# The Prague seminar on function spaces

## Lectures of the past

# Journey through time

# 1991

October 11

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Friedrichs inequality in weighted spaces - amalgams in $L^p$ and $L^q$ (joint work with H.P. Heinig)*

October 25, November 1

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Poincaré and Friedrichs inequality in Orlicz-Sobolev spaces (joint work with D.E. Edmunds and L. Pick)*

November 8

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Approximation property of weighted Orlicz spaces (joint work with L. Pick)*

November 15, 22, December 13

**Petr Gurka (Czech University of Agriculture, Prague)**
*$A_\infty$ conditions on $\mathbb{R}^1$ with general measure (joint work with L. Pick)*

December 18, 20

**Luboš Pick (University of Wales, Cardiff)**
*The Hardy operator, $L^\infty$, and BMO (joint work with Q. Lai)*

# 1992

January 6

**Luboš Pick (University of Wales, Cardiff)**
*Weighted inequalities for the Hardy operator in Orlicz classes*

January 17

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Density of smooth functions in the space $W^{k,p(x)}(\Omega)$ (joint work with D.E. Edmunds)*

January 24 and 31

**Jan Lang (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted norm inequalities involving gradients (paper by C. Carton-Lebrun and H.P. Heinig)*

February 14, 21

**Aleš Nekvinda (Czech Technical University, Prague)**
*Traces of a weighted Sobolev space*

March 13, 20

**Hana Blovská (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Inequalities by majorization (from a book by A. Marshall and J. Olkin)*

April 10, 14

**Luboš Pick (University of Wales, Cardiff)**
*One-sided better $\lambda$-inequalities*

April 28

**Jan Lang (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Traces of weighted Sobolev spaces (joint work with A. Nekvinda)*

May 12, 15

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences,**

**Prague)**
*Weighted inequalities and degenerate elliptic PDEs (paper by E.W. Stredulinsky)*


May 22

**Thomas Strömberg (Lulea University of Technology)**
*Some Young type inequalities with applications*


May 29

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Reverse Hölder inequalities withconstants close to 1 (paper by I. Wik)*


June 5, 8

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Smooth approximations of Sobolev functions on planar domains (paper by W. Smith, A. Stanoyevitch and D.A. Stenenga)*


October 22

**Thomas Schott (Friedrich Schiller Universität, Jena)**
*Inequalities of Hardy type*

# 1993

January 8, 11

**Luboš Pick (University of Wales, Cardiff)**
*Weighted Orlicz space integral inequalities for the Hardy-Littlewood maximal operator (paper by S. Bloom and R. Kerman)*

April 5, 13

**Luboš Pick (University of Wales, Cardiff)**
*Compactness of Hardy-type operators in weighted Banach function spaces (joint work with D.E. Edmunds and P. Gurka)*

August 12

**David E. Edmunds (University of Sussex, Brighton)**
*Poincaré inequalities and Minkowski dimension*

August 12

**W. Des Evans (University of Wales, Cardiff)**
*Hardy inequalities on trees (joint work with D.J. Harris and L. Pick)*

September 6, 10, 13

**Luboš Pick (University of Wales, Cardiff)**
*Poincaré inequalities on trees (joint work with W.D. Evans and D.J. Harris)*

October 4

**Hans-Jürgen Schmeisser (Friedrich Schiller Universität, Jena)**
*Approximation of functions by generalized sampling series*

September 27, October 11, 18

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Double exponential integrability of convolution operators in generalized Lorentz-Zygmund spaces (joint work with D.E. Edmunds and P. Gurka)*

November 8

**Ryskul Oinarov (Alma Ata State University)**

*Two-weight Hardy inequality*

November 15

**Ryskul Oinarov (Alma Ata State University)**
*Weighted inequalities for resolvent of spectrum of Riemann-Liouville operator*

November 1, 22, 29

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Generalized ridged domains (paper by W.D. Evans and D.J. Harris)*

December 6, 13

**Aleš Nekvinda (Czech Technical University, Prague)**
*Traces of weighted anisotropic Sobolev spaces (joint work with J. Lang)*

December 20

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Duality between gehring and Muckenhoupt classes (paper by M. Carozza)*

# 1994

January 5

**Luboš Pick (University of Wales, Cardiff)**
*The Hardy operator, $L^\infty$ and BMO*

February 2, 9, 16, 23, March 9, 16

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Banach Function Spaces (from a book by C. Bennett and R. Sharpley)*

January 19, 26

**Petr Gurka (Czech University of Agriculture, Prague)**
*Muckenhoupt's and Sawyer's conditions for maximal operators (paper by Y. Rakotondratsimba)*

March 22, 29

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Two limiting cases of Sobolev embeddings (joint work with D.E. Edmunds)*

April 20, 27

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The Hardy constant (paper by E.B. Davies)*

May 4

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Hardy inequalities for fractional order derivatives*

May 11, 18

**Petr Gurka (Czech University of Agriculture, Prague)**
*Two-weight inequality for fractional maximal operator (paper by R.L. Wheeden)*

October 19

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The Hardy operator and the gap between $L^\infty$ and BMO (joint work with J. Lang)*

October 26

**Aleš Nekvinda (Czech Technical University, Prague)**
*Difference between continuity and absolute continuity of norm in Banach function spaces (joint work with J. Lang)*

November 2

**Jan Lang (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Embeddings of weighted Orlicz-Lorentz spaces (joint work with M. Krbec)*

November 9, 16, 23

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Remarks on Poincaré inequalities (joint work with R.C. Brown and D.E. Edmunds)*

November 30

**Petr Gurka (Czech University of Agriculture, Prague)**
*Weighted Poincaré inequalities (joint work with D.E. Edmunds and A. Cianchi)*

December 7

**Sun Jiong (Inner Mongolia University, China)**
*Self-adjoint boundary conditions of the Schrödinger operator*

December 14

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Interpolation inequality with Hölder norms*

# 1995

January 18

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Elementary proof of Hardy's inequality (paper by G. Sinnamon and V. Stepanov)*


January 25, February 1, 8

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Double exponential integrability, Bessel potentials and imbedding theorems (joint work with D.E. Edmunds and P. Gurka)*


February 22

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Imbeddings of weighted Orlicz-Lorentz spaces (joint work with J. Lang)*


March 18

**Aleš Nekvinda (Czech Technical University, Prague)**
*Continuity and absolute continuity of norm in Banach function spaces (joint work with J. Lang)*


March 22, 29

**Petr Gurka (Czech University of Agriculture, Prague)**
*Sharpness of embeddings in logarithmic Sobolev spaces (joint work with D.E. Edmunds and B. Opic)*


April 5, 12, 26

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Interpolation of operators on scales of generalized Lorentz-Zygmund spaces (joint work with W.D. Evans and B. Opic)*


April 19

**Hans P. Heinig (McMaster University, Hamilton, Ontario)**
*Sharp Orlicz space inequalities for the Paley-Titchmarsh inequality)*

May 10

**Hans P. Heinig (McMaster University, Hamilton, Ontario)**
*Duality principle on the cone of monotone functions in Orlicz spaces*


June 14

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Hardy's inequality for derivatives of fractional order*


June 20, 28

**Mario Milman (Florida Atlantic University, Boca Raton)**
*Extrapolation theory and some of its applications to analysis*


June 20

**Andrea Cianchi (University of Florence)**
*Sobolev embedding theorem for Orlicz spaces*


September 13

**Amiran Gogatishvili (Mathematical Institute Georgian AS, Tbilisi)**
*Weighted strong type inequalities for integral transforms with positive kernels*


September 20, 27, October 4

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Norm inequalities for derivatives and differences (book by M.K. Kwong and A. Zettl)*


October 11

**Thomas Schott (Friedrich Schiller Universität, Jena)**
*Atomic decomposition of Lizorkin-Triebel spaces with exponential weights*


October 18, 25

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**

*Indices in Orlicz spaces and applications to variational integrals (joint work with A. Fiorenza)*


November 1, 8

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Limiting embeddings of weighted Sobolev spaces (joint work with T. Schott)*


November 15

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Extrapolation of reduced Sobolev embeddings (joint work with H.-J. Schmeisser)*


November 20

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*N-dimensional weighted Hardy inequality*


November 27, December 13, 20

**Aleš Nekvinda (Czech Technical University, Prague)**
*Maximal difference between continuity and absolute continuity of a norm in Banach function spaces (joint work with J. Lang)*

# 1996

January 17, 24, February 14, 28

**Petr Gurka (Czech University of Agriculture, Prague)**
*Approximation numbers and entropy numbers of embeddings of fractional Besov-Sobolev spaces in Orlicz spaces (paper by H. Triebel)*

February 21

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The Hardy-Littlewood maximal function and Sobolev spaces on a metric space (paper by O. Martio)*

March 3

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On the adjoint of the maximal operator (paper by A. de la Torre)*

March 20

**Ron Kerman (Brock University, St. Catharines)**
*Weighted mean convergence of Fourier-Jacobi series*

March 27

**Ron Kerman (Brock University, St. Catharines)**
*Extrapolation from modular inequalities (joint work with S Bloom)*

May 15

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*N-dimensional weighted inequalities*

May 20

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*A note on Gehring's lemma (paper by M. Milman)*

June 6

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*A note on reversed Hardy's inequalities (paper by M. Milman)*


July 19, 26

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted norm inequalities for general operators on monotone functions (paper by S. Lai)*


August 7

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Hardy's inequality of fractional order*


August 24

**Anatoly A. Kilbas (Belarus State University, Minsk)**
*H-transforms on spaces of p-summable functions*


September 11

**Andrea Cianchi (University of Florence)**
*Boundedness of solutions of variational problems under general growth conditions*


September 18

**Alberto Fiorenza (University of Naples)**
*Regularity results about some Lagrange problems of calculus of variations*


September 25

**Alberto Fiorenza (University of Naples)**
*Grand $L^p$ spaces and applications*


November 6, 13, 20, December 11, 18

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague):**
*Optimal Sobolev embeddings on rearrangement-invariant spaces (joint works with*

*D.E. Edmunds and R. Kerman, and with A. Cianchi)*

# 1997

January 8, 15, 22

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Optimal Sobolev embeddings on rearrangement-invariant spaces (joint works with D.E. Edmunds and R. Kerman, and with A. Cianchi)*

January 29

**Winfried Sickel (Friedrich Schiller Universität, Jena)**
*Existence and regularity of the Jacobian determinants in the framework of potential spaces*

January 30, February 8

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Some remarks to Hardy's inequality*

February 12, 26

**Petr Gurka (Czech University of Agriculture)**
*Norms of embeddings of logarithmic Bessel potential spaces (joint work with D.E. Edmunds and B. Opic)*

April 5, 12, 19, 23, May 7, 14, 21

**Aleš Nekvinda (Czech Technical University, Prague)**
*Boundedness of general kernel operators from a Banach Function space into $L^\infty$ (joint work with J. Lang and L. Pick)*

April 30, May 7

**Ron Kerman (Brock University, St. Catharines)**
*Weighted mean convergence on semigroups (joint work with S. Thangavelu)*

May 28, June 4, 11, 25

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted inequalities for monotone and convex functions (paper by H.P. Heinig and L. Maligranda)*

June 2

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Global limiting embeddings of logarithmic Bessel potential spaces (joint work with P. Gurka)*


July 23

**Andrea Cianchi (University of Florence)**
*An optimal interpolation theorem of Marcinkiewicz type in Orlicz space*


August 8

**Gord Sinnamon (University of Western Ontario, London)**
*From Hardy's inequality to more general kernels*


September 3

**Henryk Hudzik (Adam Mickiewicz University, Poznań)**
*An inequality of Amemiya and Orlicz norms in Orlicz spaces*


September 10

**Mats Erik Andersson (KTH, Stockholm)**
*Bergman spaces in interpolation theory, two properties*


September 17, 24, October 1

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Generalizations of Hardy inequalities (paper by H.P. Heinig and G. Sinnamon)*


October 8

**Jan Lang (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Boundedness of generalized Hardy operators (joint work with A. Gogatishvili)*


October 15

**George Jaiani (Tbilisi State University)**
*Bending of a cusp plate with the profile of a general form*

October 22, 29

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On the domain and range of the maximal operator (joint work with A. Fiorenza)*

November 5, 12

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Pointwise and integral Hardy inequalities (paper by P. Hajlasz and J. Kinnunen, and joint work with D.E. Edmunds)*

November 19

**Mats Erik Andersson (KTH, Stockholm)**
*Geometry of inner maximal functions*

November 26

**Aleš Nekvinda (Czech Technical University, Prague)**
*On $L^{p(x)}$ norms*

December 3

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Some appendix to the Hardy inequality*

**Petr Gurka (Czech University of Agriculture, Prague)**
*Entropy numbers of embeddings of Sobolev spaces in Zygmund spaces (paper by D.E. Edmunds and Yu. Netrusov)*

# 1998

January 14

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted inequalities for Hardy operator with monotone weights (the paper by J. Cerda and J. Martín)*

January 21

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Higher order Hardy inequalities*

January 28

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Interpolation inequalities for sums with three weights (joint work with R.C. Brown and D. Hinton)*

February 4

**Pavel Drábek (University of West Bohemia, Pilsen)**
*Nonhomogeneous eigenvalue problems involving the p-Laplacian*

February 11, 18

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Extrapolation characterization of exponential Orlicz spaces (joint work with D.E. Edmunds)*

March 3, 25

**Petr Gurka (Czech University of Agriculture, Prague)**
*Entropy numbers of embeddings of Sobolev spaces in Zygmund spaces (the paper by Yu. Netrusov and D.E. Edmunds)*

June 3, 10, 17, 24

**Jan Lang (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Approximation numbers of Hardy operators (joint work with W.D. Evans and D.J.*

*Harris)*

October 7, 14, 22, November 4, 11

**Petr Gurka (Czech University of Agriculture, Prague)**
*Optimality of embeddings of logarithmic Bessel potential spaces (joint work with D.E. Edmunds and B. Opic)*

November 18, 26, December 2, 9

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On embeddings between classical Lorentz spaces (joint work with M. Carro, J. Soria and V.D. Stepanov)*

December 16, 23

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted inequalities for Volterra integral operators in Banach function spaces*

