September 14, 2026 - Monday

On the accretivity and m-accretivity of Laplacians and porous medium-type operators on graphs

Alberto G. Setti
University of Insubria, Italy

We study the accretivity and m-accretivity of Laplacian and porous medium-type operators on weighted graphs, and give several conditions that imply these properties for maximal operators and investigate when these operators agree with various restrictions. For porous medium-type operators on ℓ^1 and for Laplacians on ℓ^p for $p \in [1, \infty)$, we show that there always exists a dense subset of the domain on which the maximal operator is m-accretive. Under additional conditions on the graph, we then prove that the maximal operators are m-accretive on the entire domain, and not just a dense subset. For the ℓ^2 case, we give connections to Markov uniqueness and essential self-adjointness. For the ℓ^∞ case, we establish the equivalence of stochastic completeness at infinity, m-accretivity for the maximal Laplacian on ℓ^∞ and m-accretivity of the minimal Laplacian on ℓ^1.

This is joint work with Davide Bianchi (Sun Yat-sen University, Zhuhai, China), Matthias Keller (Universität Potsdam, Germany) and Radosław K. Wojciechowski (York College and Graduate Center, CUNY, New York, USA).

Criticality theory for nonlinear Dirichlet forms

Marcel Schmidt
Friedrich-Schiller University Jena, Germany

Nonlinear Dirichlet forms are lower semicontinuous convex functionals on L^2-spaces whose subdifferentials generate order-preserving and L^∞-contractive nonlinear semigroups. Important examples include Cheeger energies on metric measure spaces, the p-Dirichlet energy, and energies arising from nonlinear resistance networks.

In this talk, we present a criticality theory for such functionals. We study the dichotomy between subcriticality and criticality, characterize subcriticality in terms of weighted Hardy inequalities and the finiteness of the associated Green operator, and characterize criticality through the existence of a ground state in the sense of Agmon. Our main aim is to identify the additional assumptions under which such a theory can be developed and to highlight both the similarities and the differences between the linear and nonlinear settings. Motivated by the theme of the conference, particular emphasis will be placed on applications to discrete spaces.

This is joint work with Ian Zimmermann (Jena).

Non-negative Ollivier curvature and polynomial volume growth

Florentin Münch
University of Leipzig, Germany

We show that reversible Markov chains with non-negative Ollivier curvature have polynomial volume growth. Specifically, we show that the maximal volume of balls increases at most by a factor only depending on the minimal positive jump rate, when doubling the radius. The proof has two ingredients. First, we show that the expected distance between two independent random walks with same starting point increases at most like square root of the time. Second, we give a Li-Yau-Hamilton gradient estimate for a non-linear modification of the heat equation. This is joint work with Camillo Brena (ETH) and Tom Hutchcroft (Caltech).

Essential self-adjointness, form uniqueness and stochastic completeness for symmetric graphs

Radosław K. Wojciechowski
City University of New York, USA

We present a series of results, many achieved with undergraduate students, on the questions of essential self-adjointness, form uniqueness and stochastic completeness on graphs. In particular, we give characterizations in terms of geometric quantities for these properties in the case of birth-death chains and, if possible, weakly spherically symmetric graphs. The main technical tool is a study of α-harmonic functions which can be reduced to working with recurrence relations for these graphs. This includes joint work with Luis Hernandez, Atsushi Inoue, Sean Ku, Jun Masamune, Genevieve Romanelli and Emily Shteynberg.

Eigenvalues of the discrete Hodge Laplacian across dimensions

Philipp Bartmann
University of Potsdam, Germany

We will show that the eigenvalues of the discrete Hodge Laplacian of a finite simplicial complex can be estimated in terms of the eigenvalues in lower dimensions. As a result, we obtain new criteria for vanishing of the cohomology groups of the complex. We then apply those results to the Alexander dual to obtain analogous estimates in terms of the eigenvalues in higher dimensions.

September 15, 2026 - Tuesday

The Point Spectrum of Periodic Quantum Trees

Jonathan Breuer
The Hebrew University of Jerusalem, Israel

Periodic Jacobi matrices on trees have been the subject of considerable interest in the past several years. Their quantum analogs, namely periodic quantum trees, have received much less attention and are less well understood. We consider the point spectrum of such operators, prove some analogous statements to those known in the discrete case and discuss some differences. This is joint work with Netanel Y. Levi.

