15th Berlin-Oxford Young Researcher's Meeting on Applied Stochastic Analysis

12^{th} May – 14^{th} May 2022

Contents

1. Welcome

It is our great pleasure to welcome you to the 15th Berlin-Oxford Young Researchers Meeting on Applied Stochastic Analysis. We hope you enjoy a productive meeting!

Conference organisers
Peter Friz (TU & WIAS Berlin)
Terry Lyons (University of Oxford)
Simon Breneis (WIAS Berlin)
Satoshi Hayakawa (University of Oxford)
Hannes Kern (TU Berlin)
Ben Walker (University of Oxford)

Presentations
All talks will be held in person. They will be 15 minutes and we will have 5 minutes for questions after each talk. On Thursday, 12th May at 18:30 will be a conference dinner.

Supporting Institutions

DataSıg

This research meeting is generously supported by the DataSıg programme (EPSRC EP/S026347/1).

2. Schedule

Thursday, 12th May
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3. Rough Paths and Regularity

3.1 The Compact Support Property of Rough Super Brownian Motion on $\mathbb{R}^2$

Ruhong Jin, University of Oxford

We discuss the compact support property of the rough super-Brownian motion constructed as a scaling limit of a branching random walk in static random environment. The semi-linear equation corresponding to this measure-valued process is PAM, which lies out of classical result. With the help of an interior estimation method, we are able to show that the compact support property also holds for rough super-Brownian motion.

3.2 An Extension of the Stochastic Sewing Lemma

Toyomu Matsuda, Freie Universität Berlin

We give an extension of Lê's stochastic sewing lemma. His stochastic sewing lemma proves convergence in L_m of Riemann type sums $\sum_{[s,t]\in\pi} A_{s,t}$ for an adapted two-parameter stochastic process $A_{s,t}$, under certain conditions on the moments of $A_{s,t}$ and of conditional expectations of $A_{s,t}$ given $\mathscr{F}_s$. Our extension replaces the conditional expectation given $\mathscr{F}_s$ by that given $\mathscr{F}_v$ for $v < s$, and it allows to make use of asymptotic decorrelation properties between $A_{s,t}$ and $\mathscr{F}_v$ by including a singularity in $(s-v)$. We provide three applications to fractional Brownian motion: (i) stochastic integral with low regularity assumption, (ii) new representation of local time and (iii) improvement of regularity assumption for Young differential equations.

3.3 An Error Representation Formula for the Log-ODE Method

Simon Breneis, WIAS Berlin

The Log-ODE method is a numerical method for solving rough differential equations. After quickly explaining the idea behind the Log-ODE method, we show a new error representation formula for the discretization error of this method. In this formula, the global discretization error is expressed as a sum of the local errors. Finally, we show some numerical examples, and construct an adaptive step size algorithm using this error representation formula.

3.4 Random Controlled Rough Paths

William Salkeld, WIAS Berlin

I will present some results relating to Lions Taylor expansions and the solutions of mean-field rough differential equations

3.5 Magnetic Impurities and a Random Rough Path Extension for the Brownian Motion

Isao Sauzedde, University of Oxford

We will talk about some pathwise properties of the planar Brownian motion, related to its winding around deterministic and random points. This will allow to state a Green formula, which describes Stratonovich integrals as areas enclosed by the path.
We will then look at an electron inside a planar crystal. When the electron is modeled by a Brownian motion, we will see that it must be endowed with a random and non-continuous rough path extension in order to account for the impurities inside the crystal.

3.6 The Geometry of Controlled Rough Paths

Mazyar Ghani, FernUniversität in Hagen

This talk investigates the structure of the spaces of controlled (branched) rough paths with arbitrary order. Indeed, we show that these spaces form a continuous field of Banach spaces. This structure is very useful in certain dynamical flows defined on infinite-dimensional spaces and is a perfect infinite-dimensional substitute for what is called an (infinite-dimensional) vector bundle. Moreover, allows defining of topology on the total space, the collection of all controlled path spaces. Our construction is intrinsic and based on a new approximation result for rough controlled paths. This framework turns well-known maps such as the rough integration map and the Itô-Lyons map into continuous (structure-preserving) mappings. Moreover, it is compatible with previous constructions of interest in the stability theory for rough integration.

