Lodz University
of Technology

4th Łódź Logic Conference

5–7 June 2026 · Łódź, Poland

ul. Wólczańska 217/221 · Campus B, Building B15, room 0.4

Abstract Booklet

The fourth installment of our annual meeting on
contemporary research in logic, set theory and their applications.

Contents

1 Invited Speakers

Sławomir Solecki

Cornell University

Mostowski Lecture

Title: An amalgamation theorem for simplicial maps

Abstract. We use a set theoretic formalism to explore connections between stellar moves on simplicial complexes (these are fundamental operations of combinatorial topology), amalgamation classes, and projective Fraïssé limits.

We will identify a class of simplicial maps that naturally arise from the stellar moves. We call these maps weld-division maps. Our main theorem asserts that the category of weld-division maps fulfills the projective amalgamation property. Despite the geometric character of the theorem, the method of proof is neither geometric nor topological, but rather it consists of combinatorial calculations performed on finite sequences of finite sets crucially relying on a set theoretic formalism.

Aside from developing a new method of dealing with stellar moves and simplicial maps, the theorem gives (1) an example of an amalgamation class that substantially differs from known classes, (2) a combinatorial description of the geometric realization of a simplicial complex, and (3) an example of a combinatorially defined projective Fraïssé class whose canonical quotient space has topological dimension strictly bigger than 1.

Alessandro Andretta

University of Turin

Title: Sierpiński's theorem and its influence on the geometry of Euclidean space

Abstract. Is it possible to partition the space in finitely many pieces such that each piece has finite intersection with certain prescribed families of geometric objects? A theorem of Sierpiński from 1951 says that $2^{\aleph_0} \leq \aleph_n$ iff $\mathbb{R}^{n+2}$ can be written as $A_1 \cup \cdots \cup A_{n+2}$ and each A_i has finite intersection with any line with direction $\mathbf{e}_i$, the ith element of the standard basis. In particular CH holds iff $\mathbb{R}^3 = A_1 \cup A_2 \cup A_3$ with the A_i as before. The sets A_1, A_2, A_3 are constructed using the axiom of choice, so we should not expect any definability. On the other hand, Törnquist and Weiss proved in 2015 that every real is constructible iff A_1, A_2, A_3 can be taken to be Σ^1_2. Together with L. Notaro, we generalized this to higher dimensions: $\mathbb{R}^{n+2}$ has a decomposition *à la Sierpiński* with Σ^1_2 pieces iff the upper semilattice of the constructibility degrees has breadth $\leq d$.

A spray in $\mathbb{R}^d$ is a subset such that every d-dimensional sphere centered in some $\mathbf{c} \in \mathbb{R}^d$ (called the center of the spray) has finite intersection with it. Schmerl and de la Vega proved in 2011 that $2^{\aleph_0} \leq \aleph_n$ iff the plane can be covered with $n+2$ sprays with collinear centers. In joint work with I. Izmestiev, we proved a similar result for $\mathbb{R}^d$ with $d \geq 3$: for example CH holds iff $\mathbb{R}^3$ can be covered with 5 sprays such that their centers are coplanar and no three of them are collinear.

Itaï Ben Yaacov

Claude Bernard University Lyon 1

Title: Towards a first-order quantum logic? A few thoughts on continuous logic, affine logic, and what's between them.

Abstract. From a practical point of view, continuous first-order logic provides us with a framework for the model-theoretic study of metric structures. From a more abstract point of

view, it also raises quite naturally the question of what should non-commutative continuous logic be?

This is an intentionally vague question that lends itself to more than one interpretation. One way to understand it is to observe that the algebra of continuous formulas forms (the self-adjoint part of) a commutative, unital C*-algebra. Can we drop « commutative » here? What should that even mean?

Ideas coming from recent developments in affine logic finally allow us to propose an answer to this question, giving rise to a logic that is strongly reminiscent of the Dirac–von Neumann formalism for observables in quantum mechanics.

Ruiyuan Chen

University of Warsaw
Title: Componentwise Polish groupoids and equivalence relations
Abstract. Given a Borel action of a Polish group, the group topology induces a canonical quotient topology on each orbit; the family of all such topologies plays a vital role in the study of Polish group actions and their induced orbit equivalence relations. We seek to abstract this structure from the action, by introducing an axiomatic notion of a Borel equivalence relation equipped with a "uniformly Borel" family of Polish topologies on each class, and more generally, a Borel groupoid equipped with such a family of topologies on each connected component. We prove that every such groupoid admits a Borel equivalence of categories to a Polish group action; in particular, the induced equivalence relations are Borel bireducible. The proof is based on groupoid generalizations of tools used in the proofs of Pettis's automatic continuity theorem, the Becker–Kechris topological realization theorem, and a result of Solecki–Srivastava on continuity of group operations.