# 1999

January 6

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted inequalities for Volterra integral operators in Banach function spaces*


February 24, March 3, 10, 24, April 7, 14

**Petr Gurka (Czech University of Agriculture, Prague)**
*Atomic decomposition in Bessel potential spaces*


April 15

**Nigel Kalton (University of Missouri, Columbia, MO)**
*The maximal regularity problem (joint work with Gilles Lancier)*


April 21, 28

**Luboš Pick (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The dual of an optimal Sobolev domain (joint work with Ron Kerman)*


May 12

**David Cruz-Uribe, SFO (Trinity College, Hartford, CT)**
*Weighted norm inequalities for singular integrals and commutators (joint work with Carlos Pérez)*


May 19

**Piotr Hajlasz (University of Warsaw)**
*Sobolev classes on metric spaces*


May 19

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Sobolev embeddings with variable exponent*


May 19

**Hans-Gerd Leopold (Friedrich Schiller University, Jena)**

*Limiting embeddings in function spaces of Besov type and entropy numbers*


May 26

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Reverse Hölder inequalities in Orlicz classes*


August 3

**Alex Stanoyevitch (University of Guam)**
*Geometry of Hölder embeddings (joint work with Steve Buckley)*


August 4

**Laura de Carli (Universita di Napoli)**
*Unique continuation for a class of degenerate elliptic operators (joint work with T. Okaji)*


September 29

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Compactness of weighted embeddings*


October 6

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Decomposition in $L(\log L)^\alpha$*


October 20

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Elliptic equations with right hand side in Zygmund spaces*


October 27, November 11

**Stanislav Hencl (Charles University, Prague)**
*Boundary behaviour of absolutely continuous functions of several variables*


November 3

**Chérif Amrouche (Université du Pau)**
*Stokes and Navier-Stokes equations: An approach in Hardy and weighted Sobolev spaces*


November 17

**Jiří Rákosník (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On equivalence between weak and strong inequalities for Sobolev functions*


November 24

**Luboš Pick (Charles University, Prague)**
*Nash implies Sobolev (joint work with Jan Malý)*


December 8

**Pekka Koskela (University of Jyvaskylä)**
*Continuity of monotone functions*


November 24, December 15

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Sharp embeddings of Bessel potential spaces with logarithmic smoothness (joint work with Walter Trebels)*

# 2000

March 8, 15

**Luboš Pick (Charles University, Prague)**
*An elementary proof of sharp Sobolev embeddings (joint work with Jan Malý)*

March 29, April 5

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Duality principles and reduction theorems (joint work with Luboš Pick)*

April 12

**W. Des Evans (University of Wales, Cardiff)**
*On the approximation numbers of Hardy-type operators on trees (joint work with Desmond J. Harris and Jan Lang)*

April 19

**Takuya Sobukawa (Okayama University)**
*Extrapolation theory on $L^p$ spaces*

April 26

**Takuya Sobukawa (Okayama University)**
*Yano's theorem and the dual result*

May 3

**Takuya Sobukawa (Okayama University)**
*Extrapolation theory for Lorentz spaces*

May 10

**Takuya Sobukawa (Okayama University)**
*Characterization of $\sum_r$ spaces of the family $L^{p,q}$*

May 17

**Takuya Sobukawa (Okayama University)**
*On the characterization of $\sum_p$ spaces*

May 24, 31, June 6, 14

**Jan Lang (University of Missouri, Columbia)**
*Second asymptotics of the approximation numbers of Volterra operators*


June 21

**J.M. Almira (Universidad de Jaen)**
*Applications of a general theory of approximation spaces in classical analysis and approximation theory*


June 28

**Alberto Fiorenza (Universita di Napoli)**
*A class of Young functions*


September 6

**Walter Trebels (Technische Universitat Darmstadt)**
*Two - sided estimates for the approximation behavior of some linear means*

**Petteri Harjulehto (University of Helsinki)**
*Traces and Sobolev extension domains*


October 4, 11, 18

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Estimates of weak solutions of linear elliptic equations in weighted spaces (paper by A. Canale, L. Caso, M. Transirico: An extension of a theorem by C. Miranda in weighted spaces)*


October 25

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On maximal functions*


November 1

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On the uniqueness of maximal function*

November 8

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On reverse weak (1,1) type inequalities for maximal operators with respect to Borel measures*


November 15, 22

**Takuya Sobukawa (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Some open problems from extrapolation theory*


November 29, December 6, 13

**Petr Gurka (Czech University of Agriculture, Prague)**
*Sharp Sobolev embeddings and related Hardy inequalities (paper by David Edmunds and Hans Triebel)*

# 2001

January 3, 10

**Aleš Nekvinda (Czech Technical University, Prague)**
*Average operators on $\{l^{p_n}\}$ and $L^{p(x)}$*

March 14, 21, 28

**Luboš Pick (Charles University, Prague)**
*Sharp rearrangement estimates for Riesz potential in metric spaces (joint work with Jan Malý)*

April 4 and 18

**Jan Vybíral (Charles University, Prague)**
*Rearrangement of Hardy-Littlewood maximal functions in Lorentz spaces (paper by J. Bastero, M. Milman and F. Ruiz)*

April 11

**Evgennyi Pustylnik (Technion, Haifa)**
*New interpolation results for spaces of Lorentz-Zygmund type*

April 25

**Petr Honzík (Charles University, Prague)**
*Wolff potentials*

May 2

**Serguei Vodop'yanov (Novosibirsk State University)**
*Quasiregular mappings in non commutative geometry*

May 16, 23

**Jan Vybíral (Charles University, Prague)**
*Distribution and rearrangement estimates of the maximal function and interpolation (paper by I.U. Asekritova, N.Y. Krugljak, L. Maligranda and L.E. Persson)*

June 6

**Takuya Sobukawa (Okayama University, Japan)**
*On the extrapolation estimates (joint work with Amiran Gogatishvili)*

June 13

**Lasha Emphremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Faktorization of positive definite matrix–functions and its applications to the Wiener–Kolmogorov prediction theory of stationary processes*

June 20

**Michael Solomyak (Weizmann Institute, Rehovot, Israel)**
*Geometry of the Sobolev spaces on a regular metric tree and Hardy inequalities*

June 26

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Duality principle in Lorentz spaces and applications*

September 12

**Fernando Cobos (Unversidad Complutense, Madrid)**
*Some recent results on interpolation of compact operators*

October 10

**Alberto Fiorenza (Universita di Napoli)**
*Some questions about Sobolev spaces with variable exponent*

October 24

**Alex Balinsky (University of Wales, Cardiff)**
*On the zero modes of Pauli operators*

October 31 and November 7

**Jan Vybíral (Charles University, Prague)**
*New Extrapolation Estimates (paper by María Carro)*

November 14

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**

*Rearrangement Inequality for the Ergodic Maximal Function*


November 21, 28 and December 5

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Recent Developments in the Theory of Lorentz Spaces and Weighted Inequalities (book by M.J. Carro, J.A. Raposo and J. Soria)*


December 5

**Nobuhiko Fujii (Tokai University, Shizuoka, Japan)**
*On Calderón's reproducing formula*


December 12, Workshop on function spaces

**Desmond J. Harris (University of Wales, Cardiff, UK)**
*Dirichlet-Neuman bracketing in $L^p$,*

**W. Des Evans (University of Wales, Cardiff, UK)**
*On the zero modes of Pauli and Dirac operators,*

**Hans-Juergen Schmeiszer (Friedrich Schiller University, Jena, Germany)**
*Vector-valued function spaces and sharp embeddings*

# 2002

January 9, February 6

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Recent Developments in the Theory of Lorentz Spaces and Weighted Inequalities (book by M.J. Carro, J.A. Raposo and J. Soria)*

February 13, March 20

**Jan Vybíral (Charles University, Prague)**
*Extrapolation theory for the real interpolation method (paper by María Carro)*

March 27

**Lasha Ephremidze (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The generalization of Stein-Weiss theorem for the ergodic Hilbert transform*

April 3

**Vakhtang Kokilashvili (Mathematical Institute Georgian AS, Tbilisi)**
*Boundary value problems for analytic and harmonic functions with boundaries from Zygmund classes*

April 10

**David Edmunds (University of Sussex, Brighton)**
*Compact and non-compact maps*

April 17, 24

**Aleš Nekvinda (Czech Technical University, Prague)**
*Equivalence of norms in $\ell^{p_n}$ spaces and the maximal operator on $L^{p(x)}(\mathbb{R}^n)$*

May 15

**Luboš Pick (Charles University, Prague)**
*A remark on classical Lorentz spaces*

May 22

**Giuseppe Rosario Mingione (Universita di Parma)**

*Functional with p(x)-growth and related issues*


October 30, November 6

**Aleš Nekvinda (Czech Technical University, Prague)**
*Maximal operator on $L^{p(x)}(R^n)$*


November 13, 20

**Stanislav Hencl (Charles University, Prague)**
*A sharp form of an embedding into exponential and double exponential spaces*


November 27, December 11

**Luboš Pick (Charles University, Prague)**
*Logarithmic Sobolev Inequalities*


December 4

**Lars Diening (University of Freiburg)**
*Generalized Lebesgue and Sobolev Spaces*

# 2003

February 5

**María Carro (Universitat de Barcelona)**
*An analytic interpolation theorem with application to the boundedness of operators on weighted Lebesgue spaces*


February 26

**Júlio Severino Neves (University of Coimbra)**
*Bessel-potential-type spaces and embeddings (limiting and super-limiting cases)*


March 12, 19, 26

**Petr Gurka (Czech University of Agriculture, Prague)**
*Boundedness and compactness of embeddings of logarithmic Bessel potential spaces*


April 2

**Petr Gurka (Czech University of Agriculture, Prague)**
*Problems of entropy numbers of compact embeddings of logarithmic Bessel potential spaces*


April 9

**Luboš Pick (Charles University, Prague)**
*New function spaces and limiting Sobolev embeddings (paper by Bastero, Milman and Ruiz)*


May 5, Workshop on function spaces

**Ron Kerman (Brock University, St. Catharines, Canada)**
*Optimal imbeddings of smoothness spaces*

**Aigerim Kalybay (University of Alma Ata)**
*Some properties of function spaces with multiweighted derivatives*


May 7

**Cherif Amrouche (Universite de Pau)**
*Elliptical problems in unbounded domains, with application to Navier-Stokes and Oseen equations*

May 14, 21

**Luboš Dostál (Charles University, Prague)**
*Weighted Hardy inequalities on classical Lorentz spaces (paper by Santiago Boza and Joaquim Martin)*


June 11

**David Swanson (Texas A&M University)**
*Pointwise and topological behavior of mappings in certain Sobolev classes*


June 25

**David Cruz-Uribe, SFO (Trinity College, Hartford)**
*$L^p$ spaces with variable exponent*


September 3

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Various criteria for the validity of the Hardy inequality*


September 24

**Raul Romero (Universidad Complutense de Madrid)**
*A characterization of the spaces satisfying a result of Lions-Peetre type for N-tuples*


October 1

**Hans-Jürgen Schmeisser (Friedrich Schiller University Jena)**
*An atomic approach to limiting embeddings for vector-valued function spaces*


October 15

**W. Des Evans (University of Wales, Cardiff)**
*Hardy and Rellich inequalities associated with magnetic fields*


October 22

**António Caetano (University of Aveiro)**
*Local growth envelopes for spaces of generalized smoothness: a unified treatment?*

October 29

**David E.Edmunds (University of Sussex, Brighton)**
*Subspaces and distances*

November 5

**Joaquim Martín (University of Barcelona)**
*Entropy function spaces and Interpolation*

November 12, 19

**Jan Lang (Ohio State University, Columbus)**
*Special trigonometric functions, p-Laplacian and geometry of the Sobolev imbedding*

November 26, December 10, 17

**Luboš Pick (Charles University, Prague)**
*The Gateway to Compactness*

# 2004

January 28

**Santiago Boza (Universitat Politecnica de Catalunya)**
*Relation between weights and equivalent expressions for norms in Lorentz spaces*

March 10

**Jan Vybíral (Friedrich Schiller Universitat Jena)**
*Function spaces with dominating mixed smoothness - decompositions and entropy numbers*

March 17

**Petteri Harjulehto (University of Helsinki)**
*Sobolev capacity in variable exponent spaces*

March 24, 31, April 7

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Functional properties of the space $S_p(w)$*

April 28

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Limiting reiteration for real interpolation with slowly-varying functions*

May 5, 12

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Sharp Embeddings of Besov Spaces with Logarithmic Smoothness (An Elementary Approach)*

May 19

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Sharp embeddings of Besov spaces with Logarithmic Smoothess: The Limiting Case*

June 23

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Decomposition and extrapolation in spaces of integrable functions*

November 3

**Vladimir Ovchinnikov (Voronezh State University)**
*New family of interpolation spaces and description of interpolation orbits*

November 10

**Henryk Hudzik (Adam Mickiewicz University Poznań)**
*Topological and geometric structure of some Calderon-Lozanovskii spaces*

November 19

**Vladimir Ovchinnikov (Voronezh State University)**
*Interpolation orbits and Orlicz spaces*

December 15

**Vladimir Ovchinnikov (Voronezh State University)**
*Minimal and maximum extensions of interpolation functors and the generalized method of means*

# 2005

February 23

**Lassi Päivärinta (Nevanlinna Institute, University of Helsinki)**
*Medical imaging, Inverse Problems and Quasiconformal Maps*

March 2, 9, 23, 30

**Luboš Pick (Charles University, Prague)**
*Optimality and Interpolation*

April 6

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Optimality and interpolation - remarks to certain results of R. Kerman and L. Pick*

April 13, 20

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*An equivalence theorem for some scales of integral conditions (joint work with A. Kufner, L.-E. Persson and A. Wedestig)*

April 27

**Miroslav Krbec (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On non-effective weights in Orlicz spaces*

October 12

**Jani Joensuu (University of Helsinki)**
*A Strong-type Capacitary Inequality*

October 19, 26

**Stanislav Hencl (Charles University, Prague)**
*Sharp generalized Trudinger inequalities via truncation*

November 9

**Aleš Nekvinda (Czech Technical University in Prague)**
*A Note on the Maximal Operator in $L^{p(x)}$*


November 16

**Henryk Hudzik (Adam Mickiewicz University, Poznan)**
*Basic topological and geometric structure of generalized Orlicz-Lorentz spaces.*
Part I - Global structure