Emergence of an unsaturated Darcy's law and a Richards-type equation via homogenization of the Stokes-Cahn-Hilliard system

Jun Masamune
Kyoto University, Japan

We study the homogenization of a microscopic Stokes–Cahn–Hilliard system in a periodically perforated porous medium with logarithmic free energy. The model describes an incompressible two-phase flow with diffuse interfaces inside pore-scale geometries and incorporates capillary effects through the chemical potential. We prove that the microscopic system converges to a Darcy–Korteweg type law coupled with a generalized Richards-type equation. A central consequence of the analysis is that the resulting macroscopic law generally cannot be reduced to the classical unsaturated Darcy law. In particular, the effective driving mechanism is not, in general, governed by a scalar gradient structure, reflecting the influence of interfacial energy and microscopic phase configurations. This is a collaborative effort with Lei RONG (Tohoku University).

Optimal Hardy inequalities for powers of the discrete Laplacian on the half-line

Frantisek Stampach & Jakub Waclawek
Czech Technical University in Prague, Czech Republic

The talk consists of two parts. In the first part (presented by F. Š.), we discuss optimal discrete p-Hardy-Rellich-Birman inequalities for general $p > 1$, i.e., optimal Hardy-type inequalities for an arbitrary integer power of the discrete p -Laplacian on the half-line. In the second part (presented by J. W.), we discuss similar developments, partly still in progress, for $p = 2$ and an arbitrary positive power of the discrete Laplacian on the half-line.

Conformal tetrahedra and global rigidity of sphere packings in constant curvature background geometry

Zunwu He (何遵武)
South China University of Technology, China

In this paper, we give the dual characterization of conformal tetrahedra in constant curvature spaces, which develops a geometric technique to obtain the global rigidity of (ideal) hyperbolic, Euclidean, spherical sphere packings on a tetrahedron. Moreover, we introduce ideal hyperbolic sphere packings and extend the variational principle to obtain the global rigidity of (ideal) hyperbolic sphere packings on 3-manifolds. We also provide a characterization of conformal $n(\geq 3)$-simplices in constant curvature spaces, which is useful for studying higher-dimensional sphere packings. This is a joint work with Guangming Hu and Ziping Lei.

Optimal eigenvalues on a metric graph with densities

Noema Nicolussi
University of Innsbruck, Austria

Motivated by the notion of conformal eigenvalues for surfaces, we investigate Laplacians on a metric graph with varying mass density. This setting provides a common framework for several well-studied classes of operators: discrete Laplacians, Dirichlet-to-Neumann operators on graphs, and Kirchhoff Laplacians (a.k.a. quantum graph operators). Our main interest is the spectral optimization problem for eigenvalues with respect to the underlying mass density, which turns out to behave rather differently than in the manifold setting. In particular, we discuss the relation of optimal eigenvalues with geometrical properties, including a complete geometric description of the first optimal eigenvalue and a Weyl law.

Based on joint work with Kiyan Naderi (University of Innsbruck).

Fractional and non-fractional Hardy inequality on a lattice $\mathbb{Z}^d$

Bartłomiej Dyda
Wroclaw University of Science and Technology, Poland

I will show the following pre-Hardy inequality: if $sp < d$, then for some $K \in \mathbb{N}$ large enough,

$$\sum_{j\in\mathbb{Z}^d_+\setminus\{0\}} \frac{|u(j)|^p}{\|j\|_\infty^{sp}} \leq C(d,p,s,K) \sum_{n=1}^{\infty} \sum_{2^{n-1}\leq\|j\|_\infty<2^n} \sum_{2^{n+K-1}\leq\|m\|_\infty<2^{n+K}} \frac{|u(j)-u(m)|^p}{2^{(n+K)(d+sp)}}$$

for all functions u for which the left side is finite. Then I will show that it yields Hardy and fractional Hardy inequalities. The constants are explicit, but not optimal.

The eigenvalue problem for infinity-Laplacian on finite graphs

Dong Zhang (张栋)
Peking University, China

In this talk, I will present some results on the graph infinity-Laplacian eigenproblem, including nodal domain theorems, as well as eigenvalue estimates involving the packing radii, the independence number, and the matching number.

