# SCIENTIFIC PROGRAM

## MONDAY, JUNE 1, 2026

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| 8:00 | **Registration** |
| 8:50 | **Opening ceremony** |
| 9:00–9:50 | **Differential operator based function spaces**<br>*Franz Gmeineder \| University of Konstanz* |
| 10:00–10:50 | **Minkowski combination of functions and its application to PDEs**<br>*Paolo Salani \| University of Florence* |
| 10:50–11:20 | **Coffee break** |
| 11:20–12:10 | **Sobolev Inequalities and the Geometry of L1**<br>*Daniel Spector \| National Taiwan Normal University* |
| 12:10–13:40 | **Lunch break** |
| 13:40–14:30 | **Singular Brascamp-Lieb estimates and quantitative convergence of ergodic averages**<br>*Polona Durcik \| Chapman University* |
| 14:30–15:00 | **Coffee break** |
| 15:00–15:15 | **Rough averages of triangular Hilbert transforms**<br>*Lenka Slavíková \| Charles University* |
| 15:15–15:30 | **Properties of certain functional generated by two rearrangement-invariant spaces**<br>*David Kubíček \| Charles University* |
| 15:30–15:45 | **A new class of function spaces generalizing the Arias-de-Reyna space**<br>*Jan Moldavčuk \|Charles University* |
| 15:45–16:00 | **Optimal stability of Dirichlet problems for the regional fractional p-Laplacian**<br>*Guy Foghem \| B-TU Cottbus* |
| 16:00–16:15 | **The Logarithmic Laplacian and Nonlocal Stochastic Completeness on Complete Riemannian Manifolds**<br>*Rui Chen \| Brandenburg University of Technology Cottbus-Senftenberg* |
| 16:15–16:30 | **Boundedness of anisotropic operators on vanishing Morrey type spaces**<br>*Farah Alissa Binti Mislar \| University of Salerno* |

16:30–16:45 **Sawyer Type Duality in Lebesgue and Orlicz Spaces**
*Pankaj Jain | South Asian University*

16:45–17:00 **On Wavelets with Extended Gevrey Regularity**
*Filip Tomic | University of Novi Sad*

17:00–17:15 **Boundedness of the segment multiplier on rearrangement-invariant spaces**
*Miguel Barea Fernandéz | Universidad Complutense de Madrid*

17:15–17:30 **The extrapolation theorems for weighted generalized Morrey spaces**
*Ayşenur Aydoğdu | Ankara University*

17:30–17:45 **Multipoint Characterization of Higher-Order Sobolev Spaces**
*Kacper Kurowski | Warsaw University of Technology*

## TUESDAY, JUNE 2, 2026

9:00–9:50 **Maximal Functions and Mean Oscillation**
*Ryan Gibara | Cape Breton University*

10:00–10:50 **Differential operator based function spaces**
*Franz Gmeineder | University of Konstanz*

10:50–11:20 **Coffee break**

11:20–12:10 **Gradient Estimates and Numerical Analysis of Nonlinear Problems with Differential Forms on Riemannian Manifolds**
*Anna Balci | Bremerhaven University of Applied Sciences*

12:10–13:40 **Lunch break**

13:40–14:30 **A Unified Approach to Optimality in Orlicz Spaces**
*Vít Musil | Masaryk University*

14:30–15:00 **Coffee break**

15:00–15:15 **On the extrapolation of bilinear compact operators in the variable exponent setting**
*Stefanos Lappas | University of Bonn*

15:15–15:30 **Mean ergodicity for composition operators on rearrangement-invariant spaces**
*Dalimil Peša | University of Pardubice*

15:30–15:45 **Quantitative non-compactness properties of the Fourier transform**
*Ladislav Drážný | Charles University*

**15:45–16:00** **Interior a priori estimate for higher order elliptic systems in Orlicz spaces**
*Pia Salerno | University of Salerno*

**16:00–16:15** **Optimal Embeddings of Campanato and Morrey Spaces**
*Zuzanna Stępień | Warsaw University of Technology*

**16:15–16:30** **Regularity of maximal functions and a Vitali covering lemma for the boundary**
*Julian Weigt | The Abdus Salam International Centre for Theoretical Physics*

**16:30–16:45** **Pointwise multipliers of function spaces related to Rosenthal's inequality**
*Jakub Tomaszewski | Poznań University of Technology*

