Darmstadt-Würzburg Logic Day, 23 June 2026

This page gives an overview of the programme. Abstracts can be found on the following pages.

The talks in the morning take place in the Ground Floor Seminar Room of Emil-Fischer-Str. 41 (Forschungsbau).

09:15 – 9:45 Ulrich Kohlenbach (TU Darmstadt; chaired by Freund)
On the Computational Content of Moduli of Regularity and their Logical Strength

9:45 – 10:15 Dominik Wehr (JMU Würzburg; chaired by Wei)
Constructive Reverse Mathematics of Cyclic Proof Theory

10:15 – 10:45 Coffee Break

10:45 – 11:15 Luisa Després (TU Darmstadt; chaired by Cozzi)
On the proximal point algorithm for strongly quasiconvex pseudomonotone equilibrium problems in Hadamard spaces

11:15 – 11:45 Anton Freund (JMU Würzburg; chaired by Treusch)
Measuring the realm of partial impredicativity

11:45 – 12:00 Break

12:00 – 12:45 Morenikeji Neri (TU Darmstadt; chaired by Dammrau)
Extracting uniform bounds from proofs that use ultraproducts

12:45 – 14:15 Lunch Break

The talks in the afternoon take place in the First-Floor Seminar Room (01.003) of Emil-Fischer-Str. 40.

14:00 – 14:30 Giacomo Cozzi (JMU Würzburg; chaired by Després)
Well-ordering principles over recursive comprehension – Part 1: From axioms to rules

14:30 – 15:00 Antonia Dammrau (JMU Würzburg; chaired by Wehr)
Well-ordering principles over recursive comprehension – Part 2: Ordinal analysis

15:00 – 15:30 Coffee Break

15:30 – 16:00 Jacqueline Treusch (TU Darmstadt; chaired by Neri)
A quantitative study of a Douglas-Rachford type primal-dual algorithm

16:00 – 16:45 Jin Wei (TU Darmstadt; chaired by Kohlenbach)
Approximate Completeness and Cut Admissibility of Hypersequent Calculi for First-Order Łukasiewicz Logic

Abstracts

Ulrich Kohlenbach (TU Darmstadt)

On the Computational Content of Moduli of Regularity and their Logical Strength

We investigate the computational status of the existence of moduli of regularity (and their use for rates of convergence) in the sense of Kohlenbach, Lopez-Acedo, Nicolae 2019 w.r.t. classical reverse mathematics as well as the amount of LEM involved (intuitionistic reverse mathematics). We also show that the existence of a modulus of regularity always yields an algorithm for the computation of a zero in the case of continuous real-valued functions F on a compact metric space K (in F equipped with a modulus of uniform continuity and K given in standard representation) whenever such a zero exists. If K is a compact subset of a uniformly convex Banach space X and the zero set of F is convex one can compute even the zero of minimal norm. We also show that there is no proof-theoretically tame nonstandard uniformity principle which would make it possible to replace in the regularity assumption compactness by metric boundedness and still guarantee classically correct bounds.

Dominik Wehr (JMU Würzburg)

Constructive Reverse Mathematics of Cyclic Proof Theory

Cyclic proof theory studies proof systems whose derivations are rule-annotated finite graphs, rather than the usual rule-annotated finite trees. This presentation aims to be both an introduction to cyclic proof theory and to outline some results of constructive reverse mathematics I obtained in my dissertation.

Luisa Després (TU Darmstadt)

On the proximal point algorithm for strongly quasiconvex pseudomonotone equilibrium problems in Hadamard spaces

In [1], A. Iusem und F. Lara provide a convergence result for a proximal point type method for finding equilibrium points of pseudomonotone and strongly quasiconvex bifunctions. In this talk, we discuss how their results can be lifted from the linear setting to Hadamard spaces in a quantitative way, following ideas in [2] and a quantitative analysis of Fejér monotonicity developed in [3]. Due to the elementary character of the proof, we will be able to discuss a strong convergence result under weakened assumptions than those featuring in [1] and provide effective rates of convergence for the iterates generated by such a procedure towards the solution. This talk is based on [4], which was written under the supervision of U. Kohlenbach and N. Pischke.

[1] A. Iusem and F. Lara, Proximal Point Algorithms for Quasiconvex Pseudomonotone Equilibrium Problems, Journal of Optimization Theory and Applications} vol. 193, no.1-3, pp. 443-461, Jun.2022.

[2] N. Pischke, On the proximal point algorithm for strongly quasiconvex functions in Hadamard spaces, Optimization Methods and Software, vol. 40, no. 6, pp. 1438-1453, 2025.

[3] U. Kohlenbach, G. López-Acedo, and A. Nicolae, Moduli of regularity and rates of convergence for Fejér monotone sequences, Israel Journal of Mathematics}, vol. 232, no. 1, pp. 261-297, 2019.

[4] L. M. Després, On the proximal point algorithm for strongly quasiconvex pseudomonotone equilibrium problems in Hadamard spaces, Master's thesis, TU Darmstadt, 2026.

Anton Freund (JMU Würzburg)
Measuring the realm of partial impredicativity

In reverse mathematics, a number of interesting mathematical theorems falls between the two strongest of the so-called big five systems. These theorems can be analyzed via theories of partial impredicativity, which haven been introduced by Towsner (JSL 2013) and were recently extended by Suzuki and Yokoyama (to appear in JML). In this talk, we discuss how the realm of partial impredicativity can be measured, in particular, by means of ordinal analysis. This is based on joint work with Katarzyna W. Kowalik and Davide Manca.

