Coster, S. Nicaise et C. Troestler, *Nodal properties of eigenfunctions of a generalized buckling problem on balls*, Positivity 19 (2015) 843-875.
[2] C. De Coster, S. Nicaise et C. Troestler, *Spectral analysis of a generalized buckling problem on ball*, Positivity 21 (2017) 1319-1340.

12:25 - 13:10, Frédéric Robert (Université de Lorraine)

Title: Sharp asymptotic profiles for singular solutions to an elliptic equation with a sign-changing nonlinearity

Abstract: We analyse the behavior at 0 of positive solutions of

$$-\Delta u = \alpha \frac{u^{2^\star(s)-1}}{|x|^s} - \beta u^q \text{ in } B \setminus \{0\}$$

where $B \subset \mathbb{R}^n$ is the unit ball and $2^\star(s) = 2(n-s)/(n-2)$, $0 < s < 2$. When $\alpha > 0$ and $\beta = 0$, the potential behaviors are classified in the spirit of the pioneer work of Caffarelli-Gidas-Spruck. Conversely, when $\alpha = 0$ and $\beta > 0$, the analysis is also classical (see for instance Véron). In the present talk, I will discuss the case when $\alpha > 0$ and $\beta > 0$. In addition to the classical profiles above when one of the parameters α, β vanishes, we show that the behavior at zero is also governed by two other original profiles. All these profiles but one are *d*ifferential in the sense that the behavior is modeled on solutions to some limiting PDEs. Surprisingly, one of them is

non-differential, in the sense that it is modeled on the equation $0 = \alpha \frac{u^{2^\star(s)-1}}{|x|^s} - \beta u^q$. This analysis permits to exhibit examples of all these profiles. This is a series of joint works with Florica Cîrstea (Sydney) and Jérôme Vétois (Montréal).

[1] F.C. Cîrstea and F.Robert, *Sharp asymptotic profiles for singular solutions to an elliptic equation with a sign-changing non-linearity*. Proc. Lond. Math. Soc. 114 (2017) 1-34.
[2] F.C. Cîrstea, F.Robert and J.Vétois, *Examples of sharp asymptotic profiles of singular solutions to an elliptic equation with a sign-changing non-linearity*, preprint (2017).

15:00 - 15:45, Philippe Souplet (Université Paris 13 & CNRS, France)

Title: A Liouville-type theorem for the 3-dimensional parabolic Gross-Pitaevskii and related systems

Abstract: After a brief survey of the literature on Liouville type theorems for superlinear elliptic and parabolic systems, and their applications, we will present recent Liouville-type theorems for semilinear parabolic systems of the form

$$\partial_t u_i - \Delta u_i = \sum_{j=1}^{m} \beta_{ij} u_i^r u_j^{r+1}, \quad i = 1, 2, ..., m$$

in the whole space $\mathbb{R}^n \times \mathbb{R}$ and in the half space $\mathbb{R}^n_+ \times \mathbb{R}$. Here the symmetric matrix (β_{ij}) has positive diagonal and nonnegative off-diagonal entries, and the growth condition $2r + 1 < n(n + 2)/(n - 1)^2$ is assumed. This in particular covers the parabolic Gross-Pitaevskii system – i.e. the cubic case $r = 1$ – in space dimension $n = 3$.

Applications to universal singularity estimates, universal bounds for global solutions, and blow-up rate estimates for the corresponding initial value problem will be given.

The proof of the Liouville type theorem in the whole space is based on nontrivial modifications of integral estimate techniques of Gidas and Spruck and of Bidaut-Véron.

Joint work with Quoc Hung Phan (Duy Tan University, Da Nang, Vietnam).

[1] Q.H. Phan and Ph. Souplet, *A Liouville-type theorem for the 3-dimensional parabolic Gross-Pitaevskii and related systems*, Math. Annalen 366 (2016) 1561-1585.