**Pawel Foralewski (Adam Mickiewicz University, Poznan)**
*Basic topological and geometric structure of generalized Orlicz-Lorentz spaces.*
Part II - Local stucture

November 23

**Aleš Nekvinda (Czech Technical University in Prague)**
*A Note on the Maximal Operator in $L^{p(x)}$ (continuation)*


December 7

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Reduction theorems for weighted Hardy inequalities (the case 0 less than p less than or equal to 1)*


December 14, 21

**Libor Pavlíček (Charles University, Prague)**
*On strict convergence in BV*

# 2006

January 4, March 1

**Libor Pavlíček (Charles University, Prague)**
*On strict convergence in BV*

March 15

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Hardy inequality: negative exponents and connection to the spectrum of a differential operator*

March 22

**Pavel Drábek (University of West Bohemia, Pilsen)**
*Hardy inequality: the spectrum of the Sturm-Liouville problem*

April 19

**Petr Gurka (Czech University of Agriculture, Prague)**
*Embeddings of Besov spaces (elementary approach)*

May 3

**Petr Gurka (Czech University of Agriculture, Prague)**
*Pictures and News from Miami (the Cwikel Conference and the AMS Meeting)*

June 14

**Salvador Rodriguez (Universitat Barcelona)**
*Some new results on restriction of Fourier multipliers*

October 18, 25

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted estimates for the averaging integral operator*

November 1

**Ales Nekvinda (Czech Technical University, Prague)**
*Averages and optimality*

November 8, 15

**Stanislav Hencl (Charles University, Prague)**
*Homeomorphisms with finite variation*


November 22, 29, December 6

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Embeddings of Lorentz spaces*

# 2007

January 10, February 28, March 14, 21

**Luboš Pick (Charles University, Prague)**
*Traces and rearrangements*

April 4, 11

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*A simple proof of a theorem of Kerman and Pick*

April 18

**Andrea Cianchi (University of Florence)**
*Quantitative Sobolev and Hardy inequalities*

April 25

**Luboš Pick (Charles University, Prague)**
*Traces and rearrangements*

May 2

**Rza Mustafayev (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On boundedness of the Riesz potential in the local Morrey-type spaces*

May 9

**Agnieszka Kalamajska (Warsaw University)**
*Gagliardo-Nirenberg inequalities in Orlicz spaces equipped with not necessarily doubling measures*

May 16

**Jan Schneider (Charles University, Prague)**
*Function Spaces with Varying Smoothness*

May 23

**Petr Honzík (Michigan State University)**
*Singular Integral Operators with Rough Kernels*

October 10

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Singular integral operators with rough kernels*


October 17

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Optimal good lambda inequalities*


October 24

**Des Evans (University of Wales, Cardiff)**
*Improved Hardy-Sobolev inequalities*

**Kasia Pietruska-Paluba (MIMUW)**
*Besov spaces arising in connection with stochastic processes on fractals*


October 31

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Hardy-negative*


November 7, 21, December 5

**Lubos Pick (Charles University, Prague)**
*Calderon type theorem for operators with non-standard endpoint behaviour*


December 12

**Jan Schneider (Charles University, Prague)**
*Interpolation characterization of the rearrangement-invariant hull of a Besov space*

# 2008

March 5, 12, 26

**Bohumír Opic (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Estimates for the modulus of continuity of the Bessel potential and applications*

March 19

**Katsuo Matsuoka (Nihon University, Tokio)**
*On the interpolation theorems concerning $B^p(\mathbb{R}^n)$, $BMO(\mathbb{R}^n)$ and $CMO^p(\mathbb{R}^n)$*

April 2

**Aleš Nekvinda (Czech Technical University, Prague)**
*Maximal Operator on $L^{p(x)}$*

April 9, 16

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Besov spaces on metric spaces*

April 23, 30

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weighted Inequalities with Non-Standard Parameters*

May 14

**Henning Kempka (Friedrich Schiller University, Jena)**
*2-microlocal Besov spaces*

May 21

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Extrapolation of compactness and its applications to Sobolev embeddings*

October 1

**Hans-Gerd Leopold (Friedrich Schiller University Jena)**

*On sharp embeddings of function spaces of generalized smoothness in $L_1^loc$*


October 8

**Hans-Juergen Schmeiszer (Friedrich Schiller University Jena)**
*Trigonometric approximation and realizations of K-functionals*


October 15

**Cornelia Schneider (Friedrich Schiller University Jena)**
*Trace operators in Besov and Triebel-Lizorkin spaces*


October 29 and November 5 and 19

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Besov Spaces of Near Zero Smoothness*


November 12

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The Hundred Years of Sergey Lvovich Sobolev*


November 19

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Besov Spaces (survey)*


November 26, December 3, 10

**David Pražák (Charles University, Prague)**
*Norms on grand and small Lebesgue spaces*

# 2009

January 19

**Jan Lang (Ohio State University, Columbus, USA)**
*Essential norms and localization moduli of Sobolev embeddings*

March 4

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The Fourier transform and function spaces*

March 11

**Loukas Grafakos (University of Missouri, Columbia)**
*Rough and rougher singular integrals*

March 18, 25

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*The Fourier transform and function spaces*

April 1, 8, 15

**Lukáš Malý (Charles University, Prague)**
*The Fourier transform and function spaces*

April 22

**Eva Pernecká (Faculty of Mathematics and Physics, Charles University, Prague)**
*Littlewood-Payley theory and multipliers*

April 29

**Valentino Magnani (University of Pisa, Italy)**
*Tangent distributions and Sobolev surfaces*

October 7

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**

*Function spaces arising in connection with the Fourier transform*

October 14

**Hans-Juergen Schmeisser (Friedrich Schiller University, Jena)**
*On trace spaces of function spaces with a radial weight (joint work with Dorothee Haroske)*

October 21, November 4

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Function spaces arising in connection with the Fourier transform*

November 11

**Luděk Kleprlík (Faculty of Mathematics and Physics, Charles University, Prague)**
*Litllewood-Paley Characterization of Lipschitz Spaces*

December 2

**Rza Mustafayev (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On the boundedness of the maximal operator in generalized Morrey spaces*

December 9

**Rza Mustafayev (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*On the boundedness of the singular integral operators in generalized Morrey spaces*

# 2010

April 28

**Luboš Pick (Faculty of Mathematics and Physics, Charles University, Prague)**
*Weak-type estimates cannot be extrapolated*

May 5, 19

**Aleš Nekvinda (Faculty of Civil Engineering, Czech Technical University, Prague)**
*Monotone metric spaces*

June 25

**I. E. Verbitsky (University of Missouri, Columbia)**
*Linear and nonlinear equations with natural growth terms*

September 29

**Henryk Hudzik (UAM Poznan)**
*In Orlicz spaces p-Amemiya norm is geometrically better than the Luxemburg and the Orlicz norms*

October 6,13, November 10

**Hana Bendová (Charles University, Prague)**
*Integral with a control function*

October 20

**Kyril Tintarev (Uppsala University)**
*Is the Trudinger-Moser nonlinearity a true critical nonlinearity?*

October 20

**Ron Kerman (Brock University)**
*Explicit formulas for optimal rearrangement-invariant norms in Sobolev imbedding inequalities*

December 1

**Luboš Pick (Charles University, Prague)**

*Optimality and iteration*

December 8

**Agnieszka Kalamajska (University of Warsaw)**
*Luzin-type theorem with convex integration and quasi-convex hulls of sets*

December 15

**Jan Lang (Ohio State University)**
*Generalized trigonometric functions from different points of view*

# 2011

January 5, 12, February 23, March 2

**Luboš Pick (Charles University in Prague)**
*Optimality, iteration and isoperimetric problem*


March 9

**Stanislav Hencl (Charles University in Prague)**
*Sobolev homeomorphism with zero Jacobian*


March 16, 23

**Luboš Pick (Charles University in Prague)**
*Optimality, iteration and isoperimetric problem*


March 30

**Alois Kufner (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Hardy inequalities of higher order*


April 6

**W. Des Evans (University of Wales, Cardiff)**
*On the zero modes of Pauli operators and inequalities of Hardy and Sobolev*


April 13

**Kai Rajala (University of Jyväskylä)**
*Invertibility conditions for mappings of finite distortion*


April 20, 27

**Luboš Pick (Charles University in Prague)**
*Optimality, iteration and isoperimetric problem*


May 11

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Maximal singular operators with rough kernels*

October 19

**Petr Honzík (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Weak-type estimates for rough commutators*

November 2, 9, 16, 30, December 7

**Filip Soudský (Charles University, Prague)**
*Boundedness of classical operators on classical Lorentz spaces*

December 14

**Luděk Kleprlík (Charles University, Prague)**
*Composition operators on Sobolev-Orlicz spaces*

# 2012

March 7, 14

**Luděk Kleprlík (Charles University, Prague)**
*Composition operators on Sobolev-Orlicz spaces*

April 4, 11, 18

**Lenka Slavíková (Charles University, Prague)**
*Compactness of higher-order Sobolev embeddings*

June 20

**Jan Lang (Ohio State University, Columbus)**
*Gelfand numbers (or widths) and compact linear operators in Banach spaces*

June 28

**Alberto Fiorenza (University of Naples)**
*Some phenomena in variable Lebesgue spaces theory*

September 26

**Walter Trebels (TU Darmstadt)**
*Inequalities for moduli of smoothness versus embeddings of function spaces*

October 10, 17

**Petr Gurka (Czech University of Agriculture, Prague)**
*The Moser constant for a Trudinger-type embedding*

October 24

**Ron Kerman (Brock University)**
*Sobolev embedding with general underlying domains*

October 31

**Ryskul Oinarov (University of Astana)**
*Weighted inequalities for Hardy integral operators with variable boundaries and applications*

November 14, 21

**Petr Gurka (Czech University of Agriculture, Prague)**
*The Moser constant for a Trudinger-type embedding*

November 28

**Vagif Guliyev (Ahi Evran University, Kirsehir)**
*Boundedness of the clasical integral operators in general Morrey type spaces and some applications*

December 5

**Luboš Pick (Charles University, Prague)**
*Marcinkiewicz interpolation theorems for Orlicz and Loretz gamma spaces*

December 12

**Wen Yuan (Friedrich Schiller University, Jena)**
*Compact interpolationon Besov-type and Triebel-Lizorkin-type spaces*

December 19

**Luboš Pick (Charles University, Prague)**
*Marcinkiewicz interpolation theorems for Orlicz and Loretz gamma spaces*

# 2013

March 6, 13, 20

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Operators on cones of monotone functions*


March 27, April 3, 10

**Ondřej Kurka (Faculty of Mathematics and Physics, Charles University, Prague)**
*On the variation of the Hardy-Littlewood maximal function*


April 17, 24

**Robert Černý (Faculty of Mathematics and Physics, Charles University, Prague)**
*Sobolev and bi-Sobolev homeomorphisms with zero Jacobian almost everywhere*


October 2

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Boundedness of spherical maximal function in variable $L^p$ spaces and applications*


October 9, 16

**Nadia Clavero (University of Barcelona)**
*On Sobolev embeddings in mixed norm spaces*


October 30, November 6, 20

**Luboš Pick (Charles University in Prague)**
*On generalized Lorentz spaces*


December 4

**Martin Křepela (University of Karstadt)**
*Convolution inequalities in weighted Lorentz spaces*


December 11, 18

**Nadia Clavero (University of Barcelona)**

# 2014

January 8

**Robert Černý (Charles University, Prague)**
*Concentration-Compactness Principle for generalized Moser-Trudinger inequalities: characterization of the non-compactness in the radial case*

February 19, 26, March 5

**Robert Černý (Charles University, Prague)**
*Concentration-Compactness Principle for the Moser-Trudinger inequality: new proof of the Lions estimate*

March 12

**Robert Černý (Charles University, Prague)**
*Concentration-Compactness Principle for the Moser-Trudinger inequality: characterization of the non-compactness in the radial case*

March 19

**Lukáš Malý (University of Linköping)**
*Sobolev-type functions in metric spaces and their regularization: the Newtonian approach. (Lipschitz truncations as an application of weak boundedness of maximal operators.)*

March 26, April 2

**Robert Černý (Charles University, Prague)**
*Concentration-Compactness Principle for the Moser-Trudinger inequality: characterization of the non-compactness in the radial case*

April 16

**Luboš Pick (Charles University, Prague)**
*Optimal Sobolev Trace Embeddings (joint work with Andrea Cianchi)*

April 23

**Lukáš Malý (University of Linköping)**
*Regularity of Newtonian functions: quasicontinuity and continuity*

May 7, 21

**Luboš Pick (Charles University, Prague)**
*Optimal Sobolev Trace Embeddings (joint work with Andrea Cianchi)*


October 8

**Ushangi Goginava (Ivane Javakhishvili Tbilisi State University, Georgia)**
*On the summability of quadratical and triangular partial sums of double Fourier series*


October 15

**Jan Malý (Charles University, Prague)**
*Non-absolutely convergent integral in metric spaces*


October 22, 29, November 5, 19

**Kristýna Kuncová (Charles University, Prague)**
*Non-absolutely convergent integral in metric spaces*


November 19, December 3, 10, 17

**Luboš Pick (Charles University, Prague)**
*Banach algebras of weakly-differentiable functions (joint work with Andrea Cianchi and Lenka Slavíková)*

# 2015

January 7

**Lenka Slavíková (Charles University, Prague)**
*A Sobolev space embedded to $L_\infty$ does not have to be a Banach algebra*

February 25

**Jan Vybíral (Charles University, Prague)**
*Marcinkewicz theorem in $L^{p(x)}$ spaces*

March 4, 11, 25, April 1, 8, 15

**Lenka Slavíková (Charles University, Prague)**
*Norms supporting the Lebesgue differentiation theorem (joint work with Paola Cavaliere, Andrea Cianchi and Luboš Pick)*