3.7 The p-Variation of Stochastic Evolution Equations and Applications in Numerical Analysis

Johanna Weinberger, Martin-Luther Universität Halle Wittenberg

The temporal regularity of Stochastic Evolution Equations (SEEs) is typically measured in terms of Hölder continuity. Such regularity results can be used to derive convergence rates for the numerical approximation of SEEs. The Hölder regularity is, however, not necessarily a strict requirement in this context. Often, it is sufficient to consider the slightly weaker p-variation norm. In this talk we consider situations where the employment of the p-variation norm allows for a wider class of problems in the numerical analysis.
This talk is based on joint work with R. Kruse and R. Weiske.

3.8 Quadratic Variation Along Refining Partitions: Constructions and Examples

Purba Das, University of Oxford

We present several constructions of paths and processes with finite quadratic variation along a refining sequence of partitions, extending previous constructions to the non-uniform case. We study in particular the dependence of quadratic variation with respect to the sequence of partitions for these constructions. We identify a class of paths whose quadratic variation along a partition sequence is invariant under *coarsening*. This class is shown to include typical sample paths of Brownian motion, but also paths which are 12-Hölder continuous. Finally, we show how to extend these constructions to higher dimensions.

4. Signatures and Data Science

4.1 From Diffusion to Reaction – Statistical Inference for Semi-linear SPDEs

Sascha Gaudlitz, Humboldt University Berlin

An estimator for the reaction intensity in semi-linear SPDEs is deduced. Consistent inference is achieved by studying a small diffusivity level, which is realistic in applications. The main result is a central limit theorem for the estimation error of a parametric estimator, from which confidence intervals can be constructed. Statistical efficiency is demonstrated by establishing local asymptotic normality. Local observations allow for non-parametric estimation of a reaction intensity varying in time and space. The statistical analysis requires advanced tools from stochastic analysis like Malliavin calculus for SPDEs, the infinite-dimensional Gaussian Poincaré inequality and regularity results for SPDEs in Lp-interpolation spaces.
This is joint work with Markus Reiß.

4.2 Tangent Space Estimation From Finite Sample

Uzu Lim, University of Oxford

Consider a smooth compact manifold M embedded in a Euclidean space. We provide a probabilistic bound on the number of sample points required to estimate tangent spaces and the dimension of M via local principal component analysis. To our knowledge, for the first time the bound (1) accommodates non-uniform density, (2) accommodates non-uniform noise, and (3) makes explicit all relevant constants. The key arguments involve a matrix concentration inequality and a Wasserstein bound for flattening a manifold.

4.3 Attention on Signature-type Features: Beating Quadratic Costs

Leonard Schmitz, Greifswald University

The attention mechanism is a fundamental building block for sequence-to-sequence tasks from machine learning. We show that its high time complexity can be reduced by a magnitude for low-rank decompositions of the input data. The signature provides such low-rank data when used as a feature of sequences. We present experimental results of an efficient matching mechanism for subsequences which combines attention and the signature method.

4.4 Improved Sliced Score Matching

Benjamin Walker, University of Oxford

Score-based generative modelling (SBGM) requires learning the score function of an SDE. This is typically done via denoising score matching (DSM). Training via DSM requires the transition kernel of the diffusion process associated with the SDE to be tractable. This restricts the choice of drift function in the SDE.
Sliced score matching (SSM) is an alternative to DSM, which doesn't require the transition kernel to be tractable. Although this allows for generic choices of the drift function, SSM generally performs worse than DSM.
This talk introduces improved SSM, a variant of SSM which reduces the variance of the stochastic estimates by replacing Hutchinson's trace estimator with Hutch++.

4.5 Signature Cumulants and Magnus Expansion - Examples

Paul Hager, HU Berlin

Our work exhibits the importance of Magnus expansions in the algorithmic problem of computing expected signature cumulants, and further offers a far-reaching generalization of recent results on characteristic exponents dubbed diamond and cumulant expansions with motivations ranging from financial mathematics to statistical physics. From an affine semimartingale perspective, the functional relation may be interpreted as a type of generalized Riccati equation.
In this brief talk, instead of presenting the general result in all its abstraction, we are going to look at a few fundamental examples.