**16:45–17:00** **The number of closed ideals in the algebra of bounded operators on rearrangement invariant function spaces**
*Tomasz Kiwerski | Poznań University of Technology*

**17:00–17:15** **A Pointwise Inequality for Rough Singular Integral Operators and Applications**
*Liviu Gabriel Marcoci | Technical University of Civil Engineering*

**17:15–17:30** **Pointwise Estimates for Rough Singular Operators on Ahlfors Regular Metric Measure Spaces**
*Anca Nicoleta Marcoci | Technical University of Civil Engineering*

**17:30–17:45** **On Sharp Constants in Equivalent Norms for Classical Banach Spaces**
*Achraf Ben Said| Complutense University of Madrid*

## WEDNESDAY, JUNE 3, 2026

**9:00–9:50** **Minkowski combination of functions and its application to PDEs**
*Paolo Salani | University of Florence*

**10:00–10:50** **Sobolev Inequalities and the Geometry of $L^1$**
*Daniel Spector | National Taiwan Normal University*

**11:50–11:20** **Coffee break**

**11:20–12:10** **Understanding and Using Modern AI Tools in Mathematical Research**
*Vít Musil | Masaryk University*

**12:10–13:40** **Lunch break**

**13:40–13:55** **Existence of constrained generalized minimizers for the Dirichlet problem on BV**
*Lukas Fußangel | University Konstanz*

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| 13:55–14:10 | **Degrees of non-compactness for some operators in Analysis (mainly Fourier Transform)**<br>*Jan Lang \| The Ohio State University* |
| 14:10–14:25 | **Relationship between limiting K-spaces and J-spaces in the real interpolation**<br>*Manvi Grover \| South Asian University* |
| 16:00–18:00 | **Sightseeing tour of Prague – walking tour** |
| | **Meeting point: Conference venue** |
| 18:00 | **Conference dinner** |

## THURSDAY, JUNE 4, 2026

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| 9:00–9:50 | **Gradient Estimates and Numerical Analysis of Nonlinear Problems with Differential Forms on Riemannian Manifolds**<br>*Anna Balci \| Bremerhaven University of Applied Sciences* |
| 10:00–10:50 | **Singular Brascamp-Lieb estimates and quantitative convergence of ergodic averages**<br>*Polona Durcik \| Chapman University* |
| *10:50–11:20* | *Coffee break* |
| 11:20–12:10 | **The LGC method: a study guide on some recent advancements in Fourier analysis**<br>*Victor Lie \| Purdue University* |
| 12:10–13:40 | **Lunch break** |
| 13:40–13:55 | **Noncommutative level functions**<br>*Alejandro Santacruz Hidalgo \| Poznan University of Technology* |
| 13:55–14:10 | **Mikusinski's operational calculus and its application to fractional PDEs**<br>*Arran Fernandez \| Eastern Mediterranean University* |
| 14:10–14:25 | **Looking for a continuous version of Bennett–Carl theorem**<br>*Karol Lesnik \| Adam Mickiewicz University in Poznan* |
| *14:30–15:00* | *Coffee break* |
| 15:00–15:15 | **Self-improving property for certain degenerate functionals with generalized Orlicz growth**<br>*Vertti Hietanen \| University of Helsinki* |
| 15:15–15:30 | **Relations between sequence spaces**<br>*Hanuš Kameník \| Charles University* |

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| 15:30–15:45 | **Fractional-Order Systems with Response Depending on Infinite Time Interval of History**<br>*Jacek Gulowski \| University of Gdańsk* |
| 15:45–16:00 | **On the Density of a Sinusoidal Signal Combined with Gaussian Noise**<br>*Dragana Jankov Maširević \| Josip Juraj Strossmayer University of Osijek* |
| 16:00–16:15 | **Weyl-type operators on weighted Bergman spaces: Berezin range and Berezin number**<br>*Anirban Sen \| Silesian University in Opava* |
| 16:15–16:30 | **Abstract Kadets–Klee properties in infinite direct sums**<br>*Paweł Kolwicz \| Poznan University of Technology* |
| 16:30–16:45 | **Generalized Potential Operators in Weighted Grand Herz Spaces**<br>*Almat Orazbayev \| Nazarbayev University* |
| 16:45–17:00 | **On grand Morrey sequence spaces**<br>*Aizhan Tulendinova \| Nazarbayev University* |
| 17:00–17:15 | **A unified approach to compactness in normed spaces**<br>*Piotr Kasprzak \| Adam Mickiewicz University in Poznan* |
| 17:15–17:30 | **Spline Characterizations of Function Spaces Measuring Smoothness**<br>*Andrew Haar \| Charles University* |