October 14, 21, November 4

**Vít Musil (Charles University, Prague)**
*Optimal Orlicz domains in Sobolev embeddings*

November 25

**Martin Křepela (Karlstad University, Sweden)**

November 25

**Martin Křepela (Karlstad University, Sweden)**
*On Peetre's maximal operator*

December 2

**Martin Franců (Charles University, Prague)**
*On local means and Peetre's maximal operator*

December 9

**Rastislav Oľhava (Charles University, Prague)**
*On local means and Peetre's maximal operator (theorem of Bui, Paluszyński and Taibleson)*

December 16

**Jan Vybíral (Charles University, Prague)**
*On local means and Peetre's maximal operator (theorem of Bui, Paluszyński and Taibleson)*

# 2016

February 24

**Ville Tengvall (Charles University, Prague, and Univeristy of Jyväskylä)**
*Mappings of finite distortion: Size of the branch set*


March 2

**Luboš Pick (Charles University, Prague)**
*Optimal rearrangement-invariant spaces for the Laplace transform*


March 9

**Vít Musil (Charles University, Prague)**
*Some maximal inequalities*


March 16

**Vít Musil (Charles University, Prague)**
*Optimal Orlicz domains in Sobolev embeddings into Orlicz spaces*


March 23

**Jan Malý (Charles University, Prague)**
*Small sets of curves with respect to function spaces (joint work with Vendula Honzlová-Exnerová and Olli Martio)*


March 30, April 6

**Petr Čoupek (Charles University, Prague)**
*The Wiener process and stochastic differential equations*


April 13

**Marcos de la Oliva (Universidad Autónoma de Madrid)**
*Luzin condition and laminates*


April 20

**Jan Malý (Charles University, Prague)**
*Small sets of curves with respect to function spaces (joint work with Vendula Honzlová-Exnerová and Olli Martio)*

April 27

**Petr Honzík (Charles University, Prague)**
*Minimal smoothness conditions for bilinear Fourier multipliers*


May 11

**Emanuela Radici (FAU Erlangen-Nürnberg)**
*Diffeomorphic approximation of planar elastic deformations*


May 18

**Lenka Slavíková (Charles University in Prague)**
*Necessity of bump conditions for the two-weighted maximal inequality*


May 25

**Antti Räninä (University of Jyväskylä)**
*Mappings of finite distortion: integrability of the Jacobian*


June 15

**Jiří Outrata (ÚTIA AV ČR, v.v.i.)**
*On the Aubin property of implicit multifunctions*


June 29

**Dmitry Ryabogin (Kent University, Ohio)**
*On a continuous Rubik's cube*


October 12

**Givi Nadibaidze (Javakhishvili Tbilisi State University)**
*On the a.e. convergence and summability of series with respect to block-orthonormal systems*


October 19

**Aapo Kauranen (Charles University, Prague)**
*Images of porous sets under Sobolev mappings*


October 26, November 2

**Michal Johanis (Charles University, Prague)**
*Marchaud's theorem in infinite dimension*


November 9

**Tomáš Roskovec (Charles University, Prague)**
*Sobolev homeomorphism in $W^{k,p}$ and the Lusin $(N)$ condition*


November 16

**Aapo Kauranen (Charles University, Prague)**
*Sobolev spaces and Lusin's condition (N) on hyperplanes*


November 23

**Ville Tengvall (University of Jyväskylä)**
*Mappings of finite distortion: size of the branch set (joint work with Chang-Yu Guo and Stanislav Hencl)*


December 7

**Martin Křepela (University of Karlstad)**
*Embeddings and duals of Copson-Lorentz spaces*


December 21

**Zdeněk Mihula (Charles University, Prague)**
*Optimality of function spaces for classical integral operators*

**Jan Vybíral (Charles University, Prague)**
*Entropy numbers of Schatten classes*

# 2017

January 4, 11

**Daniel Campbell (Charles University, Prague)**
*Approximation of monotone maps by diffeomorphisms*

February 22

**Yi Zhang (University of Jyväskylä)**
*Sobolev extension domains: from the viewpoint of uniform domains*

March 1

**Amiran Gogatishvili (MU AV ČR)**
*Characterization of interpolation between grand, small, and classical Lebesgue spaces*

March 8

**Luděk Kleprlík (Czech Technical University in Prague)**
*Composition operator for functions of bounded variation*

March 15

**Luboš Pick (Charles University, Prague)**
*How not to leave traces*

March 22

**Petr Honzík (Charles University, Prague)**
*Bisublinear Spherical Maximal Function*

March 29

**Jan Vybíral (Charles University, Prague)**
*An introduction to Total Variation for Image Analysis*

April 5, 12

**Filip Soudský (Charles University, Prague)**
*BV functions*

April 19

**Emanuela Radici (FAU Erlangen-Nurnberg)**
*Particle approximation of scalar conservation laws for self attractive species*

May 24

**Luboš Pick (Charles University, Prague)**
*Sobolev embeddings on entire $\mathbb{R}^n$*

June 28

**Filip Tomić (University of Novi Sad)**
*Superposition and propagation of singularities for extended Gevrey regularity*

October 4

**Hans Georg Feichtinger (NuHAG, Universität Wien)**
*Time-Frequency and Gabor Analysis Foudations and Application Areas*

October 18

**Rami Luisto (Charles University, Prague)**
*Properties of BLD-mappings*
Abstract: We discuss several equivalent definitions for BLD-mappings between metric spaces and study their asymptotic values and limiting properties in the setting of Riemannian manifolds

October 25

**Eva Buriánková (Charles University, Prague)**
*Rough maximal bilinear singular integrals*

November 1

**Vít Musil (Charles University, Prague)**
*Approximation of non-compact Sobolev embeddings*

November 15

**David Krejčiřík (Czech Technical University, Prague)**
*From functional inequalities to spectral properties of Schrödinger operators*

November 22

**Nenad Teofanov (University of Novi Sad)**
*Gelfand-Shilov spaces, Gevrey classes, and related topics*


November 29, December 6, 13

**Tomáš Roskovec and Filip Soudský (University of South Bohemia, České Budějovice)**
*Gagliardo-Nirenberg interpolation inequality revisited*

# 2018

January 3

**Zdeněk Mihula (Charles University, Prague)**
*Compactness of traces of Sobolev functions*

January 10

**Lenka Slavíková (University of Missouri, Columbia)**
*An optimal criterion for $L^2 \times L^2 \to L^1$ boundedness*

February 28

**Stanislav Hencl (Charles University, Prague)**
*Weak regularity of the inverse under minimal assumptions*

March 7

**Rami Luisto (Charles University, Prague)**
*Weak regularity of the inverse under minimal assumptions*

March 21

**Tomáš Roskovec (South Bohemian University, České Budějovice)**
*Interpolation between Hölder and Lebesgue spaces with applications (joint work with Filip Soudský and Anastasia Molchanova)*

March 28

**Aldo Pratelli (University of Erlangen)**
*Diffeomorphic approximation of planar maps: the INV and the non-crossing maps (joint work with Guido de Philippis)*

April 4

**Vít Musil (Charles University, Prague)**
*Optimal partners for fractional maximal operator*

April 11

**Vít Musil (Charles University, Prague)**
*Moser type inequalities in Gauss space*

May 2

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Construction of a function space close tob $L^\infty$ with associate space close to $L^1$ (joint work with D. Edmunds and T. Kopaliani)*


May 9

**Short presentations of PhD students supported by the University Center Math MAC**
*Chairman: Josef Málek (Charles University, Prague)*


May 23

**Rami Luisto (Charles University, Prague)**
*Compactness of the branch for quasiregular mappings and mappings of finite distortion*


June 13

**Abdulhamit Küçükaslan (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Boundedness of Hilbert transform in local Morrey-Lorentz spaces*


October 10

**Ondřej Bouchala (Charles University, Prague)**
*Measure of non-compactness of Sobolev embeddings*


October 17, 24

**Dalimil Peša (Charles University, Prague)**
*Fall of the star*


October 31

**Hans G. Feichtinger (NuHAG, Universität Wien, and Charles University, Prague)**
*Modulation spaces and their relationship to Besov spaces*


November 7

**Hans G. Feichtinger (NuHAG, Universität Wien, and Charles University, Prague)**
*Modulation spaces as a prototype for coorbit theory*


November 14

**Nijjwal Karak (Charles University, Prague)**
*Sobolev-type embeddings and regularity of domains*


November 21

**Nenad Teofanov and Filip Tomic (University of Novi Sad)**
*Wave front sets and related topics*


November 23

**Winfried Sickel (Friedrich Schiller University, Jena)**
*Lizorkin-Triebel spaces and differences*

**Marc Hovemann (Friedrich Schiller University, Jena)**
*Triebel-Lizorkin -Morrey spaces and differences*


November 28

**Hana Turčinová (Charles University, Prague)**
*Functional properties of one scale of rearrangement-invariant function spaces*


December 5

**Olli Saari (University of Bonn)**
*On endpoint regularity of maximal functions*

**Sergey Tikhonov (Centre de Recerca Matemática, Barcelona)**
*Sharp embedding theorems for smooth function spaces*


December 12

**Maurice de Gosson (Universität Wien)**
*The canonical group of transformations of a Gabor frame*


December 19

**Anastasia Molchanova (Sobolev Institute of Mathematics, Novosibirsk)**
*Regularity of the inverse for Banach function spaces*

# 2019

January 9

**Andrea Cianchi (University of Florence)**
*Regularity for the p-Laplace equation in minimally regular domains*
Abstract: I will discuss a few aspects of the regularity of solutions to boundary value problems for nonlinear elliptic equations and systems of p-Laplacian type. In particular, second-order regularity properties of solutions, and the boundedness of their gradient will be focused. The results to be presented are optimal as far as the regularity of the right-hand sides of the equations and the boundary of the ground domains are concerned. This is a joint work with V.Maz'ya.

**Lenka Slavíková (University of Missouri)**
*The Hörmander multiplier theorem: some recent developments*

February 20

**Daniel Campbell (University of Hradec Králové)**
*A sense preserving Sobolev homeomorphism with negative Jacobian almost everywhere*
Abstract: We construct a $W^{1,p}$ Sobolev homeomorphism $1 \leq p < 2$ equal to the identity on the boundary of the unit cube in $\mathbb{R}^4$ but whose weak Jaccobian is negative almost everywhere. This result expands on our previous result with Tengval and serves as a counter-example of approximation by diffeomorphisms to some elastic energies which require positive Jaccobian almost everywhere, a case not covered by the previous result.

March 6

**Martin Křepela (University of Freiburg)**
*Bogovski estimates and solenoidal diference quotients*
Abstract: By showing additional properties of the Bogovski solution to the divergence equation, we may construct specific test functions with solenoidal (divergence-free) difference quotients. As an application, one gets a new way to prove interior regularity of the solution to the p-Stokes system. Calderón, Zygmund, Muckenhoupt, Orlicz, Bogovski, Stokes, Růžička - all in one!

March 13

**Jan Krejčí (Charles University, Prague)**
*The atom of hydrogen*
Abstract: This is a survey lecture which does not contain new results and is aimed mainly for students. The classical solution to the Schrödinger equation for the atom of hydrogen will be treated and number and shape of its orbitals will be established.

March 20

**Antonín Češík (Charles University, Prague)**
*Transforming the Laplace operator to spherical coordinates*
Abstract: We will compute the transformation of the Laplace operator to polar (in $\mathbb{R}^2$) and spherical (in $\mathbb{R}^3$) coordinates. In the case of $\mathbb{R}^3$, two distinct approaches will be pursued. First, considering spherical coordinates as the composition of two cylindrical coordinate changes and using the formula known from $\mathbb{R}^2$ case. Second, computing the transformation for general orthogonal coordinates in $\mathbb{R}^3$ and obtaining the spherical coordinates as a special case of this. This is an elementary lecture which does not contain new results and is aimed mainly for students.

March 27

**Petr Honzík (Charles University, Prague)**
*Endpoint estimate for rough maximal singular integral operators with rough kernels*
Abstract: We show that rough maximal singular integral with kernel $\Omega(x/|x|)/|x|^n$, $\Omega \in L^\infty$, $\int_{S^{n-1}} \Omega = 0$ maps $L(\log\log L)^{2+\epsilon}$ to $L^{1,\infty}$ locally. This is the best known result so far, while the endpoint weak type estimate is a well known open question.

April 3

**Ondřej Bouchala (Charles University, Prague)**
*Transforming the Laplace operator to spherical coordinates*
Abstract: We will compute the transformation of the Laplace operator to spherical (in $\mathbb{R}^3$) coordinates in another way. We will compute the transformation for general orthogonal coordinates in $\mathbb{R}^3$ and obtaining the spherical coordinates as a special case of this. This is an elementary lecture which does not contain new results and is aimed mainly for students.

April 10, 17

**Jan Malý (Charles University, Prague)**
*Inverting BV homeomorphisms*

April 24

**Nijjwal Karak (Charles University, Prague)**
*Necessary conditions for Sobolev-type embeddings*
Abstract: In this talk, necessary conditions on domains in $\mathbb{R}^n$ or on the measure in metric measure spaces for Sobolev-type embeddings of Orlicz-Sobolev spaces and variable exponent Sobolev spaces will be discussed in details.

May 22

**Luboš Pick (Charles University, Prague)**
*Moser meets Gauss*
Abstract: We study Moser-type estimates for Gaussian-Sobolev embeddings. This is a joint work with Andrea Cianchi and Vít Musil (both of University

of Florence).

June 5

**Karol Leśnik (Poznań University of Technology)**
*Monotone substochastic operators and a new Calderón couple*

June 26

**Erich Novak (Friedrich Schiller University, Jena)**
*What is information-based complexity?*
Abstract: We give a short introduction to IBC and present some basic definitions and a few results. The general question is: How many function values (or values of other functionals) of f do we need to compute $S(f)$ up to an error $\varepsilon$? Here $S(f)$ could be the integral or the maximum of $f$. In particular we study the questions: Which problems are tractable? When do we have the curse of dimension and how can we avoid the curse?