4.6 A Young-type Euler-Maclaurin Formula

Carlo Bellingeri, TU Berlin

Considered one of the key identities in classical analysis, the Euler-McLaurin formula is one of the standard tool to relate sums and integrals, with remarkable applications in many areas of mathematics, though with little use in stochastic analysis. In this talk, we will show how the notion of signatures can generalize this identity in the context of Young's integration.
Joint work in preparation with Peter Friz (TU Berlin and WIAS) and Sylvie Paycha (Universität Potsdam)

4.7 Stability of Deep Neural Networks via discrete rough paths

Nikolas Tapia, WIAS Berlin

Using rough path techniques, we provide a priori estimates for the output of Deep Residual Neural Networks in terms of both the input data and the (trained) network weights. As trained network weights are typically very rough when seen as functions of the layer, we propose to derive stability bounds in terms of the total p-variation of trained weights for any $p \in [1,3]$. Unlike the C1-theory underlying the neural ODE literature, our estimates remain bounded even in the limiting case of weights behaving like Brownian motions, as suggested in [arXiv:2105.12245]. Mathematically, we interpret residual neural network as solutions to (rough) difference equations, and analyse them based on recent results of discrete time signatures and rough path theory.

4.8 Orthogonal and special linear invariants of paths via the iterated-integral signature: Overview and new developments

Rosa Preiß, University of Potsdam

Looking at the action of the orthogonal group, we apply Fels-Olver's moving frame method paired with the log-signature transform to construct a set of integral invariants for curves in $\mathbb{R}^d$ from the iterated-integrals signature. In particular we show that one can algorithmically construct a set of invariants that characterize the equivalence class of the truncated iterated-integrals signature under orthogonal transformations, which yields a characterization of a curve in $\mathbb{R}^d$ under rigid motions and an explicit method to compare curves up to these transformations. In this talk, we furthermore present a so far unpublished, more explicit new description of the moving frame via the QR-decomposition of a certain matrix build from the level two signature data of the curve.

Furthermore, this talk discusses the new result that such a full characterization of a path up to group action (and tree-like equivalence) via iterated-integral invariants does not exist for the special linear group. We instead hint a so far only conjectured kind of "Determinantensatz" for the iterated-integral signature which would describe the equivalence relation on paths given by only looking at special linear iterated-integral invariants.

4.9 Cumulant-to-moment relations from Hopf algebras

Yannic Vargas, University of Potsdam

The study of relations between moments and cumulants play a central role in both classical and non-commutative probability theory. In the last decade, the work of Patras and Ebrahimi-Fard has provided several tools to use the group of characters on a combinatorial Hopf algebra H of "words on words", and its corresponding Lie algebra of infinitesimal characters, to study distinct families of cumulants corresponding to different types of independences: free, boolean and monotone. We discuss several formulas for the free-to-moment and boolean-to-moment relations, obtained from the antipode of H. We also use this approach to discuss the work on signature cumulants and stochastic processes of Bonnier-Oberhauser, based on ordered partitions.

5. Numerical Analysis/Mathematical Finance

5.1 Proper Scoring Rules, Divergences, and Entropies for Paths

Patric Bonnier, University of Oxford

Many forecasts consist not of point predictions but concern the evolution of quantities. For example, a central bank might predict the interest rates during the next quarter, an epidemiologist might predict trajectories of infection rates, a clinician might predict the behaviour of medical markers over the next day, etc. The situation is further complicated since these forecasts sometimes only concern the approximate "shape of the future evolution" or "order of events". Formally, such forecasts can be seen as probability measures on spaces of equivalence classes of paths modulo time-parametrization. We leverage the statistical framework of proper scoring rules with classical mathematical results to derive a principled approach to decision making with such forecasts.

5.2 Dynamics of Market Making Algorithms in Dealer Markets

Wei Xiong, University of Oxford

The risk of ‘tacit collusion’, in which interactions of market making algorithms leads to an outcome similar to collusion among market makers, has increasingly received regulatory scrutiny. We formulate a stochastic differential game of intensity control with partial information to study the competition and equilibrium among multiple market makers in order-driven markets. We characterise Nash Equilibrium in terms of a system of coupled Hamilton-Jacobi-Bellman (HJB) equations and show the existence of Nash Equilibrium. We also define Pareto optima for the stochastic differential game and show that Pareto optimal quoting strategies are equivalent to ‘tacit collusion’ strategies. We propose a fictitious play numerical scheme to solve for Nash Equilibrium.

We then design a decentralized multi-agent deep reinforcement learning algorithm to model competing market makers applying learning algorithms to adjust their ask/bid quotes. Numerical results show evidence of perceived collusion given by learning algorithms with learned spreads above equilibrium level, even though algorithms are not intended to do so. The phenomenon of ‘perceived collusion’ can provide regulatory perspective for potential application of automated learning algorithms in dealer market making.

