Abstracts

Riku Anttila

On the uniqueness of solutions to Trudinger's parabolic equation

We establish uniqueness of solutions to Trudinger's parabolic equation with C^2 Cauchy–Dirichlet boundary data. The talk is based on the joint work with P. Lindqvist and M. Parviainen; preprint available at arXiv:2602.04748.

Ángel Arroyo

Regularity estimates for approximations of elliptic PDE's on random data clouds

The regularity question is one of the main problems in Analysis of PDE's. In the 70s, Krylov and Safonov proved that the solutions of PDEs in non divergence form are Hölder continuous. In the last decade, this result has been adapted to the nonlocal setting in several contexts. In particular, in previous works, this regularity estimate has been adapted for a class of nonlocal approximations of elliptic PDE's arising from a generalization of the mean value property for harmonic functions.

On the other hand, in the recent years, the analysis of functions defined on random data clouds has received an increasing attention due to its connection with Machine Learning. For that reason, in this talk we address the regularity problem on random data clouds, for which we adapt the nonlocal Krylov-Safonov theory for functions satisfying Pucci-type extremal inequalities.

It is worth mentioning that the mean value property, which is the corner stone in the connection between elliptic PDE's and their nonlocal counterparts, can also be interpreted from a stochastic point of view, allowing the use of probabilistic ideas. Our proof, however, relies entirely on analytic arguments.

This is a joint work with P. Blanc (U. Buenos Aires) and M. Parviainen (U. Jyväskylä).

Lorenzo Brasco

Eigenvalues of the $p-$Laplacian on a general open set

We start by revisiting from a variational point of view the classical Spectral Theory of the Dirichlet-Laplacian. On a general open set, it is well-known that the spectrum may fail to be purely discrete. We then turn our attention to the case of the $p-$Laplacian with Dirichlet homogeneous conditions. More precisely, we analyze the minmax levels of the constrained

$p-$Dirichlet integral: we show that, whenever one of these levels lies below the threshold given by the L^p Poincaré constant at infinity, it actually defines an eigenvalue. We also prove a quantitative exponential fall-off at infinity for the relevant eigenfunctions: this can be seen as a generalization of classical Shnol-Simon–type estimates to the nonlinear case. Some of the results presented have been obtained in collaboration with Luca Briani (TUM Munich), Giovanni Franzina (CNR-IAC) and Francesca Prinari (Pisa).

Karl Brustad

Infinity-harmonic functions in the plane: Regularity by injectivity

It has been a long standing conjecture that the ∞-harmonic functions in the plane have a 1/3-Hölder continuous gradient. Aronsson's solution $x^{4/3} - y^{4/3}$ shows that no better general regularity is possible. It *is* known that solutions are C^1 and that the gradient is locally α-Hölder, but α comes without any positive lower bound. In the plane there is also a connection between the ∞-Laplace equation and the one-dimensional heat equation, observed already by Aronsson himself. I shall show that this link can be accessed under a certain injectivity condition on the gradient, and that the caloric structure then is enough to prove the 1/3-Hölder continuity. Of course, an injective gradient is by no means a *necessary* condition, as seen by smooth solutions such as the planes and cones.

Leon Bungert

Approximation rates for infinity-harmonic functions

We show that any Hölder continuous function that satisfies a comparison principle with respect to some metric that is close to the Euclidean one, is uniformly close to the infinity harmonic function with the same boundary values. We apply this to $p-$harmonic functions as well as infinity-harmonic functions on graphs with n vertices to get convergence rates as p or n tend to infinity, respectively.

This is based on joint work with Jeff Calder and Tim Roith.

Jeff Calder

Introduction to PDEs in graph-based learning

We'll give an introduction to PDE analysis and applications in graph-based-learning, with a focus on how analysis of PDEs can be used to understand graph-based learning algorithms. Topics will include pointwise consistency of graph Laplacians, spectral convergence, and regularity theory of equations involving graph Laplacians. The talk will be accessible to graduate students with some previous background in PDEs and probability.