October 9, 16

**Stanislav Hencl and Ondřej Bouchala (Charles University, Prague)**
*Injectivity a.e. of limits of Sobolev homeomorphisms*

October 23

**Tomáš Roskovec (University of South Bohemia, České Budějovice)**
*Example of a Smooth Homeomorphism Violating the Luzin N-1 Property (joint work with Luděk Kleprlík and Anastasia Molchanova)*

October 30

**Amiran Gogatishvili (Institute of Mathematics, Czech Academy of Sciences, Prague)**
*Remarks on Hardy-type inequalities involving suprema*

November 13

**Giovanni Gravina (Charles University, Prague)**
*An introduction to Gamma-convergence with an application to phase transitions*

December 4

**Luboš Pick (Charles University, Prague)**
*Existence of minimizers for Moser estimates in Gaussian-Sobolev embeddings*

December 11

**Dalimil Peša (Charles University, Prague)**
*Wiener-Luxemburg Amalgam Spaces*


December 18

**Jan Malý (Charles University, Prague)**
*Hajlasz spaces and cuspidal domains*

# 2020

January 8

**Hana Turčinová (Charles University, Prague)**
*Pursue of optimality in characterization of Sobolev functions with zero traces via the distance function*

**Jan Vybíral (Technical University, Prague)**
*Schur's theorem and numerical integration*

February 19

**Lyubomira Softova (University of Salerno)**
*Gradient estimates for nonlinear elliptic equations in Morrey type spaces*

March 4

**Haiqing Xu (University of Jyväskylä)**
*Optimal extensions of conformal mappings from the unit disk to cardioid-type domains*

October 8

**Georgios Dosidis (University of Missouri, Columbia)**
*Linear and multilinear spherical maximal functions*
Abstract: The classical spherical maximal function is an analogue of the Hardy-Littlewood maximal function that involves averages over spheres instead of balls. We will review the classical bounds for the spherical maximal function obtained by Stein and explore their implications for partial differential equations and geometric measure theory. The main focus of this talk is to discuss recent results on the multilinear spherical maximal function and on a family of operators between the Hardy-Littlewood and the spherical maximal function. We will cover boundedness and convergence results for these operators for the optimal range of exponents. We will also include a discussion on Nikodym-type sets for spheres and spherical maximal translations.

October 15

**David Cruz-Uribe, OFS (University of Alabama, Tuscaloosa)**
*Norm inequalities for linear and multilinear singular integrals on weighted and variable exponent Hardy spaces*
Abstract: I will discuss recent work with Kabe Moen and Hanh Nguyen on norm inequalities of the form

$$T : H^{p_1}(w_1) \times H^{p_2}(w_2) \to L^p(w),$$

where $T$ is a bilinear Calderón-Zygmund singular integral operator, $0 < p, p_1, p_2 <$

$\infty$ and

$$\frac{1}{p_1} + \frac{1}{p_2} = \frac{1}{p},$$

the weights $w$, $w_1$, $w_2$ are Muckenhoupt weights, and the spaces $H^{p_i}(w_i)$ are the weighted Hardy spaces introduced by Strömberg and Torchinsky.

We also consider norm inequalities of the form

$$T : H^{p_1(\cdot)} \times H^{p_2(\cdot)} \to L^{p(\cdot)},$$

where $L^{p(\cdot)}$ is a variable Lebesgue space (intuitively, a classical Lebesgue space with the constant exponent $p$ replaced by an exponent function $p(\cdot)$) and the spaces $H^{p_i(\cdot)}$ are the corresponding variable exponent Hardy spaces, introduced by me and Li-An Wang and independently by Nakai and Sawano.

To illustrate our approach we will consider the special case of linear singular integrals. Our proofs, which are simpler than existing proofs, rely heavily on three things: finite atomic decompositions, vector-valued inequalities, and the theory of Rubio de Francia extrapolation.

October 22

**Dominic Breit (Heriot-Watt University, Edinburgh)**
*Optimal Sobolev embeddings for symmetric gradients (joint work with Andrea Cianchi)*
Abstract: I will present an unified approach to embedding theorems for Sobolev type spaces of vector-valued functions, defined via their symmetric gradient. The Sobolev spaces in question are built upon general rearrangement-invariant norms. Optimal target spaces in the relevant embeddings are determined within the class of all rearrangement-invariant spaces. In particular, I show that all symmetric gradient Sobolev embeddings into rearrangement-invariant target spaces are equivalent to the corresponding embeddings for the full gradient built upon the same spaces.

October 29

**Karol Leśnik (Poznań University of Technology)**
*Factorization of function spaces and pointwise multipliers*
Abstract: Given two function spaces $X$ and $Y$ (over the same measure space), we say that $X$ factorizes $Y$ if each $f \in Y$ may be written as a product

$$f = gh \quad \text{for some } g \in X \text{ and } h \in M(X, Y),$$

where $M(X, Y)$ is the space of pointwise multipliers from $X$ to $Y$. During the lecture I will present recent developments in the subject of factorization. The problem whether one space may be factorized by another will be discussed for general function lattices as well as for special classes of function spaces. Moreover, it will be explained why the developed methods may be regarded as a kind of arithmetic of function spaces. Finally, the problem of regularizations for factorization will be presented together with a number of applications.

November 5

**Irshaad Ahmed (Sukkur IBA University)**
*On Limiting Approximation Spaces with Slowly Varying Functions*
Abstract: This talk is concerned with limiting approximation spaces involving slowly varying functions, for which we establish some interpolation formulae via limiting reiteration. An application to Besov spaces is given.

November 12

**Gord Sinnamon (University of Western Ontario, London)**
*A Normal Form for Hardy Inequalities*
Abstract: Let $b$ be a non-negative, non-increasing function on $(0, \infty)$ and let $H_b f(x) = \int_0^{b(x)} f$. The inequality $\|H_b f\|q \leq C\|f\|_p$ expresses the boundedness of this operator from unweighted $L^p(0, \infty)$ to unweighted $L^q(0, \infty)$. It is called a *normal form Hardy inequality.*

An abstract formulation of a Hardy inequalities is given and every abstract Hardy inequality is shown to be equivalent, in a strong sense, to one in normal form. This equivalence applies to Hardy operators and their duals of the weighted continuous, weighted discrete, and general measures types, as well as those based on averages over starshaped sets in many dimensions. A straightforward formula relates each Hardy inequality to its normal form parameter $b$.

Besides giving a uniform treatment of many different types of Hardy operator, the reduction to normal form provides new insights, simple proofs of known theorems, and new results concerning best constants.

November 19

**Lars Diening (Bielefeld University)**
*Elliptic Equations with Degenerate Weights*
Abstract: We study the regularity of the weighted Laplacian and $p$-Laplacian with degenerate elliptic matrix-valued weights. We establish a novel logarithmic BMO-condition on the weight that allows to transfer higher integrability of the data to the gradient of the solution. The sharpness of our estimates is proved by examples.

The talk is based on joint work with Anna Balci, Raffaella Giova and Antonia Passarelli di Napoli.

November 26

**Jan Lang (The Ohio State University)**
*Extremal functions for Sobolev Embedding and non-linear problems*
Abstract: We will focus on extremal functions for Sobolev embbedings of 1st and 2nd order and at the eigenfunctions and eigenvalues of corresponding non-linear problems (i.e. $pq$-Laplacian and $pq$-bi-Laplacian on interval or rectangular domain). The main results will be the full characterization of spectrum for corresponding non-linear problems, geometrical properties of eigenfunctions and their connection with approximation theory.

December 3

**Agnieszka Kałamajska (University of Warsaw)**

*Strongly nonlinear multiplicative inequalities*

Abstract: In 2012 together with Jan Peszek we obtained the following inequality:

$$\int_{(a,b)} |f'(x)|^q h(f(x))dx \leq C \int_{(a,b)} \left(\sqrt{|f''(x)\mathcal{T}_h(f(x))|}\right)^q h(f(x))dx, \qquad (1)$$

as well as its Orlicz variants, where $\mathcal{T}_h(\cdot)$ is certain transformation of function $f$ with the property $\mathcal{T}_{\lambda^\alpha}(f) \sim f$, generalizing previous results in this direction due to Mazja.

Inequalities in the form (1) were further generalized in several directions in the chain of my joint works with Katarzyna Pietruska-Pałuba, Jan Peszek, Katarzyna Mazowiecka, Tomasz Choczewski, Ignacy Lipka and with Alberto Fiorenza and Claudia Capogne, Tomáš Roskovec and Dalmil Peša.

I will discuss various versions of inequality (1), together with its multidimensional variants. We will also show some applications of such inequalities to the regularity theory for degenerated PDE's of elliptic type.

December 10

**Behnam Esmayli (University of Pittsburgh)**

*Co-area formula for maps into metric spaces*

Abstract: Co-area formula for maps between Euclidean spaces contains, as its very special cases, both Fubini's theorem and integration in polar coordinates formula. In 2009, L. Reichel proved the coarea formula for maps from Euclidean spaces to general metric spaces. I will discuss a new proof of the latter by the way of an implicit function theorem for such maps. An important tool is an improved version of the coarea inequality (a.k.a Eilenberg inequality) that was the subject of a recent joint work with Piotr Hajłasz. Our proof of the coarea formula does not use the Euclidean version of it and can thus be viewed as new (and arguably more geometric) in that case as well.

December 17

**Anastasia Molchanova (University of Vienna)**

*An extended variational approach for nonlinear PDE via modular spaces*

Abstract: Let $H$ be a Hilbert space and $\varphi \colon H \to [0, \infty]$ be a convex, lower-semicontinuous, and proper modular. We study an evolution equation

$$\partial_t u + \partial\varphi(u) \ni f, \qquad u(0) = u_0 \qquad (2)$$

for $t \in [0, T]$ and $f \in L^1(0, T; H)$. If $u_0 \in H$ and $\partial\varphi$ is considered as a nonlinear operator from $V$ to $V^*$, for some separable and reflexive $V \subset H$, one can apply the classical variational approach to obtain well-posedness of the problem (2). In this talk, we present a more general method, which allows to treat (2) in nonseparable or nonreflexive cases of modular spaces $L_\varphi$ instead of $V$.

This is a joint work with A. Menovschikov and L. Scarpa.

# 2021

January 7

**Andrea Cianchi (University of Firenze)**
*Optimal embeddings for fractional-order Orlicz-Sobolev spaces*
Abstract: The optimal Orlicz target space is exhibited for embeddings of fractional-order Orlicz–Sobolev spaces in the Euclidean space. An improved embedding with an Orlicz–Lorentz target space, which is optimal in the broader class of all rearrangement-invariant spaces, is also established. Both spaces of order less than one, and higher-order spaces are considered. Related Hardy type inequalities are proposed as well. This is a joint work with A. Alberico, L. Pick and L. Slavíková.

January 14

**Angela Alberico (Italian National Research Council, Naples)**
*Limits of fractional Orlicz-Sobolev spaces*
Abstract: We establish versions for fractional Orlicz-Sobolev seminorms, built upon Young functions, of the Bourgain-Brezis-Mironescu theorem on the limit as $s \to 1^-$, and of the Maz'ya-Shaposhnikova theorem on the limit as $s \to 0^+$, dealing with classical fractional Sobolev spaces. As regards the limit as $s \to 1^-$, Young functions with an asymptotic linear growth are also considered in connection with the space of functions of bounded variation. Concerning the limit as $s \to 0^+$, Young functions fulfilling the $\Delta_2$-condition are admissible. Indeed, counterexamples show that our result may fail if this condition is dropped. This is a joint work with Andrea Cianchi, Luboš Pick and Lenka Slavíková.

January 21

**Nikita Evseev (Steklov Mathematical Institute, Moscow)**
*Vector-valued Sobolev spaces based on Banach function spaces*
Abstract: It is known that for Banach valued functions there are several approaches to define a Sobolev class. We compare the usual definition via weak derivatives with the Reshetnyak-Sobolev space and with the Newtonian space; in particular, we provide sufficient conditions when all three agree. As well we revise the difference quotient criterion and the property of Lipschitz mapping to preserve Sobolev space when it acting as a superposition operator.

January 28

**Winfried Sickel (Friedrich Schiller University, Jena)**
*Complex Interpolation of Smoothness Spaces built on Morrey Spaces*
Abstract: Let $\mathcal{M}_p^u([0,1]^d)$ denote the Morrey space on the cube $[0,1]^d$ and $[\,\cdot\,,\,\cdot\,]_\Theta$, $0 < \Theta < 1$, refers to the complex method of interpolation. We shall discuss generalizations of the formula

$$[\mathcal{M}_{p_0}^{u_0}([0,1]^d), \mathcal{M}_{p_1}^{u_1}([0,1]^d)]_\Theta = \mathring{\mathcal{M}}_p^u([0,1]^d)\,,$$

if

$$1 \le p_0 < u_0 < \infty, \quad 1 < p_1 < u_1 < \infty, \quad p_0 < p_1, \quad 0 < \Theta < 1$$

and

$$p_0 \cdot u_1 = p_1 \cdot u_0 \,, \quad \frac{1}{p} := \frac{1-\Theta}{p_0} + \frac{\Theta}{p_1} \,, \quad \frac{1}{u} := \frac{1-\Theta}{u_0} + \frac{\Theta}{u_1} \,.$$

For a domain $\Omega \subset \mathbb{R}^d$ the space $\mathring{\mathcal{M}}_p^u(\Omega)$ is defined as the closure of the smooth functions with respect to the norm of the space $\mathcal{M}_p^u(\Omega)$. The generalizations will include more general bounded domains (Lipschitz domains) and more general function spaces (Lizorkin-Triebel-Morrey spaces).

My talk will be based on joint work with Marc Hovemann (Jena) and Ciqiang Zhuo (Changsha).

February 4

## Carlos Pérez (Basque Center for Applied Mathematics, Bilbao)
*Fractional Poincaré inequalities and Harmonic Analysis*
Abstract: In this mostly expository lecture, we will discuss some recent results concerning fractional Poincaré and Poincaré-Sobolev inequalities with weights, the degeneracy. These results improve some well known estimates due to Fabes-Kenig-Serapioni from the 80's in connection with the local regularity of solutions of degenerate elliptic equations and also some more recent results by Bourgain-Brezis-Minorescu. Our approach is different from the usual ones and it is based on methods that come from Harmonic Analysis, in particular there is intimate connection with the BMO spaces. If we have time we will discuss also some new results in the context of multiparameter setting improving also some results from Shi-Torchinsky and Lu-Wheeden from the 90's.