September 16, 2026 - Wednesday

Hardy inequalities for magnetic p-Laplacians

David Krejcirik
Czech Technical University in Prague, Czech Republic

We establish improved Hardy inequalities for the magnetic p-Laplacian due to adding nontrivial magnetic fields. In particular, for Aharonov-Bohm potentials, we show that the sharp constant in the Hardy inequality becomes strictly larger than in the case of a magnetic-free p-Laplacian. We also post some remarks with open problems.

The talk is based on joint work with Cristian Cazacu, Nguyen Lam and Ari Laptev published in Nonlinearity.

News on Hardy inequalities for discrete Laplacians

Felix Pogorzelski
University of Leipzig, Germany

Hardy inequalities play a fundamental role in analysis and its applications. Although the earliest forms of these inequalities, established by G. H. Hardy and others around 1920, were discrete in nature, subsequent research focused predominantly on the continuum setting for many decades. More recently, the discrete perspective has attracted renewed attention, in particular through the study of Hardy weights and their optimality properties for Laplace- and Schrödinger operators on graphs. In this talk, we focus on some new developments and emerging ideas.

Hardy-Rellich inequalities on $\mathbb{Z}^d$

Xia Huang (黄侠)
East China Normal University, China

In this talk, we will show the sharp asymptotic behaviour of the corresponding optimal constants in discrete Hardy-Rellich inequality on the lattice $\mathbb{Z}^d$ as $d \to \infty$ with $\Delta^{\ell/2}$, for any $\ell \geq 1$. Our approach is based on general weighted identities, which yield anisotropic weighted inequalities on the d-dimensional torus, then settle the higher order cases by iteration.

September 17, 2026 - Thursday

A survey about some curvature rigidity results

Norbert Peyerimhoff
Durham University, UK

Two widely used Ricci curvature notions for general graphs are Ollivier and Bakry-Émery curvature. They are defined on the edges and vertices of a graph and they can be computed with very reasonable effort. A lower positive curvature bound for these local curvature values imply bounds for global invariants like the diameter and the first non-zero Laplace eigenvalue. These relations are motivated by similar results in the setting of Riemannian manifolds (Bonnet-Myers and Lichnerowicz), and it is natural to ask whether all spaces, for which these curvature/diameter and curvature/eigenvalue inequalities hold with equality, can be classified. Since these weaker strictness inequality assumptions lead to strong restrictions of the spaces, such results are called rigidity results. The aim of this talk is to survey about the current state those rigidity results.

Spectral rigidity of the hypercube via Bakry-Émery curvature

Shiping Liu (刘世平)
University of Science and Technology of China, China

Hypercube graphs are fundamental model spaces of positive curvature in discrete geometry. In this talk, we will discuss spectral rigidity results for hypercube graphs in the category of unweighted graphs, from the viewpoint of Bakry-Émery curvature. In particular, we show that the hypercube is forced by a weaker spectral multiplicity assumption than previously known, and that this improvement is optimal. The proof combines a global spectral embedding associated with the first eigenspace with a local analysis of curvature matrices. This is based on joint work with Yanlong Ding and Chiyu Zhou.

Entropic Ricci Curvature on Graphs: An Introduction and Survey

Supanat Kamtue
Chulalongkorn University, Thailand

The notion of entropic Ricci curvature introduced by Erbar and Maas provides a synthetic framework for lower Ricci curvature bounds on finite graphs and Markov chains based on optimal transport and entropy. In this talk, I will present the basic construction of this curvature notion and discuss some of its analytic consequences, particularly its connections to functional inequalities. I will conclude with a brief survey of recent developments, including explicit curvature estimates for several families of graphs.

The Lin-Lu-Yau Ricci flow on graphs

Shuang Liu (刘双)
Renmin University of China, China

In this talk, I will introduce our recent work on the Lin-Lu-Yau Ricci flow on graphs. The flow is formulated as a system of nonlinear equations that characterizes the evolution of the edge metric governed by the Lin-Lu-Yau Ricci curvature. By treating edge weights and edge metrics as independent variables, we study the existence and uniqueness of solutions to the Ricci flows on general graphs. Furthermore, we investigate the convergence of the solutions on graphs with girth at least 6.