## FRIDAY, JUNE 5, 2026

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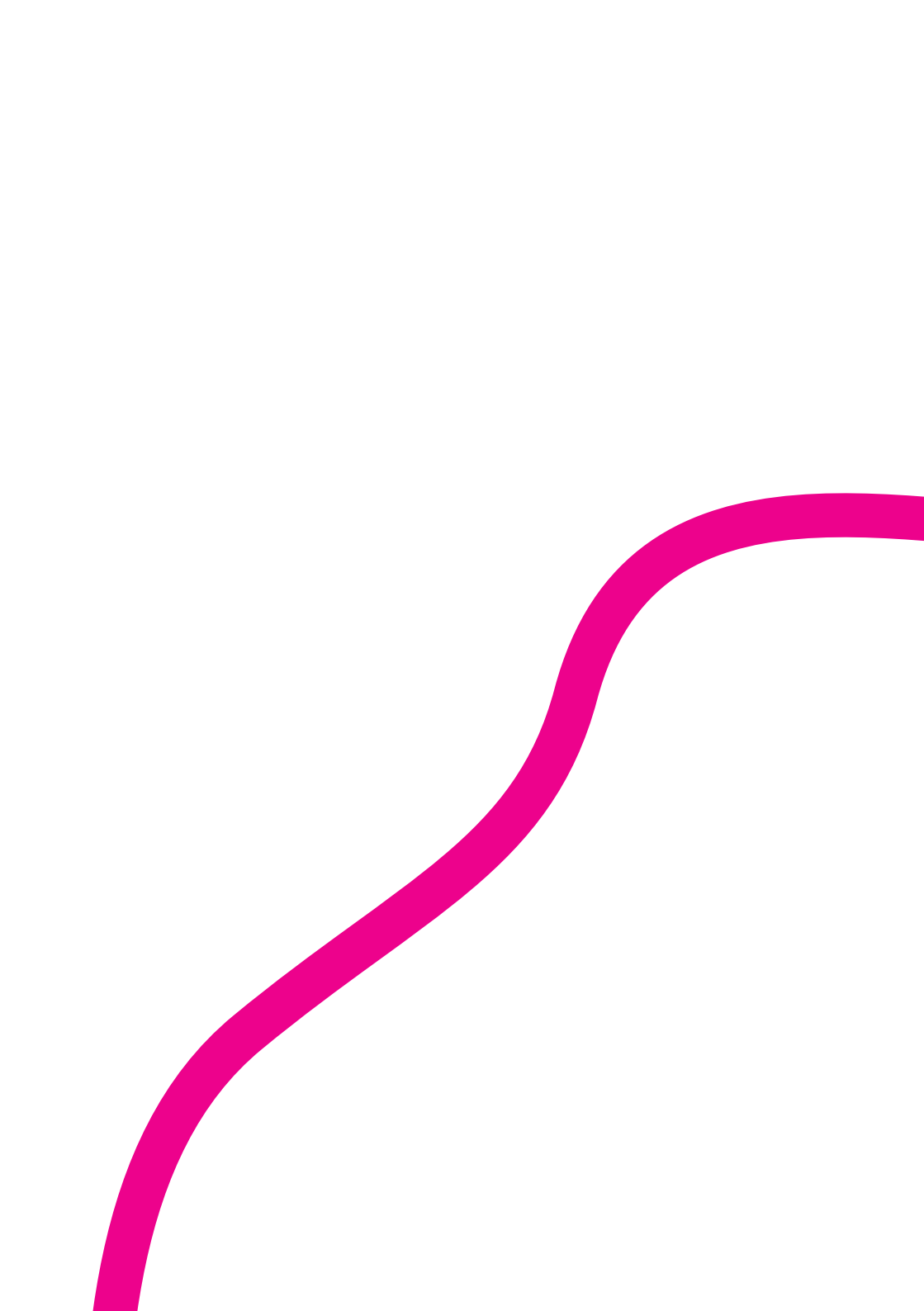
| 9:00–9:50 | **The LGC method: a study guide on some recent advancements in Fourier analysis**<br>*Victor Lie \| Purdue University* |
| 10:00–10:50 | **Maximal Functions and Mean Oscillation**<br>*Ryan Gibara \| Cape Breton University* |
| *10:50–11:20* | *Coffee break* |
| **11:20–11:30** | **Closing ceremony** |



# ABSTRACTS

Abstracts are listed in alphabetical order by the author's surname.