5.3 Random Convex Hull, Cubature, Hypercontractivity

Satoshi Hayakawa, University of Oxford

We give sharp estimates of the probability that a given vector is in the convex hull of i.i.d. random vectors in a very general setting. When this given vector is the expectation, the problem is closely related to the problem of constructing cubature formulas in numerical analysis, and we give an answer to the following question: how many points do we need to sample before the random algorithm finishes?

In the second part of the talk, we will show that, in some specific cases, the estimate can be improved by using hypercontractivity in the Gaussian Wiener chaos. This gives an insight into the random construction of cubature on Wiener space.

5.4 High Order Splitting Methods for Stochastic Differential Equations

James Foster, University of Oxford

In this talk, we will discuss how ideas from rough path theory can be leveraged to develop high order numerical methods for SDEs. In particular, by driving the system with piecewise linear paths instead of Brownian paths, we can obtain sequences of ODEs that well approximate the SDE. To achieve a high accuracy, these piecewise linear paths are then constructed to match certain iterated integrals of Brownian motion.

Alternatively, this can be viewed as a technique for developing splitting methods for SDEs, which connects our work nicely to the existing literature. For example, we show how the well-known Strang splitting can be slightly modified to give an improved convergence rate. We conclude the talk with several examples, which demonstrate the flexibility and convergence properties of the proposed methodology.

5.5 Strong Rate of Convergence of the Euler Scheme for SDEs with Irregular Drift Driven by Levy Noise

Oleg Butkovsky, WIAS Berlin

Joint work with Konstantinos Dareiotis and Máté Gerencsér.

We study the strong rate of convergence of the Euler–Maruyama scheme for a multidimensional stochastic differential equation (SDE)

$$dX_t = b(X_t)dt + dL_t,$$

with irregular β-Holder drift, $\beta > 0$, driven by a Levy process with exponent $\alpha \in (0,2]$. For $\alpha \in [2/3,2]$ we obtain strong L_p and almost sure convergence rates in the whole range $\beta > 1-\alpha/2$, where the SDE is known to be strongly well–posed. This significantly improves the current state of the art both in terms of convergence rate and the range of α. In particular, the obtained convergence rate does not deteriorate for large p and is always at least $n^{-1/2}$; this allowed us to show for the first time that the the Euler-Maruyama scheme for such SDEs converges almost surely and obtain explicit convergence rate. Furthermore, our results are new even in the case of smooth drifts. Our technique is based on a new extension of the stochastic sewing arguments.

6. SPDEs

6.1 A Diagram-free Approach to the Stochastic Estimates in Regularity Structures

Markus Tempelmayr, Max Planck Institute for Mathematics in the Sciences

We consider the renormalized model for quasi-linear parabolic SPDEs. Instead of a tree-based approach, the model is indexed by partial derivatives w.r.t. the Taylor coefficients of the non-linearity, allowing to organize elements of the same noise homogeneity in linear combinations. We construct and stochastically estimate the renormalized model in the full subcritical regime, avoiding the use of Feynman diagrams but still in a fully automated, i.e. inductive way.

We assume a spectral gap inequality on the (not necessarily Gaussian) noise ensemble. The resulting control on the variance of the model naturally complements its vanishing expectation arising from the BPHZ-choice of renormalization. Our approach is analytic and top-down rather than combinatorial and bottom-up.

This is joint work with Pablo Linares, Felix Otto and Pavlos Tsatsoulis.

6.2 Anderson Hamiltonians with singular potentials

Willem van Zuijlen, WIAS Berlin

In this talk we consider the construction of random Schrödinger operators, called Anderson Hamiltonians, with Dirichlet and Neumann boundary conditions for a fairly general class of singular random potentials on bounded domains. Furthermore, we discuss the integrated density of states of these Anderson Hamiltonians.

This is joint work with Toyomu Matsuda.

6.3 Gaussian Fluctuation of Periodic KPZ Equation

Huanyu Yang, Freie Universität Berlin

In this talk, we will prove that the KPZ equation converges to a Brownian motion under the CLT scaling. Our argument is based on a straightforward computation by making use of the energy solution to the KPZ equation.

This is the joint work with Nicolas Perkowski.

6.4 Interacting-Particle Systems with Sticky Boundary

Julian Meier, University of Oxford

We study interacting-particle systems on the positive half-line. The particles follow diffusion processes with common noise and experience a sticky reflection at zero. We show weak convergence of this system by characterising weak limit points as solution to a nonlinear SPDE and proving uniqueness of solutions for this equation. To deal with the nonlinearity we establish a probabilistic representation of solutions and regularity in L2.