Cristiana De Filippis
Schauder reloaded, Part II

I will focus on a novel nonlinear potential-theoretic approach to Schauder theory, developed in recent years to address longstanding open problems which had resisted progress for over half a century. This approach yields sharp Schauder-type results in nonuniformly elliptic settings, and identifies the precise borderline configurations for the validity of Schauder estimates.

Giovanni Franzina
A Nonlinear Persson Theorem

We present a variational definition of essential spectrum that suites nonlinear operators like the Dirichlet $p-$Laplacian. We extend Persson's Theorem to this framework, by relating the bottom of the essential spectrum to the sharp Poincaré constant at infinity. Based on a joint work with Luca Briani and Lorenzo Brasco.

Ryan Hynd
Extremals for a family of fractional Sobolev inequalities

I will discuss an ongoing project on Sobolev inequalities involving two fractional seminorms. The main focus will be the existence of extremals and approaches to understanding their qualitative properties. This is joint work with Pierre Feulefack and Erik Lindgren.

Espen Jakobsen
On fully nonlinear parabolic mean field games

We introduce a class of fully nonlinear parabolic Mean Field Games systems (PDEs) corresponding to Mean Field Games with controlled local and/or nonlocal diffusion. After a heuristic derivation, we will focus on 3 model problems: (i) Nondegenerate local 2nd order problems, (ii) Nondegenerate nonlocal problems (e.g. with fractional Laplacians), and (iii) a degenerate nonlocal problem. In all cases we give existence and uniqueness results and discuss proofs. Some highlights we may be able to touch upon: A moment free theory of MFGs, uniqueness of MFGs without strict convexity or strict monotonicity, existence for MFG without uniqueness for Fokker-Planck, uniqueness for a Fokker-Planck equation with degenerate non-Lipschitz coefficient via non-standard viscosity solution doubling of variables. This talk is based on joint work with Milosz Krupski (Wroclaw) and Indranil Chowdhury (Kanpur) contained in the two papers: SIMA 2024 `https://epubs.siam.org/doi/epdf/10.1137/23M1615528` and JDE 2025 `https://doi.org/10.1016/j.jde.2025.113436`.

Vesa Julin
Harnack inequality for degenerate fully nonlinear parabolic equations

I will discuss degenerate fully nonlinear parabolic equations that generalize the p-parabolic equation for $p > 2$ in nondivergence form. Our main results are an intrinsic Harnack inequality for nonnegative solutions and a weak Harnack inequality for nonnegative supersolutions. These theorems can be seen as nondivergence-form analogues of the results of DiBenedetto–Gianazza–Vespri (2008) and Kuusi (2008).

Erik Lindgren
Comparison principles and uniqueness for problems related to the infinity Laplacian

The talk will take as its starting point my first joint paper with Peter Lindqvist on stability for an inhomogeneous equation involving the infinity Laplacian, which marked the beginning of a very fruitful collaboration and friendship. I will discuss comparison principles and uniqueness questions for problems related to the infinity Laplacian, with particular emphasis on inhomogeneous cases. I will also present some recent progress concerning nonlocal versions of the infinity Laplacian.

Juan Manfredi
A Mathematical Tribute to Peter Lindqvist

Giuseppe Mingione
Schauder reloaded, Part I

Schauder theory is one of the two major perturbation theories developed for elliptic and parabolic problems, the other being the Calderón–Zygmund theory. It began in the 1920s, when the concept of a priori estimates emerged, closely intertwined with the then-developing theory of abstract function spaces. These spaces were introduced in order to provide general, abstract frameworks for proving the existence of solutions to PDEs that were otherwise inaccessible by more classical methods. Since then, the theory has developed in several directions. I will try to give a brief account of a few relevant approaches and milestones, eventually leading to more recent developments in nonuniformly elliptic settings. These will then be discussed in depth by Cristiana De Filippis in the second part.