# Gradient Estimates and Numerical Analysis of Nonlinear Problems with Differential Forms on Riemannian Manifolds

Anna Balci

Bremerhaven University of Applied Sciences

**Abstract**

The first lecture will focus on the analysis of nonlinear problems involving differential forms. We consider systems in which the exponent of nonlinearity varies across the domain, a setting that effectively models so-called "smart" materials. Our work addresses a long-standing gap in the theory by extending classical results previously restricted to constant exponents to a more flexible and technically challenging variable-exponent framework. By combining nonlinear Hodge theory with variable-exponent spaces, we develop a theoretical foundation that supports the numerical treatment of practical three-dimensional problems arising in semiconductor modeling and electromagnetism. The focus of the second lecture will be on numerical analysis using the finite element method for such problems.

# Singular Brascamp-Lieb estimates and quantitative convergence of ergodic averages

Polona Durcik

Chapman University

**Abstract**

Many problems in ergodic theory concern averages along the orbits of one or more transformations, with the classical Birkhoff averages as a basic example. A central question is in what sense these averages converge, for instance in the $L^2$ norm or pointwise almost everywhere. This series of talks will focus on multilinear averages taken with respect to multiple commuting measure-preserving transformations. While their convergence in norm is known, pointwise convergence remains a major open problem in general. Standard proofs typically yield only limited quantitative information on the rate of convergence. We will discuss how qualitative convergence can be approached via stronger quantitative variation norm estimates, and how methods from real harmonic analysis can be used to obtain such estimates. This naturally leads to the study of $L^p$ bounds for certain singular Brascamp-Lieb integrals. We will survey recent progress, ongoing work, and related open problems.

# Maximal Functions and Mean Oscillation

Ryan Gibara

Cape Breton University

**Abstract**

In 1981, a seminal paper of Bennett, DeVore, and Sharpley contains the proof that the classical Hardy-Littlewood maximal operator is bounded on the space BMO of functions of bounded mean oscillation. In these two lectures, we will discuss generalisations of this result to other maximal operators, including fractional ones, and other function spaces defined by mean oscillation, including the space VMO of functions of vanishing mean oscillation.

# Differential operator based function spaces

Franz Gmeineder

University of Konstanz

**Abstract**

In these lectures, we give an introduction to function spaces which impose integrability conditions on differential expressions. Such spaces arise naturally in applications, but often differ from the usual Sobolev spaces in a variety of respects. It is then particularly crucial to examine which properties survive when passing to weaker expressions than the full gradients. With a particular focus on (trace) embeddings, we survey recent developments and techniques in the field. The latter especially applies to the borderline case $p = 1$, which leads to the recently introduced functions of bounded A-variation.

# The LGC method: a study guide on some recent advancements in Fourier analysis

Victor Lie

Purdue University

**Abstract**

In this mini-course we will discuss a versatile method initiated by the speaker and further developed in some joint works in order to analyze the boundedness properties of large classes of maximal/oscillatory/multi-linear operators.

This so-called **LGC-method** consists of three basic steps:

- phase ***(L)****inearization*: the time/frequency plane is discretized in regions within which both both the argument of the input functions and the phase of the multiplier associated to the operator under analysis oscillates at the linear level;
- ***(G)****abor* frame discretization: within each of the regions obtained at the first item, one performs an adapted wave-packet decomposition of the input functions;
- ***C****ancelation* via *time-frequency **(C)****orrelation*: the resulting discretized model operator is now analyzed based on various tools such as
  - a sparse-unform dichotomy addressing the size distribution of the Gabor coefficients;
  - a level set analysis with respect to the structure of the time-frequency correlation set.

As a consequence of this methodology (Rank I LGC) one can provide a unified approach to three main themes in Harmonic Analysis:

- The linear Hilbert transform and maximal operator along variable curves;
- Carleson-type operators in the presence of curvature;
- The bilinear Hilbert transform and maximal operator along variable curves.