15:55 - 16:40, Bernd Kawohl (Universität zu Köln, Germany) and **Conference Photo**

Title: On the importance of being positive

▷ Friday/Vrijdag 25-5

09:15 - 10:00, Anna Dall'Acqua (University of Ulm)

Title: Minimal elastic networks

Abstract: We consider planar networks Γ of three curves that meet at two junctions with prescribed equal angles. On this class we minimise the energy functional

$$\mathcal{E}(f) = \int_\Gamma (k^2 + 1)\, ds\,,$$

with k the curvature of the smooth pieces of curves and s the arc-length parameter. This energy is the sum of the elastic energy and a term that penalises the total length of the network. We prove existence and regularity of minimisers and show some properties of the minimal configurations.

[1] A. Dall'Acqua, A. Pluda, *Some minimization problems for planar networks of elastic curves*, Geom. Flows 2 (2017) 105–124.
[2] A. Dall'Acqua, M. Novaga, A. Pluda, *Minimal elastic networks*, submitted.

10:10 - 10:55, Denis Bonheure (Université libre de Bruxelles)

Title: Stability in a nonlinear nonlocal plate equation.

Abstract: We consider a thin and narrow rectangular plate where the two short edges are hinged whereas the two long edges are free. We study a nonlocal evolution equation modeling the deformation of the plate.

Joint work with E. dos Santos & F. Gazzola.

11:30 - 12:15, Sergei A. Nazarov (St. Petersburg State University and Institute of Mechanical Engineering Problems, Russia)

Title: Spectral problems for long and infinite Kirchhoff plates

Abstract: Asymptotics of eigenvalues and eigenfunctions of the bi-harmonic operator Δ^2 with various boundary conditions related to two-dimensional Kirchhoff plates, are obtained when the relative width ε of the plate tends to zero. Several series of eigenvalues with stable asymptotics of orders 1, ε^{-2} and ε^{-4} are found in the case of the Neumann conditions (edges of the plate are free) and the Dirichlet conditions (edges of the plate are rigidly fixed) which are described by fourth- and second-order ordinary differential equations in the longitudinal coordinate. Junctions and lattices of such plates are studied as well while new series of eigenvalues appear due to the boundary layer effects near the junction nodes. These eigenvalue series are related to the

discrete spectrum of waveguides Ξ composed of clamped infinite Kirchhoff plates, i.e., eigenvalues below the continuous spectrum of the bi-harmonic operator Δ^2 in Ξ with either the Dirichlet conditions on $\partial\Xi$, or the boundary conditions of simple support. Certain results on the spectra of such Kirchhoff infinite waveguides are obtained but many questions on the spestral structures remain open.

The results are derived in cooperation with Fedor Bakharev within the grant 17-11-01003 of Russian Science Foundation.

12:25 - 13:10, Carlo Nitsch (University of Napoli)

Title: New and old bounds for Steklov eigenvalues

Abstract: In a celebrated paper [1], Weinstock proves that the first Steklov Laplacian eigenvalue, among planar simply connected sets of given perimeter, is maximized by the disk. The resulting functional inequality was named after him and belongs nowadays to the folklore of applied mathematics. More recently Brock [2] showed that, if the perimeter constraint is replaced by a measure constraint, no topological restriction is needed, and moreover the inequality holds true in any dimension. In a recent paper [3] we show how to generalize the original Weinstock inequality in any dimension, in the class of convex sets with prescribed surface area. We use the inverse mean curvature flow together with shape derivative arguments. The key result is the proof of a sharp isoperimetric inequality involving simultaneously the surface area, the volume and the boundary momentum of convex sets.