Michał Doucha

Czech Academy of Sciences
Title: Genericity in topological dynamics
Abstract. Given a countable group G, the space of actions of G on the Cantor space carries a natural Polish structure (one may also study some of its subspaces, such as the spaces of transitive or minimal actions). I will briefly discuss why, in order to understand the properties of this space of actions, one is led to study spaces of subshifts, and how an abstract, general criterion leads to the notions of isolated and projectively isolated subshifts. The density of the latter set is connected to the existence of a comeager conjugacy class in the space of actions of G.

The talk will then focus on minimal actions of particular groups. Hochman proved that the universal odometer is a generic minimal and a generic transitive homeomorphism on the Cantor space. I will discuss what happens when we replace a single homeomorphism by a finite tuple of homeomorphisms, i.e., when we consider actions of free groups on finitely many generators instead of actions of the integers. Depending on the perspective, the situation is both remarkably similar to and very different from the integer case.

Time permitting, I will also present a general model-theoretic criterion ensuring that a Fraïssé limit has a comeager isomorphism class when the corresponding Fraïssé class is not a countable set, but is instead equipped with a Polish topology. This is joint work with Julien Melleray and Todor Tsankov.

Joanna Garbulińska-Węgrzyn

Jan Kochanowski University
Title: Fraïssé limits as generic objects

Abstract. Let us consider the following infinite game between two players, *Eve* and *Adam*. Eve starts by choosing an object E_0 in a fixed category $\mathfrak{K}$. Adam responds by choosing an object E_1, such that $E_1 \supseteq E_0$. Eve then chooses another object E_2, and so on. Thus, at each stage of the game, an object of the category $\mathfrak{K}$ is chosen.

After infinitely many steps, we obtain a chain of objects $\{E_n\}_{n\in\omega}$. Let E_∞ denote the completion of $\{E_n\}_{n\in\omega}$. At this point, no winner has yet been determined.

We say that an object X is *generic* if Adam has a strategy ensuring that the object E_∞ is isometric to X.

We will present examples of generic objects.

Tomasz Kania

Czech Academy of Sciences & Jagiellonian University

Title: Canonical reconstruction and forcing-absoluteness of standardness

Abstract. A natural question, raised in slightly different guises across algebra, analysis and set theory, is whether being a "standard" object of a given type is itself a definable property of the abstract structure. The motivating instance, posed by Noah Schweber, is: if a group G is not isomorphic to any full symmetric group $\mathrm{Sym}(X)$, can forcing make it one? On its face the predicate "$A \cong F(X)$ for some set X" is Σ^1_2, and the standard route to ruling out a Π^1_1 definition is to exhibit such an A which fails to be standard in a ground model and succeeds in a forcing extension.

I shall isolate a simple preservation principle obstructing this strategy. Call a standard form $F(X)$ *canonically reconstructible* if the index set X can be recovered, up to a definable bijection, from the abstract structure of $F(X)$ by a formula in the relevant signature. Whenever this holds, the predicate "$A \cong F(X)$ for some X" is downward absolute between any pair $M \subseteq N$ of transitive ZF-models. Answering Schweber's question, no forcing extension of any ZFC model can turn a non-full group into a full symmetric group, and indeed fullness is itself uniformly Π^1_1 over transitive ZF-models.

The same scheme covers a broad catalogue: full transformation monoids, powerset Boolean algebras, relation algebras, clones, partition lattices, products R^X of finitely generated centrally indecomposable rings, the atomic commutative C^*-algebras $\ell_\infty(X)$ and $c_0(X)$, full endomorphism rings, the operator algebras $\mathcal{B}(H)$ and $\mathcal{K}(H)$, and $\ell_1(X)$ as a real Banach lattice.

I shall then exhibit the opposite phenomenon. Finite covers $Y \times n$ already separate ZF-failure from ZFC-descent: a family of two-element sets with no choice function gives an explicit ground-model obstruction. The finite-support space $c_{00}(I)$ provides the analogous Banach example via sign torsors, and $H \cong \ell_2(\Gamma)$ reduces to basis-existence. The talk closes with a few cases where canonical reconstruction breaks down, together with open problems.

Katarzyna Kowalik

University of Warsaw

Title: Fraïssé conjecture, partial impredicativity and well-orering principles

Abstract. Fraïssé's conjecture (proved by Laver) is the statement that every infinite sequence of countable linear orders $L_0, L_1, \ldots$ admits $i < j$ such that L_i embeds into L_j.