Julio D. Rossi
Asymptotic mean value formulas for nonlinear PDEs

It is well-known that there is a mean value formula that characterizes harmonic functions; a function u is harmonic (u is a solution to $\Delta u = 0$) if and only if u satisfies the mean value property

$$u(x) = \fint_{B_\varepsilon(x)} u(y)\, dy. \tag{0.1}$$

In fact, a weaker statement is enough to characterize harmonicity: A continuous function u is harmonic in Ω if and only if u verifies the asymptotic mean value formula

$$u(x) = \fint_{B_\varepsilon(x)} u(y)\, dy + o(\varepsilon^2) \quad \text{as } \varepsilon \to 0. \tag{0.2}$$

In recent years there has been an increasing interest in whether mean value properties can be extended in some weak form to characterize solutions to nonlinear equations. This question has been partially motivated by the surprising connection between Random Tug-of-War games and the normalized $p-$Laplacian discovered some years ago, where a nonlinear asymptotic mean value property for solutions of a PDE is related to a dynamic programming principle for an appropriate game.

In this talk we will review some recent results concerning asymptotic mean value formulas for different nonlinear elliptic equations including the classical Monge-Ampère equation, fully nonlinear equations, the $p-$Laplacian and we will also comment on some parabolic extensions.

Based on several collaborations with P. Blanc (Buenos Aires), F. Charro (Detroit), J.J. Manfredi (Pittsburgh), A. Miranda (Buenos Aires), F. Del Teso (Madrid) and C. Moran (Madrid).

Eero Saksman

On a random Dirichlet series and integral means spectra

We consider a random Dirichlet series that has some interesting properties with regards to integral means spectrum problems in univalent mapping. The talk is based on collaboration with Bertrand Duplantier (Universite Paris-Saclay, CEA, CRNS) and Veronique Gayrard (Aix Marseille Univ.).

Saara Sarsa

Regularity results for a p-Laplacian type equation in non-divergence form

We consider viscosity solutions to equation $-|Du|^\gamma \Delta_p^N u = f$ where $\gamma > -1$ and $p > 1$. This equation generalizes both the classical inhomogeneous p-Laplace equation and its normalized version that arises from stochastic game theory. We prove that the Hessian D^2u is locally square-integrable under some restrictions to the ranges of γ and p. Our results improve the previous results by Attouchi and Ruosteenoja (2018). The talk is based on joint work with Yawen Feng (JYU) and Mikko Parviainen (JYU).

Armin Schikorra

Calderón-Zygmund Theory and Uniqueness for p-Laplacian and for $p = 2$ and for A_p weights

Calderón-Zygmund theory for the Laplace equation is among the most classical results in Harmonic Analysis. It was conjectured by Iwaniec in 1983 that an analogue theory holds for the p-Laplace – and it can be disproved by surprisingly simple arguments following ideas by Colombo and Tione using convex integration laminates. I will also discuss versions of these results when $p = 2$, nonlinear as well as a linear version with A_p weights. Based on joint works with Martin Ulmer, Akshara Vincent.

Jarkko Siltakoski

On the regularity of solutions to Trudinger's equation

Trudinger's equation is a doubly nonlinear equation that was originally suggested as an example of an equation that may have a simpler Harnack's inequality than the standard p-parabolic equation. In this talk, we discuss some recent developments regarding the regularity of solutions.

Bianca Stroffolini

A journey across general growth problems

I will review some old and recent results on elliptic and parabolic problems with general growth. Next, I will present a new proof of partial regularity for double phase systems based on general growth techniques, obtained in collaboration with Jihoon Ok and Giovanni Scilla. Furthermore, I will present some recent results concerning the parabolic case.

José Miguel Urbano

A sharp differentiability threshold for minimizers of singular energies

We address the borderline regularity of local minimizers of singular energy functionals. For bounded and measurable potentials, we show that sign-changing minimizers are Log-Lipschitz continuous, which is optimal in this generality. In the one-phase case, however, we derive gradient bounds along the free boundary, uncovering a structural gain in regularity. Our first main result establishes sharp Lipschitz regularity for a merely bounded potential. Most notably, we prove that if the potential is further assumed to be a modulus of continuity, then minimizers become continuously differentiable. We thus identify a sharp threshold for differentiability in terms of the potential's regularity.

This is joint work with D. Araújo (UFPB), A. Sobral (KAUST), and E. Teixeira (OSU).