6.5 Increased Regularity of Minimizers in the Study of Laplace Asymptotics

Philipp Forstner, TU Berlin

Motivated by Laplace asymptotics for singular stochastic PDEs we study the regularity of the minimizer of a functional constructed from the Φ^4_3 equation. The proof uses a boot strapping argument to obtain a spatially smooth minimizer. We plan to use this result to define a translation operator in direction of the minimizer on models in the Φ^4_3-regularity structure.

7. Further Topics in Stochastic Analysis

7.1 Strong Convergence of Propagation of Chaos for McKean-Vlasov SDEs with Singular Interactions

Zimo Hao, Bielefeld University

In this work we show the strong convergence of propagation of chaos for the particle approximation of McKean-Vlasov SDEs with singular Lp-interactions as well as the moderate interaction particle system in the level of particle trajectories. One of the main obstacles is to establish the strong well-posedness of particle system with singular interaction. In particular, we develop the theory of strong well-posedness of Krylov and Röckner [KR05] in the case of mixed Lp-drifts, where the heat kernel estimates play a crucial role. Moreover, when the interaction kernel is bounded measurable, we also obtain the optimal rate of strong convergence, which is partially based on Jabin and Wang's entropy method [JW16] and Zvonkin's transformation.

7.2 Existence of an Invariant Measure for the Stochastic Landau-Lifschitz-Gilbert Equation in 1D

Emanuela Gussetti, Bielefeld University

We establish existence of an invariant measure in $H^1(D,\mathbb{R}^3)\cap L^2(D,\mathbb{S}^2)$ for the stochastic Landau-Lifschitz-Gilbert equation on a one dimensional interval. The conclusion is achieved by employing the classical Krylov-Bogoliubov theorem. We show that the semigroup associated to the solution has the Feller property in $H^1(D,\mathbb{R}^3)\cap L^2(D,\mathbb{S}^2)$ by means of a rough path approach. By employing the classical Stratonovich calculus, we prove the tightness hypothesis. In some specific cases, we show that there exists a unique Gibbs invariant measure and we establish the qualitative behaviour of the unique stationary solution.

7.3 Periodic Homogenization for Singular SDEs

Helena Kremp, FU Berlin

In this talk we generalize the theory of periodic homogenization for SDEs with additive Brownian or stable Lévy noise to the setting of singular Besov drifts F. For the martingale solution X, we prove existence and uniqueness of an invariant, ergodic measure with strictly positive Lebesgue density exploiting the theory of paracontrolled distributions and a strict maximum principle for the singular Fokker-Planck equation. With that, we define the integral of the drift against the invariant measure in a stable fashion. Furthermore, we prove a spectral gap on the semigroup of the diffusion and solve the singular resolvent equation, which, through a limiting argument in the Sobolev-type space with respect to the generator, enables to solve the Poisson equation with singular right-hand-side F. In the CLT scaling, we prove that the diffusion converges in distribution to the Brownian motion $\sqrt{D}B$ with constant diffusion matrix D involving the solution to the Poisson equation. In the pure α-stable noise case for α in $(1,2)$, we rescale by $n^{-1/\alpha}$ and show convergence to the stable process itself (without diffusivity enhancement).

7.4 Reflected Singular SDEs

Łukasz Mądry, Universite Paris-Dauphine

We consider differential equations with reflection, i.e. which are constrained to remain in a given domain. We obtain ""regularization by noise"" results in this context, namely we show that adding a (fractional) noise term allows to restore well-posedness for equations driven by singular (possibly distributional) drift vector fields. Our proof follows the methods developed by Catellier-Gubinelli based on nonlinear Young integration, combined with a Lipschitz property for the Skorokhod map due to Falkowski-Slominski. In order to obtain well-posedness under optimal regularity assumptions on the vector fields (i.e. in the regime where Girsanov theorem is needed), we show that suitable perturbations of fBm (such as reflected fBm) have similar pathwise regularizing properties as fBm.

7.5 Weak Solutions for Singular Multiplicative SDEs via Regularization by Noise

Florian Bechtold, Bielefeld University

We study multiplicative SDEs perturbed by an additive fractional Brownian motion on another probability space. Provided the Hurst parameter is chosen in a specified regime, we establish existence of probabilistically weak solutions to the SDE if the measurable diffusion coefficient merely satisfies an integrability condition. In particular, this allows to consider certain singular diffusion coefficients.
Based on joint work with Martina Hofmanova.