The logical strength of Fraïssé's conjecture is one of the major open problems in reverse mathematics – a programme in mathematical logic aiming to classify mathematical theorems according to the strength of axioms necessary to prove them.

It has been known that the strength of Fraïssé's conjecture lies between ATR_0 and Π^1_1-CA_0, the strongest axiom systems traditionally considered in reverse mathematics. Recently, Freund improved the upper bound by showing that Fraïssé's conjecture is provable in the theory Π^1_1-CA^Γ_0,

which can be placed in the hierarchy of partial impredicative theories introduced by Suzuki and Yokoyama, who extended an earlier work by Towsner. This hierarchy makes it possible to calibrate the strength of some mathematical theorems that follow from the very strong system Π^1_1-CA_0, but cannot be equivalent to it due to their lower syntactic complexity.

In the ongoing project with Anton Freund and Davide Manca, we provide an ordinal analysis of the theory Π^1_1-CA^Γ_0 and characterize it by a certain well-ordering principle – a statement that a certain computable transformation of linear orders preserves well-foundedness. Well-ordering principles play a prominent role in proof theory, as many natural theories of second-order arithmetic are equivalent to such principles.

Our result, together with an earlier observation by Freund, establishes the first connection between well-ordering principles and theories of partial impredicativity.

In the talk, I will provide the context and motivation for our work as well as explain some of our proof methods.

Piotr Kowalski

University of Wrocław
Title: Model theory of differential equations
Abstract. In the first part of my talk, I will survey model-theoretic results concerning (mostly ordinary) differential equations. In the second part, I will report on work in progress (joint with Omar León Sánchez) on the model theory of partial differential equations, where some arguments are AI-assisted.

Krzysztof Krupiński

University of Wrocław
Title: On the structure of approximate rings
Abstract. A $[K]$-approximate subgroup of a group is a symmetric subset X such that $X \cdot X$ is covered by finitely many [resp. K] left translates of X.

A breakthrough in the study of approximate subgroups was Hrushovski's Lie model theorem, which roughly speaking says that for every pseudofinite approximate subgroup X there is a homomorphism from the group $\langle X \rangle$ generated by X into a locally compact (or even Lie) group with some good properties. This paved the way to a classification of finite approximate subgroups by Breuillard, Green, and Tao. However, in general, not every approximate subgroup has a locally compact model.

By a $[K$-]approximate subring of a ring we mean an additively symmetric subset X such that $X \cdot X \cup (X + X)$ is covered by finitely many [resp. K] additive translates of X.

In the first part of my talk, I will discuss my theorem that every approximate subring has a locally compact model. In the second part of my talk, I will mention several quick structural applications of the existence of locally compact models, and then I will focus on a deep application. I will discuss my joint theorem with Simon Machado describing the structure of finite approximate subrings. Our aim is to develop a general framework for the sum–product phenomenon that applies uniformly across arbitrary rings. The main result identifies nilpotent quotients as the fundamental obstruction to growth under both addition and multiplication. Another application of the main structure theorem is a ring-theoretic counterpart of Gromov's theorem on groups of polynomial growth. We (Simon Machado and myself) also have applications of locally compact models to structural results for infinite approximate subrings in some contexts. Notably, we establish a structure theorem for uniformly discrete approximate subrings of semi-simple real algebras, generalizing a classical sum–product result of Meyer.

Basic model theory plays an essential role in this research. The construction of locally compact models is obtained via model-theoretic connected components of definable groups and

rings. Structural results on approximate subrings are obtained either using the aforementioned components or locally compact models together with a pseudofinite context and some non-standard analysis.

Wiesław Kubiś

Czech Academy of Sciences
Title: Generic homomorphisms
Abstract. We shall present new developments in the theory of universal homogeneous (called generic) homomorphisms, both in the discrete and the continuous setting. In particular, we show that there is a generic projection on the universal Banach space with the Schauder decomposition. We also show that there exists a generic projection on the Fraisse limit of finite-dimensional C*-algebras with left-invertible embeddings.

Dominik Kwietniak

Jagiellonian University
Title: Bowen's Problem 32 and the conjugacy of symbolic systems with specification.
Abstract. Problem 32 on Rufus Bowen's list asks to classify symbolic systems with the specification property. I will explain why no such classification by concrete (Borel) invariants exists.