Morenikeji Neri (TU Darmstadt)
Extracting uniform bounds from proofs that use ultraproducts

A central application of ultraproduct constructions in mathematics is a uniformity principle, which states that if one can show that every ultraproduct of structures in a given family satisfies a `for all exists' statement, then one obtains a bound on the existential witness that is uniform across the entire family.

Although the proof of the uniformity principle is a straightforward application of Łoś's theorem, its non-constructive nature means it is not clear how one can extract explicit bounds for results obtained through it. Simmons and Towsner observed, however, that instead of invoking the uniformity principle, one could analyse the proofs of such theorems directly, following the perspective of proof mining via the monotone functional interpretation developed by Kohlenbach, and obtain quantitative information. From this, Simmons and Towsner obtained explicit quantitative results for theorems in algebra that had previously been established using the ineffective uniformity principle.

We provide a formal explanation of the successes of the approach of Simmons and Towsner by establishing a metatheorem that serves as a proof-theoretic analogue of the model-theoretic uniformity principle. We then present new applications of this approach to stable group theory.

Giacomo Cozzi (JMU Würzburg)

Well-ordering principles over recursive comprehension – Part 1: From axioms to rules

Ordinal analysis and well-ordering principles play a crucial role in proof theory. Recently, Pakhomov and Walsh have proved a conservativity result allowing to convert well-ordering axioms to well-ordering rules for Π^1_1 formulas over ACA_0. We prove an analogous result with base theory RCA_0. To do so, we work with rankings between well-founded partial orders rather than embeddings between well-orders. Given two partial orders P,Q, a ranking is an order preserving function $r:T(P) \to Q$ from the set of finite strictly P-descending sequences to Q. Crucially, rankings reflect well-foundedness, and respect usual constructions on partial orders. Our result is the following:

Theorem. Let T be a $\Pi^1_2(\Sigma^0_3)$-axiomatisable extension of RCA_0 and $\psi(X)$ be a $\Pi^1_2(\Sigma^0_3)$-formula that is reflected by rankings. Then the extension of T by the axiom $\forall P.(WF(P) \Rightarrow \psi(P))$ is conservative over the extension of T with the rule $WF(P) / \psi(P)$.

With this equivalence at our disposal we aim to study ordinal analysis over weak theories and extend further results for well-orders to RCA_0 and rankings.

Antonia Dammrau (JMU Würzburg)

Well-ordering principles over recursive comprehension – Part 2: Ordinal analysis

Carlucci, Mainardi and Rathjen have shown that the proof-theoretic ordinal of $RCA_0+WO(\alpha)$ is α^ω (for an ordinal α with $\alpha = \omega \cdot \alpha$) and thus, if this theory shows β is a well-order, we have $\beta<\alpha^\omega$. We want to transfer this result to partial orders:
If $RCA_0+WO(\alpha)$ proves the well-foundedness of a partial order P, then there is an $n \in \omega$ so that RCA_0 proves we have a ranking of P into α^n. To this end we use Buchholz's approach to ordinal analysis. This result is useful to analyze well-ordering principles via rules.

Jacqueline Treusch (TU Darmstadt)
A quantitative study of a Douglas-Rachford type primal-dual algorithm

This talk presents recent results from applied proof theory where logic-based techniques were applied to a so-called Douglas-Rachford type primal-dual algorithm due to R.I. Boţ and C. Hendrich in [1]. This algorithm solves a primal inclusion involving monotone set-valued operators together with its dual inclusion. General logical metatheorems for monotone set-valued operators were applied to extract rates of convergence and metastability for the convergence results of this method. As the metatheorems suggest, these rates only depend on some bounding information and moduli of uniform monotonicity or total boundedness (depending on the analyzed convergence result). A similar quantitative study was also carried out for a Tseng type primal-dual method by U. Kohlenbach and N. Pischke in [2].

[1] R. I. Boţ and C. Hendrich. A Douglas–Rachford type primal-dual method for solving inclusions with mixtures of composite and parallel-sum type monotone operators. SIAM Journal on Optimization, 23(4):2541–2565, 2013.

[2] U. Kohlenbach and N. Pischke, Quantitative results for a Tseng-type primal-dual method for composite monotone inclusions, Computational Optimization and Applications, 93(3):1191–1223, 2026.

Jin Wei (TU Darmstadt)
Approximate Completeness and Cut Admissibility of Hypersequent Calculi for First-Order Łukasiewicz Logic

Continuous logic for metric structures is based on first-order Łukasiewicz logic and inherits an Hilbert-style axiomatization. However, its syntactic study encounters difficulties, most notably the failure of the deduction theorem related to the contraction rule. Its Gentzen-style proof systems for Łukasiewicz Logic have been developed by Metcalfe, Olivetti, and Gabbay (2005) and later Baaz and Metcalfe (2010), primarily in the form of hypersequent calculi.

Baaz and Metcalfe established approximate completeness of their calculi for valid prenex first-order formulas in their paper, following several corrections by Alexander Gerasimov (2020). In this talk, I will present a stronger approximate completeness result for arbitrary valid hypersequents, based on a generalized Herbrand's theorem inspired by the approach of Baaz and Metcalfe. As corollaries, we also obtain approximate completeness for arbitrary valid first-order formulas and approximate cut admissibility for the hypersequent calculus.