[1] R. Weinstock, *Inequalities for a Classical Eigenvalue Problem, Journal of Rational Mechanics and Analysis*, 3 (1954) 745–753
[2] F. Brock, *An isoperimetric inequality for eigenvalues of the Stekloff problem*. ZAMM Z. Angew. Math. Mech. 81 (2001) 6—71.
[3] D. Bucur, V. Ferone, C. Nitsch, C. Trombetti, *Weinstock inequality in higher dimensions*. (arxiv-preprint)

Lunch and dinner/Lunch en diner

Lunches are available in the Mensa on May 22 – 24, but not on May 25. Down below you will find some places for lunch or dinner near the university. They range from very simple to not so simple. See also the map on one of the next pages. On Campus:

- Main Mensa
- Mensa Robert-Koch Straße

Direction Northwest:

- Il Belluno, Hans-Sachs-Straße 4, 0221 99876900, `http://www.il-belluno.de`
- NIKKO, Dürener Straße 89, 0221 400-0094, `http://www.nikko-koeln.de`
- Landmann, Dürener Straße 143, 0221 409364 `https://www.landmann-lindenthal.de`
- Al Gufo, Dürener Straße 157, 0221 409651, `http://www.algufo.de`
- Culinarius, Dürener Straße 193-197, 0221 4061348, `http://www.culinarius-koeln.de`
- Haus Schwan, Dürener Straße 235, 0221 403368, `http://www.haus-schwan.de`

Direction South

- Café Krümel, Zülpicher Straße 207, 0221 426767
- Cantina Mexicana Laspediras, Weyertal 38, 0221 428007
- Da Siro, Weyertal 41, 0221 441051, `http://www.dasiro.de`

Direction city-center

- Restaurant L'escalier, Brüsseler Straße 11, 0221 2053998, `http://www.lescalier-restaurant.de`
- El-Inca Restaurant, Görresstraße 2, 0221 245503, `http://www.el-inca.de`

- Weinstube Bacchus, Rathenauplatz 17, 0221 217986, http://www.weinstubebacchus.de
- Fischermanns, Rathenauplatz 21, 0221 801-7790, http://fischermanns.info/
- Hellers Brauhaus, Roonstraße 33, 0221 2401881, http://www.hellers-brauhaus.de
- Ristorante Etrusca, Zülpicher Straße 27, 0221 2403900, http://www.ristorante-etrusca.de

City-center: Brauhauses offer usually good value for money concerning food

- Gaffel am Dom, Bahnhofsvorplatz 1, 0221 9139260, http://www.gaffelamdom.de
- Früh am Dom, Am Hof 12-18, 0221 2613211, http://www.frueh.de
- Gilden im Zims, Heumarkt 77, 0221 16866110, http://gilden-im-zims.de

▷ Traditional local food/Traditioneel lokaal eten

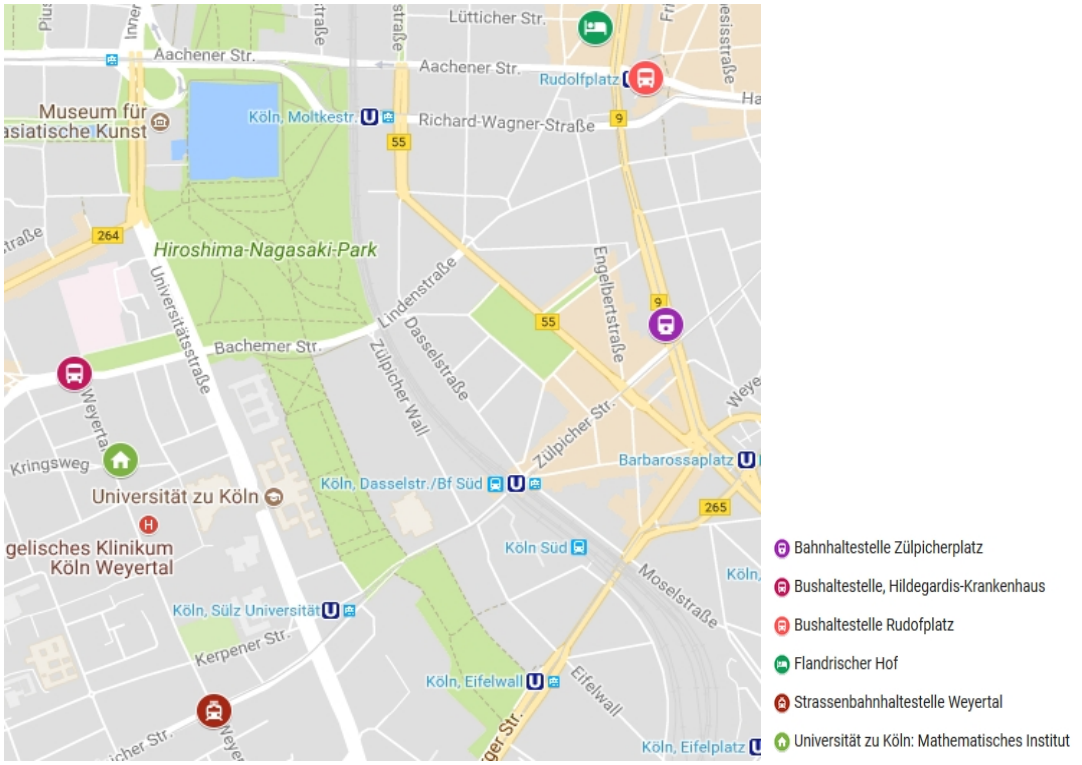
Mett auf einem Röggelchen (raw ground pork on a rye roll) – Kölsche Kaviar (blood sausage) – Halver Hahn (cheese on a bread roll) – met Musik (onions added) – Ehrengarde der Stadt Köln (fried egg with spinach) – Himmel un Ääd (fried blood sausage, apple sauce and mashed potatoes) – Hämmchen (boiled knuckle of pork) – Matjes (salted fresh herring) – Grillhaxe (grilled knuckle of pork) – Pommes Rut-Wiess (french fries, ketchup and mayonnaise)