Since conjugacy of subshifts is a countable Borel equivalence relation, the natural question is its complexity. I will discuss how to construct families of subshifts with specification showing that the conjugacy relation among them is not treeable (and hence not smooth, nor hyperfinite), and so Bowen's Problem 32 has no solution by concrete (Borel) invariants.

Joint work with Konrad Deka, Bo Peng, and Marcin Sabok.

Witold Marciszewski

University of Warsaw
Title: Counting Banach spaces $C(K)$
Abstract. I will present some results concerning the following general problem: how many isomorphism types of Banach spaces $C(K)$ of real continuous functions on K do we have, for K from a given class $\mathcal{C}$ of compacta?

The classical result of Bessaga and Pełczyński gives us a complete classification of $C(K)$, for the class of countable compact spaces K; in particular, we have ω_1 isomorphism types of such spaces $C(K)$. On the other hand, Milutin's theorem says that, for the class of uncountable metrizable compact spaces K, we have only one isomorphism type of spaces $C(K)$.

I will discuss two well-known classes of compact spaces of weight ω_1, for which the above problem is not decidable in ZFC.

The first of these classes is the class AU of compact spaces K generated by families of almost disjoint subsets of the set of natural numbers $\mathbb{N}$, usually associated with the names of Mrówka, Isbell, Franklin, or Aleksandrov and Urysohn. Assuming the continuum hypothesis, we have $2^{\mathfrak{c}}$ ($\mathfrak{c}$ – continuum) isomorphism types of $C(K)$, for K from AU. In turn, assuming Martin's axiom and negation of the continuum hypothesis, for all $K, L \in \mathsf{AU}$ with weight $w(K) = w(L) = \omega_1$, the spaces $C(K)$ and $C(L)$ are isomorphic (joint results with R. Pol, F. Cabello Sánchez, J. Castillo, G. Plebanek, A. Salguero-Alarcón).

The second class considered is the class SCL of separable, compact linearly ordered spaces of weight ω_1. Again, assuming the continuum hypothesis, we have $2^{\mathfrak{c}}$ isomorphism types of $C(K)$, for $K \in \mathsf{SCL}$. On the other hand, assuming a certain axiom proposed by Baumgartner, we have

only one isomorphism type of $C(K)$, for $K \in \mathsf{SCL}$ (joint results with Maciej Korpalski and Piotr Koszmider).

In general, we can prove (in ZFC) that we have 2^{ω_1} isomorphism types of $C(K)$, for compact spaces K of weight ω_1 (joint with Korpalski and Koszmider).

Marcin Sabok

McGill University

Title: The conjugacy of pointed systems with specification

Abstract. This is a continuation of Dominik Kwietniak's talk on the conjugacy problem for systems with specification.

During this talk we will focus on pointed systems on the Cantor set and the Hilbert cute. We will connect the conjugacy problem for pointed systems on the Cantor set with a recent problem posed by Ding and Gu and solve that problem using a construction of minimal systems due to Oxtoby. We will also look at the conjugacy of Hilbert cube systems with specification and answer a question of Bruin and Vejnar showing that this relation is not classifiable by countable structures.

Joint work with Dominik Kwietniak, Konrad Deka and Bo Peng.

Jacek Tryba

University of Gdańsk

Title: Path of pathology

Abstract. The talk will cover the topic of (non)pathological submeasures and ideals on ω. We will recall the connection between Measure Dichotomy and nonpathological analytic P-ideals to show how these topics are closely related to the class of matrix summability ideals and Problem 5 from The Scottish Book. Moreover, we will provide a necessary condition for F_σ ideals to be nonpathological and show a few new examples of (non)pathological F_σ ideals. Finally, we will present an idea how to define a class of nonpathological ideals that would be independent of submeasures and provide a few examples of such nonpathological ideals.

2 Poster Abstracts

Jakub Cieplechowicz

Politechnika Wrocławska
Title: Everywhere I sets
Abstract. In [ros] Andrzej Rosłanowski introduced a new σ-ideal on the Cantor space 2^ω:

$$\mathcal{R}_{\text{os}} = \{X \subseteq 2^\omega : (\forall S \in [\omega]^\omega)\ X \restriction S \neq 2^S\}.$$

where $X \restriction S = \{x \restriction S : x \in X\}$. As for any $X \in \mathcal{R}_{\text{os}}$ its section on *every* infinite $S \subseteq \omega$ is not the whole 2^S, we call sets from $\mathcal{R}_{\text{os}}$ *everywhere not everything* sets.