We will also outline more recent developments of this method (including Rank II LGC) covering higher complexity classes of operators among which we mention:

- the $n-$linear Hilbert transform along the moment curve:

$$T_C(f_1, f_2, \dots, f_n)(x) := \text{p.v.} \int_{\mathbb{R}} f_1(x-t) f_2(x+t^2) \dots f_n(x+t^n) \frac{dt}{t}, \quad x \in \mathbb{R}\,.$$

- the hybrid trilinear Hilbert transform:

$$T_H(f_1, f_2, f_3)(x) := \text{p.v.} \int_{\mathbb{R}} f_1(x-t) f_2(x+t) f_3(x+t^3) \frac{dt}{t}, \quad x \in \mathbb{R}\,.$$

- the 2D Carleson–Radon transform:

$$CR(f)(x,y) := \sup_{a \in \mathbb{R}} \left| \text{p.v.} \int_{\mathbb{R}} f(x-t^{\alpha_1}, y-t^{\alpha_2}) \, \frac{e^{a\, i\, t^{\alpha_3}}}{t} \, dt \right|, \quad (x,y) \in \mathbb{R}^2\,,$$

  for some suitable choices of $\{\alpha_j\}_{j=1}^3 \subset \mathbb{R}_+$.

If time allows we will mention some interesting applications/connections with the areas of ergodic and number theory.

Vít Musil

Masaryk University

**Abstract**

## A Unified Approach to Optimality in Orlicz Spaces

In mathematical modeling, data and solutions are often represented by measurable functions, with their quality described via membership in suitable function spaces. A key analytical question is the relationship between the regularity of data and solutions, and whether the resulting estimates are optimal. Addressing optimality requires function spaces that balance expressivity with practical accessibility. We present a unified approach to optimality problems in Orlicz spaces, a flexible class of spaces determined by a single convex function. We establish a general principle providing easily verifiable necessary and sufficient conditions for the existence of optimal Orlicz spaces in various settings, and illustrate it on problems such as Sobolev embeddings and boundedness of operators, including the Hardy–Littlewood maximal operator and the Laplace transform.

## Understanding and Using Modern AI Tools in Mathematical Research

Artificial intelligence has undergone a rapid transformation in recent years, evolving from advances in neural network architectures to systems capable of reasoning, coding, and autonomous multi-step problem solving. This talk provides an overview of modern AI, explaining the key ideas behind contemporary language models and agentic AI while separating realistic capabilities from hype. Particular emphasis is placed on how these tools are already influencing research and scientific writing.

# Minkowski combination of functions and its application to PDEs

Paolo Salani

University of Florence

**Abstract**

Minkowski addition of sets is a crucial operation in the theory of convex bodies (whose central result is the Brunn-Minkowski inequality, which states that the Lebesgue measure raised to power $1/n$ is concave with respect to this addition in $\mathbb{R}^n$). The functional version of this operation is infimal convolution, which can be used to investigate several aspects of the theory of partial differential equations. In particular, I will describe a technique, based on infimal convolution, which permits to investigate concavity/convexity properties of solutions to elliptic and parabolic problems and to obtain related geometric-analytic inequalities and Talenti's like results for equations in non divergence form.

# Sobolev Inequalities and the Geometry of $L^1$

Daniel Spector

National Taiwan Normal University

**Abstract**

After the seminal work of Bourgain and Brezis in their 2004 CR Note and 2007 JEMS paper, the theory of Sobolev inequalities in $L^1$ has been rapidly developed over the last two decades. While a basic example of such results has been known since the 1970s - the Korn-Sobolev inequality of M.J. Strauss - these surprising inequalities in $L^1$ seem to have been largely unnoticed, perhaps because of their complicated dependence on the vector structure of the differential operators (This is in contrast to the scalar case where only the gradient appears.). The characterization of homogeneous vector differential operators which support such inequalities is due to Van Schaftingen through the introduction of the somewhat mysterious cancelation condition. This mystery served as the impetus for the speaker, in collaboration with Dmitriy Stolyarov, to introduce so-called dimension stable spaces of measures. These spaces consist of scalar measures, which, absent the vector structure of canceling differential operators, capture some of their essential features, for example various Sobolev inequalities and dimension estimates. In this series of talks we discuss in more detail the motivation for these spaces, as well as to give their definition, examples, and applications. If time permits, we mention a recent application obtained with Riju Basak concerning estimates for the wave equation with data in these spaces.