February 11

## Nenad Teofanov (University of Novi Sad)
*Continuity properties of analytic pseudodifferential operators*
Abstract: Motivated by some questions in quantum mechanics, V. Bargmann (in 1960s) introduced and studied integral transform that now bears his name. More recently, J. Toft studied the mapping properties of the Bargmann transform when acting on Feichtinger's modulation spaces. These investigations served as a starting point in the recent study of analytic pseudodifferential operators. Our aim is to give an introduction to recent results in that direction, obtained with J. Toft and P. Wahlberg.

In the first part of the talk, we provide a historical background by discussing Hermite functions, linear harmonic oscillator, and different spaces of (ultra)differentiable functions, notably Pilipovic spaces. Thereafter, we introduce the Bargmann transform and analytic pseudodifferential operators. To stress the connection with the classical theory, we will consider Wick and anti-Wick connection. At the end, we briefly mention how our findings can be used to recover and improve some known results in the context of real analysis.

February 18

## María Carro (Universidad Complutense de Madrid)
*Boundedness of Bochner–Riesz operators on rearrangement invariant spaces*
Abstract: We shall present very briefly the Bochner-Riesz conjecture, which is

an open problem in dimension $n > 2$, and we shall prove, with the help of the extrapolation theory of Rubio de Francia, some estimates for the decreasing rearrangement of $B_\alpha f$, where $B_\alpha$ is the B-R operator.

As a consequence, we can give sufficient conditions (which are necessary sometimes) for the boundedness of $B_\alpha$ in weighted Lorentz spaces among other rearrangement invariant spaces.

This is a joint work with Jorge Antezana, Elona Agora and my PhD student Sergi Baena.

February 25

### Javier Soria (Universidad Complutense de Madrid)
*Optimal doubling measures and applications to graphs*
Abstract: In a joint work with P. Tradacete, we have recently proved that the doubling constant on any homogeneous metric measure space is at least 2. Continuing with this line of research, and in collaboration with E. Durand-Cartagena, we have studied further results in the discrete case of graphs, showing the connection between the optimal constant and spectral properties.

March 4

### Jan Kristensen (University of Oxford)
*Regularity and uniqueness results in some variational problems*
Abstract: It is known that minimizers of strongly polyconvex variational integrals need not be regular nor unique. However, if a suitable Gårding type inequality is assumed for the variational integral, then both regularity and uniqueness of minimizers can be restored under natural smallness conditions on the data. In turn, the Gårding inequality turns out to always hold under an a priori $C^1$ regularity hypothesis on the minimizer, while its validity is not known in the general case. In this talk, we discuss these issues and how they are naturally connected to convexity of the variational integral on the underlying Dirichlet classes.

Part of the talk is based on ongoing joint work with Judith Campos Cordero, Bernd Kirchheim and Jan Kolář.

March 11

### Alex Kaltenbach (University of Freiburg)
*Variable exponent Bochner–Lebesgue spaces with symmetric gradient structure*
Abstract: We introduce function spaces for the treatment of non-linear parabolic equations with variable log-Hölder continuous exponents, which only incorporate information of the symmetric part of a gradient. As an analogue of Korn's inequality for these functions spaces is not available, the construction of an appropriate smoothing method proves itself to be difficult. To this end, we prove a point-wise Poincaré inequality near the boundary of a bounded Lipschitz domain involving only the symmetric gradient. Using this inequality, we construct a smoothing operator with convenient properties. In particular, this smoothing operator leads to several density results, and therefore to a generalized formula of integration by parts with respect to time. Using this formula and the theory of maximal monotone operators, we prove an abstract existence result. This is a

joint work with Michael Růžička

March 18

### Hans G. Feichtinger (TU Wien and NuHAG)

*Completeness of sets of shifts in invariant Banach spaces of functions*

Abstract: We show that well-established methods from the theory of Banach modules and time-frequency analysis allow to derive completeness results for the collection of shifted and dilated version of a given (test) function in a quite general setting. While the basic ideas show strong similarity to the arguments used in a recent paper by V. Katsnelson we extend his results in several directions, both relaxing the assumptions and widening the range of applications. There is no need for the Banach spaces considered to be embedded into $(L^2(\mathbb{R}), \|\cdot\|_2)$, nor is the Hilbert space structure relevant. We choose to present the results in the setting of the Euclidean spaces, because then the Schwartz space $\mathcal{S}'(\mathbb{R}^d)$ $(d \geq 1)$ of tempered distributions provides a well-established environment for mathematical analysis. We also establish connections to modulation spaces and Shubin classes $(Q_s(\mathbb{R}^d), \|\cdot\|_{Q_s})$, showing that they are special cases of Katsnelson's setting (only) for $s \geq 0$.

March 25

### Tino Ullrich (Technische Universität Chemnitz)

*Consequences of the Kadison Singer solution and Weaver's conjecture for the recovery of multivariate functions from a few random samples*

Abstract: The celebrated solution of the Kadison Singer problem by Markus, Spielman and Srivastava in 2015 via Weaver's conjecture is the starting point for a new subsampling technique for finite frames in $C^m$ by keeping the stability. We consider the special situation of a frame coming from a finite orthonormal system of $m$ functions evaluated at random nodes (drawn from the orthogonality measure). It is well known that this yields a good frame with high probability when we logarithmically oversample, i.e. take $n$ samples with $n = m \log(m)$. By the mentioned subsampling technique we may select a sub-frame of size $O(m)$. The consequence is a new general upper bound for the minimal $L^2$-worst-case recovery error in the framework of RKHS, where only $n$ function samples are allowed. This quantity can be bounded in terms of the singular numbers of the compact embedding into the space of square integrable functions. It turns out that in many relevant situations this quantity is asymptotically only worse by square root of $\log(n)$ compared to the singular numbers. The algorithm which realizes this behavior is a weighted least squares algorithm based on a specific set of sampling nodes which works for the whole class of functions simultaneously. These points are constructed out of a random draw with respect to distribution tailored to the spectral properties of the reproducing kernel (importance sampling) in combination with a sub-sampling mentioned above. For the above multivariate setting, it is still a fundamental open problem whether sampling algorithms are as powerful as algorithms allowing general linear information like Fourier or wavelet coefficients. However, the gap is now rather small.

This is joint work with N. Nagel and M. Schaefer from TU Chemnitz.

April 1

## Pedro Fernández-Martínez (Universidad de Murcia)

*General Reiteration Theorems for $\mathcal{R}$ and $\mathcal{L}$ spaces*

Abstract: The results contained in this lecture are part of an ongoing research project with T. Signes. We will work with the real interpolation method defined by means of slowly varying functions and rearrangement invariant (r.i.) spaces. More precisely, for $0 \leq \theta \leq 1$, $b$ a slowly varying function and $E$ an r.i. space we define the following interpolation space for the couple $\overline{X} = (X_0, X_1)$:

$$\overline{X}_{\theta,\mathrm{b},E} = \left\{ f \in X_0 + X_1 : \; \left\| t^{-\theta} \mathrm{b}(t) K(t,f) \right\|_{\widetilde{E}} < \infty \right\}.$$

This interpolation scale is stable under reiteration for $0 < \theta < 1$. Indeed, for $0 < \theta < 1$ and $0 < \theta_0 < \theta_1 < 1$,

$$\left( \overline{X}_{\theta_0,\mathrm{b}_0,E_0}, \overline{X}_{\theta_1,\mathrm{b}_1,E_1} \right)_{\theta,\mathrm{b},E} = \overline{X}_{\tilde{\theta},\tilde{\mathrm{b}},E}.$$

However, interpolation with parameter $\theta = 0$ or $\theta = 1$ gives rise to the $\mathcal{L}$ and $\mathcal{R}$ spaces:

$$\left( \overline{X}_{\theta_0,\mathrm{b}_0,E_0}, \overline{X}_{\theta_1,\mathrm{b}_1,E_1} \right)_{0,\mathrm{b},E} = \overline{X}^{\mathcal{L}}_{\theta_0,\mathrm{b}\circ\rho,E,\mathrm{b}_0,E_0}$$

$$\left( \overline{X}_{\theta_0,\mathrm{b}_0,E_0}, \overline{X}_{\theta_1,\mathrm{b}_1,E_1} \right)_{1,\mathrm{b},E} = \overline{X}^{\mathcal{R}}_{\theta_1,\mathrm{b}\circ\rho,E,\mathrm{b}_1,E_1}.$$

Here, we will present reiteration theorems that identify the spaces

$$\left( \overline{X}^{\mathcal{R}}_{\theta_0,\mathrm{b}_0,E_0,a,F}, \overline{X}_{\theta_1,\mathrm{b}_1,E_1} \right)_{\theta,\mathrm{b},E} \qquad \left( \overline{X}_{\theta_0,\mathrm{b}_0,E_0}, \overline{X}^{\mathcal{L}}_{\theta_1,\mathrm{b}_1,E_1,a,F} \right)_{\theta,\mathrm{b},E}$$

$$\left( \overline{X}_{\theta_0,\mathrm{b}_0,E_0}, \overline{X}^{\mathcal{R}}_{\theta_1,\mathrm{b}_1,E_1,a,F} \right)_{\theta,\mathrm{b},E} \qquad \left( \overline{X}^{\mathcal{L}}_{\theta_0,\mathrm{b}_0,E_0,a,F}, \overline{X}_{\theta_1,\mathrm{b}_1,E_1} \right)_{\theta,\mathrm{b},E}.$$

We illustrate the use of these results with applications to interpolation of grand and small Lebesgue spaces, Gamma spaces and $A$ and $B$-type spaces.

April 8

## Ryan Gibara (Université Laval, Québec)

*The decreasing rearrangement and mean oscillation*

Abstract: In joint work with Almut Burchard and Galia Dafni, we study the boundedness and continuity of the decreasing rearrangement on the space BMO of functions of bounded mean oscillation in $\mathbb{R}^n$. Improvements on the operator bounds will be presented, including recent progress bringing the $O(2^{n/2})$ bound to $O(\sqrt{n})$. Then, the failure of the continuity of decreasing rearrangement on BMO will be discussed, along with some sufficient normalisation conditions to guarantee continuity on the subspace VMO of functions of vanishing mean oscillation.

April 15

## Fernando Cobos (Universidad Complutense de Madrid)

*Interpolation of compact bilinear operators*

Abstract: Interpolation of compact bilinear operators is a problem already considered by Calderón [2] in his foundational paper on the complex interpolation method. The study on the real method started more recently with the papers by Fernadez and Silva [6] and Fernández-Cabrera and Martínez [7, 8]. An important motivation for this research has been the fact that compact bilinear operators occurs rather naturally in harmonic analysis (see, for example, the paper by Bényi and Torres [1]).

In this talk we will review some recent results on the topic taken from joint papers with Fernández-Cabrera and Martínez [3, 4, 5].

References:

[1] Á. Bényi and R.H. Torres, *Compact bilinear operators and commutators*, Proc. Amer. Math. Soc. **141** (2013) 3609–3621.

[2] A.P. Calderón, *Intermediate spaces and interpolation, the complex method*, Studia Math. **24** (1964) 113–190.

[3] F. Cobos, L.M. Fernández-Cabrera and A. Martínez, *Interpolation of compact bilinear operators among quasi-Banach spaces and applications*, Math. Nachr. **291** (2018) 2168–2187.

[4] F. Cobos, L.M. Fernández-Cabrera and A. Martínez, *On compactness results of Lions-Peetre type for bilinear operators*, Nonlinear Anal. **199** (2020) 111951.

[5] F. Cobos, L.M. Fernández-Cabrera and A. Martínez, *A compactness result of Janson type for bilinear operators*, J. Math. Anal. Appl. **495** (2021) 124760.

[6] D.L. Fernandez and E.B. da Silva, *Interpolation of bilinear operators and compactness*, Nonlinear Anal. **73** (2010) 526–537.

[7] L.M. Fernández-Cabrera and A. Martínez, *On interpolation properties of compact bilinear operators*, Math. Nachr. **290** (2017) 1663–1677.

[8] L.M. Fernández-Cabrera and A. Martínez, *Real interpolation of compact bilinear operators*, J. Fourier Anal. Appl. **24** (2018) 1181–1203.

April 22

**Lukáš Malý (Linköping University)**
*Dirichlet problem for functions of least gradient in domains with boundary of positive mean curvature in metric measure spaces*
Abstract: Sternberg, Williams, and Ziemer showed that existence, uniqueness, and regularity of solutions to the Dirichlet problem for 1-Laplacian on domains in $R^n$ are closely related to the mean curvature of the domain's boundary. In my talk, I will discuss the problem of minimization of the corresponding energy functional, which can be naturally formulated and studied in the setting of BV functions on metric measure spaces. Having generalized the notion of positive mean curvature of the boundary, one can prove existence of solutions to the Dirichlet problem. However, solutions can fail to be continuous and/or unique even if the boundary and the boundary data are smooth, which shall be demonstrated using fairly simple examples in weighted $R^2$.

The talk is based on a joint work with Panu Lahti, Nages Shanmugalingam, and Gareth Speight, with contribution of Esti Durand-Cartagena and Marie Snipes.

April 29

**Gael Diebou Yomgne (University of Bonn)**
*Stationary Navier–Stokes flow with irregular Dirichlet data*
Abstract: In this talk, we discuss recent results on the well-posedness of the forced Navier-Stokes equations in bounded/unbounded domain (in arbitrary dimension) subject to Dirichlet data assuming minimal smoothness properties at the boundary. We will emphasize on the construction of the solution space which reflects the intrinsic features (scaling and translation invariance, type of nonlinearity) of the equation. Our machinery together with some known facts in harmonic analysis and function space theory predicts a boundary class from a Triebel-Lizorkin scale. By prescribing small data, existence, uniqueness and regularity results are obtained using a non-variational approach. This solvability improves the previous existing results which will be mentioned. If time allows, we will also discuss self-similarity properties of solutions in a somewhat different setting.