Curvature of hypergraphs with applications in hypergraph community detection

Liang Zhao (赵亮)
Beijing Normal University, China

We first introduce definitions of Ollivier and Lin-Lu-Yau curvatures of hypergraphs. Next, we define a hypergraph Ricci flow and prove the long-time existence of the flow. As applications, we focus on community detection in hypergraphs, which is both instrumental for functional module identification and intricate due to higher-order interactions among nodes of hypergraphs. We develop a Ricci-flow-based community detection approach (HyperRCD) that deforms hyperedge weights through curvature-driven evolution. Extensive experiments on both synthetic and real-world hypergraphs demonstrate that HyperRCD exhibits competitive performance across diverse datasets.

The report is based on collaborative works with Tian Yulu, Ma Jicheng and Yang Yunyan.

Optimal Hardy Inequalities for Fractional p-Laplacians on the Integers

Marius Nietschmann
Sorbonne Université (IMJ-PRG), France

We obtain optimal Hardy-type inequalities for fractional powers of the p-Laplacian Δ_p^σ on $\mathbb{Z}$, $p \in (1, \infty)$, $\sigma \in (0, 1/p)$. Asymptotically, the optimal weights behave like $|x|^{-p\sigma}$ as $|x| \to \infty$. This is joint work with Florian Fischer.

Sharp criteria for the existence of positive solutions to Lane-Emden-type inequalities

Xueping Huang (黄学平)
Nanjing University of Information Science and Technology, China

We study positive solutions of the superlinear Lane-Emden inequality $-\Delta u \geq \sigma u^q$, $q > 1$, on

infinite locally finite weighted graphs and connected domains. We explore both the potential theoretic approach and a new method via flow decomposition.

We first prove that solvability is equivalent to a nonlinear Green potential inequality. Then under conditions ensuring regular Green function estimates, we prove sharp characterizations of existence of positive solutions.

Our main result gives a sharp criterion of the form

$$\sum_{n\geq 1} \frac{n^{2q-1}}{\mu(B(o,n))^{q-1}} = \infty,$$

for the nonexistence of positive solution in full generality. Intrinsic metrics can be employed for general positive potential function σ. The proof combines flow decomposition and Hardy estimates along paths. Applications to concrete examples are also discussed. This talk is based on joint work with Qingsong Gu, Lu Hao, and Yuhua Sun.

September 18, 2026 - Friday

Discrete Hardy inequality for Sobolev-Bregman forms

Krzysztof Bogdan
Wroclaw University of Science and Technology, Poland

We establish ground-state representations and critical Hardy inequalities for Sobolev-Bregman forms in discrete settings. This is a joint project with Shubham Gupta, Kamil Kaleta, and Antoni Szczukiewicz.

Heat kernels of left-invariant diffusions on infinite dimensional compact groups

Qi Hou (侯琦)
Beijing Institute of Mathematical Sciences and Applications, China

Infinite dimensional compact (connected metrizable) groups are projective limits of compact Lie groups. Many of them arise as infinite products, such as products of circles. On such product groups, the heat kernel measures of many bi-invariant Laplacians are the laws of independent Brownian motions on the factors. The Kakutani dichotomy theorem for product type measures thus applies, and satisfactory characterizations of such heat kernels have been obtained, pointing to a variety of properties ranging from genuine infinite dimensional phenomena to finite dimensional ones. Contrary to this diagonal case, the heat kernels of left-invariant Laplacians or sub-Laplacians are not well-understood, because most standard tools in finite dimensions do not carry over. I plan to present some attempts to analyze the heat kernel behaviors for left-invariant elliptic or subelliptic diffusions, via comparisons of intrinsic distances or Dirichlet forms at various levels. I will try to discuss the relations with graphs. This talk is based on joint works with Laurent Saloff-Coste.

Existence, uniqueness and qualitative properties of solutions for evolution equations driven by accretive Laplacian-type operators on graphs

Davide Bianchi
Sun Yat-sen University, China

We study evolution equations on infinite weighted graphs driven by accretive Laplacian-type operators, covering generalized porous medium equations and semilinear equations with monotone or Lipschitz nonlinearities. Accretivity (or ω-accretivity) on ℓ^p yields existence and uniqueness of mild solutions via Crandall-Liggett-Bénilan theory. The construction uses implicit Euler discretization and exhaustion by finite Dirichlet subgraphs, requiring no heat kernel or spectral information. We also establish a range of qualitative properties, including comparison principles, a priori estimates, positivity, and finite-time extinction.