7.6 Gaussian Limits for Subcritical Chaos

Francesca Cottini, University of Milano-Bicocca

In this talk we will present a general and novel criterion, only based on second moment assumptions, to show the convergence towards a Gaussian limit for polynomial chaos (a multi-linear polynomial of independent random variables). This result is motivated by the study of 2d directed polymer in the subcritical regime and of the related 2d Stochastic Heat Equation, whose asymptotic behavior has been thoroughly investigated in recent years. In particular, we will show how this criterion allow us to recover the existing results in a simpler way and, furthermore, to obtain new information on our models of interest.
This is a joint work with Francesco Caravenna.

7.7 Counting Subgraphs Using Hopf Algebras

Emanuele Verri, Greifswald University

We study the problem of counting subgraphs through the lens of algebraic combinatorics. For the many notions of subgraphs appearing in the literature, I will show how some of these can be nicely encoded into certain Hopf algebras. I will explain why these Hopf algebras are isomorphic and present some of the combinatorial implications that follow.
Finally, I will show that well known combinatorial identities arise as character properties over some of these Hopf algebras.
This is joint work with Diego Caudillo (NTNU).

7.8 Precise Regularity of SLE

Yizheng Yuan, TU Berlin

Many random processes have fractal behaviour; this can be quantified e.g. by laws of iterated logarithm, modulus of continuity, or variation regularity. For Brownian motion, precise rules are known for all these. I will discuss analogous results for SLE (Schramm-Löwner evolution), a random curve appearing in random conformal geometry and statistical physics. Sharp gauge functions (up to multiplicative constants) can be obtained for certain variants of SLE (namely, two-sided whole-plane SLE and space-filling SLE). One main step in the proof is obtaining sharp estimates on the lower tail of the Minkowski content.
This talk is based on ongoing work with Nina Holden.

8. Participants

Peter Bank (TU Berlin)
Nikolay Barashkov (Univeristy of Helsinki)
Dirk Becherer (HU Berlin)
Florian Bechtold (University of Bielefeld)
Christoph Belak (TU Berlin)
Carlo Bellingeri (TU Berlin)
Patric Bonnier (University of Oxford)
Simon Breneis (WIAS Berlin)
Lucas Broux (LPSM)
Oleg Butkovsky (WIAS)
Gideon Chiusole (TU Munich)
Francesca Cottini (University of Milano-Bicocca)
Purba Das (University of Oxford)
Guilherme de Lima Feltes (University of Bath)
Robert Denkert (HU Berlin)
Ana Djurdjevac (FU Berlin)
Henri Elad Altman (FU Berlin)
Salvador Esquivel Calzada (University of Bath)
Philipp Forstner (TU Berlin)
James Foster (University of Oxford)
Peter Friz (TU Berlin)
Sascha Gaudlitz (HU Berlin)
Sarah Geiss (TU Berlin)
Mazyar Ghani (FernUniversität Hagen)
Milo Grillo (HU Berlin)
Trishen Gunaratnam (Université de Genève)
Emanuela Gussetti (University of Bielefeld)
Rishabh Gvalani (MPI)
Paul Hager (HU Berlin)
Zimo Hao (University of Bielefeld)
Satoshi Hayakawa (University of Oxford)
Akshay Hegde (University of Oxford)
Michael Hofstetter (University of Cambridge)
Wei Huang (TU Berlin)
Philipp Jettkant (University of Oxford)
Likai Jiao (HU Berlin)
Ruhong JIN (University of Oxford)
Hannes Kern (TU Berlin)
Tom Klose (TU Berlin)
Laura Körber (TU Berlin)
Helena Katharina Kremp (FU Berlin)
Gerald Lampl (TU Wien)
Khoa Le (TU Berlin)
David Lee (Bagnolet)
Uzu Lim (University of Oxford)
Chengcheng Ling (TU Berlin)
Terry Lyons (University of Oxford)
Łukasz Mądry (Universite Paris-Dauphine)
Toyomu Matsuda (FU Berlin)
Sima Mehri (University of Warwick)
Julian Meier (University of Oxford)
Alexander Merkel (TU Berlin)
Laszlo Mikolas (University of Oxford)
Nicolas Perkowski (FU Berlin)
Nimit Rana (University of Bielefeld)
Tommaso Rosati (Imperial College)
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