May 6

**Santeri Miihkinen (Karlstad University)**
*The infinite Hilbert matrix on spaces of analytic functions*
Abstract: The (finite) Hilbert matrix is arguably one of the single most well-known matrices in mathematics. The infinite Hilbert matrix $\mathcal{H}$ was introduced by David Hilbert around 120 years ago in connection to his double series theorem. It can be interpreted as a linear operator on spaces of analytic functions by its action on their Taylor coefficients. The boundedness of $\mathcal{H}$ on the Hardy spaces $H^p$ for $1 < p < \infty$ and Bergman spaces $A^p$ for $2 < p < \infty$ was established by Diamantopoulos and Siskakis. The exact value of the operator norm of $\mathcal{H}$ acting on the Bergman spaces $A^p$ for $4 \leq p < \infty$ was shown to be $\frac{\pi}{\sin(2\pi/p)}$ by Dostanic, Jevtic and Vukotic in 2008. The case $2 < p < 4$ was an open problem until in 2018 it was shown by Bozin and Karapetrovic that the norm has the same value also on the scale $2 < p < 4$. In this talk, we review some of the old results and consider the still partly open problem regarding the value of the norm on weighted Bergman spaces. The talk is partly based on a joint work with Mikael Lindström and Niklas Wikman (Åbo Akademi).

May 13

**Nages Shanmugalingam (University of Cincinnati)**
*Uniformization of weighted Gromov hyperbolic spaces and uniformly locally bounded geometry*
Abstract: The seminal work of Bourdon and Pajot gave a way of constructing a Gromov hyperbolic space whose boundary is a compact doubling metric space of interest. The work of Bonk, Heinonen, and Koskela gave us a way of turning a Gromov hyperbolic space into a uniform domain whose boundary is quasisymmetric to the original compact doubling space. In this talk we will describe a

way of uniformizing measures on a Gromov hyperbolic space that is uniformly locally doubling and supports a uniformly local Poincare inequality to obtain a uniform space that is equipped with a globally doubling measure supporting a global Poincare inequality. This is then used to compare Besov spaces on the original compact doubling space with traces of Newton-Sobolev spaces on the uniform domain. This talk is based on joint work with Anders Bjorn and Jana Bjorn.

May 20

### Viktor Kolyada (Karlstad University)
*Estimates of Besov mixed-type norms for functions in Sobolev and Hardy-Sobolev spaces*
Abstract: We prove embeddings of Sobolev and Hardy-Sobolev spaces into Besov spaces built upon certain mixed norms. This gives an improvement of the known embeddings into usual Besov spaces. Applying these results, we obtain Oberlin type estimates of Fourier transforms for functions in Sobolev spaces.
   Published in: Ann. Mat. Pura Appl., 192, no. 2 (2019), 615-637.

May 27

### Jose Maria Martell (ICMAT, Madrid)
*Distilling Rubio de Francia's extrapolation theorem*
Abstract: Rubio de Francia's extrapolation theorem states that if a given operator is bounded on $L^2(w)$ for all $w \in A_2$, then the same occurs on $L^p(w)$ for all $w \in A_p$ and for all $1 < p < \infty$. Its proof only uses the boundedness of the Hardy-Littlewood maximal function on weighted spaces. In this talk I will adopt a new viewpoint on which the desired estimate follows from some "embedding" based on this basic ingredient. This allows us to generalize extrapolation in the context of Banach function spaces on which the some weighted estimates hold for the Hardy-Littlewood maximal function.

June 3

### Petru Mironescu (l'Institut Camille Jordan de l'Université Lyon 1)
*Sobolev maps to the circle*
Abstract: Sobolev spaces $W^{s,p}$ of maps with values into a compact manifold naturally appear in geometry and material sciences. They exhibit qualitatively different properties from scalar Sobolev spaces: in general, there is no density of smooth maps, and standard trace theory fails. We will present some of their basic properties, with focus on the cases where $s < 1$ or the target manifold is the circle, in which harmonic analysis tools combined with geometric considerations are quite effective. In particular, we discuss the factorization of unimodular maps, which can be seen as a geometric version of paraproducts.

June 10

### Gianluigi Manzo (University of Naples)
*The spaces $BMO_{(s)}$ and o-O structures*
Abstract: In 2015 a new Banach space $B$ was introduced by Bourgain, Brezis and Mironescu, equipped with a norm defined as a supremum of oscillations. This

space has a subspace $B_0$ which has a vanishing condition the oscillations and whose bidual is exactly $B$. This situation is similar to what happens with the $(VMO, BMO)$: in fact, there are many Banach spaces $E$, defined by a supremum ("big o") condition that are biduals of a subspace $E_0$ defined by a vanishing ("little o") condition. The space $B$ sparked the interest in these spaces, with the help of a construction due to K. M. Perfekt. This talk aims to give a brief overview on some results on these o-O pairs, with a focus on the family of spaces $BMO_{(s)}$ recently introduced by C. Sweezy.

June 17

**Polona Durcik (Chapman University)**
*Singular Brascamp-Lieb inequalities with cubical structure*
Abstract: Brascamp-Lieb inequalities are Lp estimates for certain multilinear integral forms on functions on Euclidean spaces. They generalize several classical inequalities, such as Hoelder's inequality or Young's convolution inequality. In this talk we focus on singular Brascamp-Lieb inequalities, which arise when one of the functions in a Brascamp-Lieb integral is replaced by a singular integral kernel. Singular Brascamp-Lieb integrals are much less understood than their non-singular variants. We discuss some results and open problems in the area and focus on a special case which features a particular cubical structure. Based on joint works with C. Thiele and work in progress with L. Slavíková and C. Thiele.

June 24

**Ritva Hurri-Syrjänen (University of Helsinki)**
*On the John-Nirenberg space*
Abstract: Fritz John and Louis Nirenberg gave a summation condition for cubes which gives rise to a function space. This $JN_p$ space has been less well known than the BMO space. The talk will address questions related to functions belonging to the $JN_p$ space when the functions are defined on certain domains in $R^n$.

July 1

**Jean Van Schaftingen (Université catholique de Louvain )**
*Estimates for the Hopf invariant in critical fractional Sobolev spaces*
Abstract: The Brouwer degree classifies the homotopy classes of mappings from a sphere into itself. Bourgain, Brezis and Mironescu have obtained some linear estimates of the degree of a mapping by any critical first-order or fractional Sobolev energy. Similarly, maps from the three-dimensional sphere to the two-dimensional spheres are classified by their Hopf invariant. Thanks to the Whitehead formula, Rivière has proved a sharp nonlinear control of the Hopf invariant by the first-order critical Sobolev energy. I will explain how a general compactness argument implies that sets that have bounded critical fractional Sobolev energy have bounded Hopf invariant and how we are obtaining in collaboration with Armin Schikorra sharp nonlinear estimates in critical fractional Sobolev spaces with order is close to 1.

November 4

### Alexei Karlovich (NOVA University Lisbon, Portugal)
*On the interpolation constants for variable Lebesgue spaces*

Abstract: For $\theta \in (0,1)$ and variable exponents $p_0(\cdot), q_0(\cdot)$ and $p_1(\cdot), q_1(\cdot)$ with values in $[1, \infty]$, let the variable exponents $p_\theta(\cdot), q_\theta(\cdot)$ be defined by

$$1/p_\theta(\cdot) := (1-\theta)/p_0(\cdot) + \theta/p_1(\cdot), \quad 1/q_\theta(\cdot) := (1-\theta)/q_0(\cdot) + \theta/q_1(\cdot).$$

The Riesz-Thorin type interpolation theorem for variable Lebesgue spaces says that if a linear operator $T$ acts boundedly from the variable Lebesgue space $L^{p_j(\cdot)}$ to the variable Lebesgue space $L^{q_j(\cdot)}$ for $j = 0, 1$, then

$$\|T\|_{L^{p_\theta(\cdot)} \to L^{q_\theta(\cdot)}} \le C \|T\|_{L^{p_0(\cdot)} \to L^{q_0(\cdot)}}^{1-\theta} \|T\|_{L^{p_1(\cdot)} \to L^{q_1(\cdot)}}^{\theta},$$

where $C$ is an interpolation constant independent of $T$. We consider two different modulars $\varrho^{\max}(\cdot)$ and $\varrho^{\mathrm{sum}}(\cdot)$ generating variable Lebesgue spaces and give upper estimates for the corresponding interpolation constants $C_{\max}$ and $C_{\mathrm{sum}}$, which imply that $C_{\max} \le 2$ and $C_{\mathrm{sum}} \le 4$, as well as, lead to sufficient conditions for $C_{\max} = 1$ and $C_{\mathrm{sum}} = 1$. We also construct an example showing that, in many cases, our upper estimates are sharp and the interpolation constant is greater than one, even if one requires that $p_j(\cdot) = q_j(\cdot)$, $j = 0, 1$ are Lipschitz continuous and bounded away from one and infinity (in this case $\varrho^{\max}(\cdot) = \varrho^{\mathrm{sum}}(\cdot)$). This is a joint work with Eugene Shargorodsky (King's College London, UK).

November 11

### João P.G. Ramos (ETH Zürich, Switzerland)
*Stability for geometric and functional inequalities*

Abstract: The celebrated isoperimetric inequality states that, for a measurable set $S \subset \mathbb{R}^n$, the inequality

$$\mathrm{per}(S) \ge n \mathrm{vol}(S)^{\frac{n-1}{n}} \mathrm{vol}(B_1)^{\frac{1}{n}}$$

holds, where $\mathrm{per}(S)$ denotes the perimeter (or surface area) of $S$, and equality holds if and only if $S$ is an euclidean ball. This result has many applications throughout analysis, but an interesting feature is that it can be obtained as a corollary of a more general inequality, the Brunn–Minkowski theorem: if $A, B \subset \mathbb{R}^n$, define $A + B = \{a + b, a \in A, b \in B\}$. Then

$$|A + B|^{1/n} \ge |A|^{1/n} + |B|^{1/n}.$$

Here, equality holds if and only if $A$ and $B$ are homothetic and convex. A question pertaining to both these results, that aims to exploit deeper features of the geometry behind them, is that of stability: if $S$ is close to being optimal for the isoperimetric inequality, can we say that $A$ is close to being a ball? Analogously, if $A, B$ are close to being optimal for Brunn–Minkowski, can we say they are close to being compact and convex?

These questions, as stand, have been answered only in very recent efforts by several mathematicians. In this talk, we shall outline these results, with focus on the following new result, obtained jointly with A. Figalli and K. Böröczky.

If $f, g$ are two non-negative measurable functions on $\mathbb{R}^n$, and $h : \mathbb{R}^n \to \mathbb{R}_{\geq 0}$ is measurable such that

$$h(x + y) \geq f(2x)^{1/2} g(2y)^{1/2}, \ \forall x, y \in \mathbb{R}^n,$$

then the Prekopa–Leindler inequality asserts that

$$\int h \geq \left( \int f \right)^{1/2} \left( \int g \right)^{1/2},$$

where equality holds if and only if $h$ is log-concave, and $f, g$ are 'homothetic' to $h$, in a suitable sense. We prove that, if $\int h \leq (1 + \varepsilon) \left( \int f \right)^{1/2} \left( \int g \right)^{1/2}$, then $f, g, h$ are $\varepsilon^{\gamma n} - L^1-$close to being optimal. We will discuss the general idea for the proof and, time-allowing, discuss on a conjectured sharper version.

November 18

## Iwona Chlebicka (Institute of Applied Mathematics and Mechanics, University of Warsaw, Poland)

*Approximation properties of Musielak-Orlicz-Sobolev spaces and its role in well-posedness of nonstandard growth PDE*

Abstract: Musielak-Orlicz-Sobolev spaces describe in one framework Sobolev spaces with variable exponent, with double phase, as well as isotropic and anisotropic Orlicz spaces. There is significant interest in PDEs and calculus of variations fitting in such a framework. These spaces share an essential difficulty - smooth functions are not dense in Musielak-Orlicz-Sobolev spaces unless the function generating them is regular enough. It is closely related to the so-called Lavrentiev's phenomenon describing the situation when infima of a variational functional over regular functions and over all functions in the energy space are different. Throughout the talk I will be explaining in detail why for PDEs it is so critical to have density especially in non-reflexive spaces.

The typical examples of sufficient conditions for the density is log-Hölder continuity of the variable exponent or the closeness condition for powers in the double phase spaces. Some sufficient conditions were known in the anisotropic cases, but they were not truly capturing full anisotropy. I will present new sufficient conditions obtained in collaboration with Michał Borowski (student at University of Warsaw). They improve previous conditions covering all known optimal conditions and being essentially better than any non-doubling or anisotropic condition before.

December 9

## Marco Fraccaroli (University of Bonn, Germany)

*Outer $L^p$ spaces: Köthe duality, Minkowski inequality and more*

Abstract: The theory of $L^p$ spaces for outer measures, or outer $L^p$ spaces, was developed by Do and Thiele to encode the proof of boundedness of certain multilinear operators in a streamlined argument. Accordingly to this purpose, the theory was developed in the direction of the real interpolation features of these spaces, such as versions of Hölder's inequality and Marcinkiewicz interpolation, while other questions remained untouched.

For example, the outer $L^p$ spaces are defined by quasi-norms generalizing the classical mixed $L^p$ norms on sets with a Cartesian product structure; it is then natural to ask whether in arbitrary settings the outer $L^p$ quasi-norms are equivalent to norms and what other reasonable properties they satisfy, e.g. Köthe duality and Minkowski inequality. In this talk, we will answer these questions, with a particular focus on two specific settings on the collection of dyadic intervals in $\mathbb{R}$ and the collection of dyadic Heisenberg boxes in $\mathbb{R}^2$. This will allow us to clarify the relation between outer $L^p$ spaces and tent spaces, and get a glimpse at the use of this language in the proof of boundedness of prototypical multilinear operators with invariances.

December 16

**Daniel Cameron Campbell (University of Hradec Králové)**
*Closures of planar BV homeomorphisms and the relaxation of functionals with linear growth*
Abstract: Motivated by relaxation results of Kristensen and Rindler, and of Benešová, Krömer and Kružík for BV maps, we study the class of strict limits of BV planar homeomorphisms. We show that, although such maps need not be injective and are not necessarily continuous on almost every line, the class has a reasonable behavior expected for limit of elastic deformations. By a characterization of the classes of strict and area-strict limits of BV homeomorphisms we show that these classes coincide.

This is based on joint works with S. Hencl, A. Kauranen and E. Radici.