▷ Local beverage/Traditionele lokale Drank

To have it fresh, Kölsch is served in small glasses called Stange. To keep the customer satisfied empty glasses are quickly replaced by full ones. To stop the waiter, den Köbes, from changing glasses, just put the beer coaster on top.

▶ Map & Local transportation/Kaart & openbaar vervoer

▷ Map/Kaart



▷ Local transportation / openbaar vervoer

- Buses 136 and 146 stop where Bachemer Straße meets Weyertal and pass close to Hotel Flandrischer Hof. The distance is a so-called 'Kurzstrecke', which costs €1.90.
- Taking the subway/tramway one should make a change at 'Zülpicher Platz' and head for 'Universität' with Line 9.
- Tickets from the university to the city-center cost €2.90. Tickets are valid on buses and subway/tramway. Vending machines for the tickets can be found inside buses and trams.

Participants/Deelnemer

Catherine Bandle (Basel)
Denis Bonheure (Bruxelles)
Anna Dall' Acqua (Ulm)
Colette De Coster (Valenciennes)
Matthias Erven (München)
Alberto Farina (Amiens)
Evgeny Galakhov (Moscow)
Filippo Gazzola (Milano)
Jan Gerdung (Köln)
Hans-Christoph Grunau (Magdeburg)
Jiri Horak (Ingolstadt)
Dirk Horstmann (Köln)
Illia Karabash (Bonn)
Bernd Kawohl (Köln)
Samuel Littig (Köln)
Marcello Lucia (New York)
Miguel Navarro (Santiago de Compostela)
Sergei Nazarov (St. Petersburg)
Serge Nicaise (Valenciennes)
Carlo Nitsch (Napoli)
Steffen Parr (Mainz)
Michael Plum (Karlsruhe)
Patrizia Pucci (Perugia)
Wolfgang Reichel (Karlsruhe)
Frederic Robert (Nancy)
Giulio Romani (Marseille)
Alberto Saldana (Karlsruhe)
Olga Salieva (Moscow)
Inka Schnieders (Köln)
Sebastian Schwarzacher (Bonn)
Philippe Souplet (Paris)
Kathrin Stollenwerk (Aachen)
Athanasios Stylianou (Kassel)
Guido Hendrikus Sweers (Köln)
Tom ter Elst (Auckland)
Michiel van den Berg (Bristol)
Katerina Vassi (Hannover)
Tobias Weth (Frankfurt)