# 2022

January 6

**Franz Gmeineder (University of Konstanz, Germany)**
*$\mathcal{A}$-quasiconvexity, function spaces and regularity*
By Morrey's foundational work, quasiconvexity displays a key notion in the vectorial Calculus of Variations. A suitable generalisation that keeps track of more elaborate differential conditions is given by Fonseca & Müller's $\mathcal{A}$-quasiconvexity. With the topic having faced numerous contributions as to lower semicontinuity, in this talk I give an overview of recent results for such problems with focus on the underlying function spaces and the (partial) regularity of minima.

The talk is partially based on joint work with Sergio Conti (Bonn), Lars Diening (Bielefeld), Bogdan Raita (Pisa) and Jean Van Schaftingen (Louvain).

January 13

**Paolo Baroni (University of Parma)**
*New results for non-autonomous functionals with mild phase transition*
We describe how different regularity assumptions on the x-dependence of the energy impact the regularity of minimizers of some non-autonomous functionals having nonuniform ellipticity of moderate size. We put particular emphasis on double phase functionals with logarithmic phase transition, including some new results.

January 20

**Aleksander Pawlewicz (University of Warsaw, Poland)**
*On the Embedding of* BV *Space into Besov-Orlicz Space*
During the presentation I will give a sufficient (and, in the case of a compact domain, necessary) condition for the boundedness of the embedding operator from $BV(\Omega)$ space (the space of integrable functions for which a weak gradient exists and is a Radon measure) into Besov-Orlicz space $B_{\varphi,1}^{\psi}(\Omega)$, where $\Omega \subseteq \mathbb{R}^d$. The condition has a form of an integral inequality involving a Young function $\varphi$ and a weight function $\psi$ and can be written as follows

$$\frac{s^{d-1}}{\varphi^{-1}(s^d)} \int_0^s \frac{\psi(1/t)}{t} dt + \int_s^\infty \frac{\psi(1/t)s^{d-1}}{\varphi^{-1}(ts^{d-1})t} dt < D,$$

for some constant $D > 0$ and every $s > 0$. The main tool of the proof will be the molecular decomposition of functions from $BV$ space.

The talk will be based on a joint work with Michał Wojciechowski. Our paper "On the Embedding of BV Spaces into Besov-Orlicz Space" is already available on arXiv.

January 27

**Vincenzo Ferone (University of Naples Federico II, Italy)**
*Symmetrization for fractional elliptic problems: a direct approach*
We provide new direct methods to establish symmetrization results in the form of

mass concentration (*i.e.* integral) comparison for fractional elliptic equations of the type $(-\Delta)^s u = f$ $(0 < s < 1)$ in a bounded domain $\Omega$, equipped with homogeneous Dirichlet boundary conditions. The classical pointwise Talenti rearrangement inequality is recovered in the limit $s \to 1$. Finally, explicit counterexamples constructed for all $s \in (0, 1)$ highlight that the same pointwise estimate cannot hold in a nonlocal setting, thus showing the optimality of our results. This is a joint work with Bruno Volzone.

February 3

**Loukas Grafakos (University of Missouri, Columbia, MO)**
*From Fourier series to multilinear analysis*
We present a survey of classical results related to summability of Fourier series. We indicate how the question of summability of products of Fourier series motivates the study of multilinear analysis, in particular the study of multilinear multiplier problems. We discuss some new results in this area and outline our methodology.

February 10

**Sergi Baena Miret (University of Barcelona, Spain)**
*Decreasing rearrangements on average operators*
Let $\{T_\theta\}_\theta$ be a family of operators indexed in a probability measure space $(\Omega, \mathcal{A}, P)$ such that the boundedness

$$T_\theta : L^1(u) \longrightarrow L^{1,\infty}(u), \qquad \forall u \in A_1,$$

holds with constant less than or equal to $\varphi(\|u\|_{A_1})$, with $\varphi$ being a nondecreasing function on $(0, \infty)$ and where $A_1$ is the class of Muckenhoupt weights. The aim of this talk is to address the following two questions: what can we say about the decreasing rearrangement of the average operator

$$T_A f(x) = \int_\Omega T_\theta f(x) dP(\theta), \qquad x \in \mathbb{R}^n,$$

whenever is well defined and what can we say about its boundedness over r.i. spaces as, for instance, the classical Lorentz spaces?

February 17

**Daniel Spector (National Taiwan Normal University)**
*An Atomic Decomposition for Divergence Free Measures*
In this talk we describe a recent result obtained in collaboration with Felipe Hernandez where we give an atomic decomposition for the space of divergence free measures. The atoms in this setting are piecewise $C^1$ closed curves which satisfy a ball growth condition, while our result can be used to deduce certain "forbidden" Sobolev inequalities which arise in the study of electricity and magnetism.

February 24

**Giuseppe Rosario Mingione (Università di Parma, Italy)**
*Perturbations beyond Schauder*

So-called Schauder estimates are a standard tool in the analysis of linear elliptic and parabolic PDEs. They had been originally proved by Hopf (1929, interior case), and by Schauder and Caccioppoli (1934, global estimates). Since then, several proofs were given (Campanato, Trudinger, Simon). The nonlinear case is a more recent achievement from the 80s (Giaquinta & Giusti, Ivert, J. Manfredi, Lieberman). All these classical results take place in the uniformly elliptic case. I will discuss progress in the nonuniformly elliptic one. From joint work with Cristiana De Filippis.

March 3

### Lukas Koch (Max Planck Institute Mathematics in the Sciences, Leipzig, Germany)

*Functionals with nonstandard-growth and convex duality*

I will present recent results obtained in collaboration with Jan Kristensen (Oxford) and Cristiana de Filippis (Parma) concerning functionals of the form

$$\min_{u \in g + W_0^{1,p}(\Omega, \mathbb{R}^n)} \int_\Omega F(Du)\, dx,$$

where $F(z)$ satisfies $(p, q)$-growth conditions. In particular, I will highlight how ideas from convex duality theory can be used in order to show $L^1$-regularity of the stress $\partial_z F(Du)$ and the validity of the Euler–Lagrange equation without an upper growth bound on $F(x, \cdot)$ as soon as $F(z)$ is convex, proper, essentially smooth and superlinear in $z$. Further, I will give a example of how to use similar ideas to obtain $W^{1,q}$-regularity of minimisers under controlled duality $(p, q)$-growth with $2 \leq p \leq q \leq \frac{np}{n-2}$.

March 10

### Tuomas Hytönen (University of Helsinki, Finland)

*One-sided sparse domination*

Over the past ten years, sparse domination has proven to be an efficient way to capture many key features of singular operators. Much of current research is about extending the method to ever more general classes of operators. The objects of this talk are somewhat against this trend: to dominate more specific operators, but then to have these special features reflected in the estimates. More concretely, we deal with "one-sided" (or "causal") operators such that $Tf(x)$ only depends on the function $f$ on one side of the point $x$. Is it then possible to obtain a sparse bound with the same kind of causality? The dream theorem that one could hope for remains open, but we are able to get a certain weaker version. This version is still good enough to obtain the boundedness of one-sided operators in some function spaces, relevant for partial differential equations, where usual "two-sided" operators are not bounded in general.

The talk is based on joint work with Andreas Rosén (https://arxiv.org/abs/2108.10597).

March 17

### Bogdan Raita (Scuola Normale Superiore, Pisa, Italy)

*Nonlinear spaces of functions and compensated compactness for concentrations*

We study compensation phenomena for fields satisfying both a pointwise and a linear differential constraint. The compensation effect takes the form of nonlinear elliptic estimates, where constraining the values of the field to lie in a cone compensates for the lack of ellipticity of the differential operator. We give a series of new examples of this phenomenon, focusing on the case where the cone is a subset of the space of symmetric matrices and the differential operator is the divergence or the curl. One of our main findings is that the maximal gain of integrability is tied to both the differential operator and the cone, contradicting in particular a recent conjecture from arXiv:2106.03077. This appends the classical compensated compactness framework for oscillations with a variant designed for concentrations, and also extends the recent theory of compensated integrability due to D. Serre. In particular, we find a new family of integrands that are Div-quasiconcave under convex constraints.

March 24

**Anna Kh. Balci (Universität Bielefeld, Germany)**
*(Generalized) Sobolev-Orlicz Spaces of differential forms*
We study generalised Sobolev-Orlicz spaces of differential forms. In particular we provide results on density of smooth functions and design examples on Lavrentiev gap for partial spaces of differential forms such as variable exponent, double phase and weighted energy. As an application we consider Lavrentiev gap for so-called borderline case of double phase potential model.

March 31

**Sebastian Schwarzacher (University of Uppsala, Sweden)**
*Construction of a right inverse for the divergence in non-cylindrical time dependent domains*
We discuss the construction of a stable right inverse for the divergence operator in non-cylindrical domains in space-time. The domains are assumed to be Hölder regular in space and evolve continuously in time. The inverse operator is of Bogovskij type, meaning that it attains zero boundary values. We provide estimates in Sobolev spaces of positive and negative order with respect to both time and space variables. The regularity estimates on the operator depend on the assumed Hölder regularity of the domain. The results can naturally be connected to the known theory for Lipschitz domains. As an application, we prove refined pressure estimates for weak and very weak solutions to Navier-Stokes equations in time-dependent domains. This is a joint work with Olli Saari.

April 7

**Rupert Frank (California Institute of Technology)**
*Sobolev spaces and spectral asymptotics for commutators*
We discuss two different, but related topics. The first concerns a new, derivative-free characterization of homogeneous, first-order Sobolev spaces, the second concerns spectral properties of so-called quantum derivatives, which are commutators with a certain singular integral operator. At the endpoint, these two topics come together and we try to explain the analogy between the results and the proofs,

as well as an open conjecture.

April 14

**Peter Hastö (University of Helsinki)**
*Anisotropic generalized Orlicz spaces and PDE*
Vector-valued generalized Orlicz spaces can be divided into anisotropic, quasi-isotropic and isotropic. In isotropic spaces, the Young function depends only on the length of the vector, i.e. $\Phi(v) = \phi(|v|)$. In the quasi-isotropic case $\Phi(v) \approx \phi(|v|)$ so the dependence is via the length of the vector up to a constant. In the anisotropic case, there is no such restriction, and the Young function depends directly on the vector.

Basic assumptions in anisotropic generalized Orlicz spaces are not as well understood as in the isotropic case. In this talk I explain the assumptions and prove the equivalence of two widely used conditions in the theory of generalized Orlicz spaces, usually called (A1) and (M). This provides a more natural and easily verifiable condition for use in the theory of anisotropic generalized Orlicz spaces for results such as Jensen's inequality.

In collaboration with Jihoon Ok, we obtained maximal local regularity results of weak solutions or minimizers of

$$\operatorname{div} A(x, Du) = 0 \quad \text{and} \quad \min_u \int_\Omega F(x, Du) \, dx,$$

when $A$ or $F$ are general quasi-isotropic Young functions. In other words, we studied the problem without recourse to special function structure and without assuming Uhlenbeck structure. We established local $C^{1,\alpha}$-regularity for some $\alpha \in (0, 1)$ and $C^\alpha$-regularity for any $\alpha \in (0, 1)$ of weak solutions and local minimizers. Previously known, essentially optimal, regularity results are included as special cases.

Preprints are available at `https://www.problemsolving.fi/pp/`.

April 21

**Michael Ruzhansky (Ghent University, Belgium)**
*Subelliptic pseudo-differential calculus on compact Lie groups*
In this talk we will give an overview of several related pseudo-differential theories and give a comparison for them in terms of regularity estimates, on compact and nilpotent groups, also contrasting the cases of elliptic and sub elliptic classes in the compact case.

April 28

**Óscar Domínguez (Universitè Claude Bernard Lyon 1)**
*New estimates for the maximal functions and applications*
We discuss sharp pointwise inequalities for maximal operators, in particular, an extension of DeVore's inequality for the moduli of smoothness and a logarithmic variant of Bennett–DeVore–Sharpley's inequality for rearrangements. This is joint work with Sergey Tikhonov.

May 5

**Alan Chang (Princeton University)**
*Nikodym-type spherical maximal functions*
We study $L^p$ bounds on Nikodym maximal functions associated to spheres. In contrast to the spherical maximal functions studied by Stein and Bourgain, our maximal functions are uncentered: for each point in $\mathbb{R}^n$, we take the supremum over a family of spheres containing that point.

May 12

**Angkana Rüland (Heidelberg University)**
*On Rigidity, Flexibility and Scaling Laws: The Tartar Square*
In this talk I will discuss a dichotomy between rigidity and flexibility for certain differential inclusions from materials science and the role of function spaces in this dichotomy: While solutions in sufficiently regular function spaces are "rigid" and are determined by the "characteristics" of the underlying equations, at low regularity this is lost and a plethora of "wild" irregular solutions exist. I will show that the scaling of certain energies could serve as a mechanism distinguishing these two regimes and may yield function spaces that separate these regimes. By discussing the Tartar square, I will present an example of a situation with a dichotomy between rigidity and flexibility where such scaling results can be proved.

   This is based on joint work with Jamie Taylor, Antonio Tribuzio, Christian Zillinger and Barbara Zwicknagl.

May 19

**Glenn Byrenheid (Friedrich-Schiller University, Jena)**
*Sparse approximation for break of scale embeddings*
We study sparse approximation of Sobolev type functions having dominating mixed smoothness regularity borrowed for instance from the theory of solutions for the electronic Schrödinger equation. Our focus is on measuring approximation errors in the practically relevant energy norm. We compare the power of approximation for linear and non-linear methods working on a dictionary of Daubechies wavelet functions. Explicit (non-)adaptive algorithms are derived that generate $n$-term approximants having dimension-independent rates of convergence.

May 26

**Wentao Teng (Kwansei Gakuin University)**
*Dunkl translations, Dunkl–type $BMO$ space and Riesz transforms for Dunkl transform on $L^\infty$*
We study some results on the support of Dunkl translations on compactly supported functions. Then we will define Dunkl–type $BMO$ space and Riesz transforms for Dunkl transform on $L^\infty$, and prove the boundedness of Riesz transforms from $L^\infty$ to Dunkl–type $BMO$ space under the uniform boundedness assumption of Dunkl translations. The proof and the definition in Dunkl setting will be harder than in the classical case for the lack of some similar properties of Dunkl translations to that of classical translations. We will also extend the preciseness

of the description of support of Dunkl translations on characteristic functions by Gallardo and Rejeb to that on all nonnegative radial functions in $L^2(m_k)$.