It can be observed that a set is *everywhere countable* if and only if it is countable. However, Miroslav Repický in [repic] modified definition of everywhere countable sets and obtained a σ-ideal:

$$\mathcal{I}_o = \{X \subseteq 2^\omega : (\forall S \in [\omega]^\omega)(\exists A \in [S]^\omega)\ |X \restriction A| \leq \omega\}.$$

Another σ-ideals we consider were introduced in [krasz] by Jan Kraszewski:

$$\mathcal{EM} = \{X \subseteq 2^\omega : (\forall S \in [\omega]^\omega)\ X \restriction S \text{ is meager in } 2^S\},$$
$$\mathcal{EN} = \{X \subseteq 2^\omega : (\forall S \in [\omega]^\omega)\ X \restriction S \text{ is null in } 2^S\}.$$

We call sets from $\mathcal{EM}$ (respectively $\mathcal{EN}$) *everywhere meager* (*everywhere null).*

We will also examine a σ-ideal $\mathcal{EE}$, where $\mathcal{E}$ stands for σ-ideal generated by closed null subsets of 2^ω.

These families present some concepts of being *small*, but we do not know whether they are actually different in ZFC.

References

[**krasz**] J. Kraszewski, *Everywhere meagre and everywhere null sets*, Houston Journal of Mathematics, **35** (2009), 103-111.

[**ros**] A. Rosłanowski, *On game ideals*, Colloquium Mathematicum, **59** (1990), 159–168.

[**repic**] M. Repický, *Mycielski ideal and the perfect set theorem*, Proceedings of the American Mathematical Society, **132** (2004), 2141–2150.

Ramesh Kumar Devaraj

Vellore Institute of Technology, India.
Title: On Proinov-Type Z-Contractions via Simulation Functions in Quasi-Metric Spaces
Abstract. The intention of this work is to introduce a generalization of Proinov-type contraction via simulation functions. We name this generalized contraction map as Proinov-type Z-contraction. This work establishes the existence and uniqueness of fixed points for these contraction mappings in quasi-metric space and also, include explanatory examples with graphical interpretation. As an application, we generate a new iterated function system(IFS) consisting of Proinov-type Z-contractions in quasi-metric spaces. At the end, we prove the existence of a unique attractor for the IFS consisting of Proinov-type Z-contractions.

Michal Hevessy

Charles University
Title: Hjorth's conjecture
Abstract. We consider the natural action of $\mathcal{H}^+([0,1])$ on the space of compact subsets of $[0,1]^2$ and show that it is classifiable by countable structures. This is a promising step towards confirming the Hjorth's conjecture.

Bartosz Kamiński

Lodz University of Technology
Title: Descriptive Set Theory of (Baire) Lower Density Operator(s)
Abstract. The Lebesgue lower density operator has been thoroughly discussed on the Cantor space in recent papers by A. Andretta and R. Camerlo et al. In 2023 M. Balcerzak, J. Hejduk and A. Wachowicz introduced a dual notion of Baire density points for the σ-algebra of sets with Baire property. This poster will discuss the analogous density preserving Wadge constructions that allow us to climb Borel Hierarchy in a more fragmented fashion (mainly the Wadge hierarchy), as the ones made by A. Andretta and R. Camerlo. Moreover, the generalization of this method will be shown in order for any 'nicely behaving' lower density operator to climb Wadge hierarchy up to Δ^0_2 sets.

Adrian Krawczyk

Politechnika Wrocławska
Title: Cardinal invariants related to sequential Banach spaces
Abstract. Over the years, various cardinal characteristics have been studied, largely in connection with the Cichoń diagram. In addition to the classical characteristics associated with an ideal I, such as $add(I)$, $cov(I)$, $non(I)$, and $cof(I)$, other characteristics with interesting properties are also considered – for example, the reaping number $\mathfrak{r}$, the splitting number $\mathfrak{s}$, the bounding number $\mathfrak{b}$, and the dominating number $\mathfrak{d}$. It turns out that some of the classical cardinal characteristics can be expressed in terms of Banach sequence spaces – for example, $\mathfrak{b} = \min\{|\mathcal{F}| : F \subseteq c_0 \wedge (\forall X \in [\omega]^\omega)(\exists f \in \mathcal{F})(f \restriction X \in \ell^1)\}$. The aim is to investigate what happens when c_0 or ℓ^1 are swapped with other sequential Banach spaces and $[\omega]^\omega$ with some subset of itself.

Adam Majewski

Politechnika Wrocławska
Title: Steinhaus Propeties
Abstract. The classical Steinhaus theorem states that for every subset $A \subseteq \mathcal{R}$ with positive measure, the algebraic sum $A + A$ contains an interval. An analogous result holds for sets that have the Baire property and are not meager—this is given by Pettis' theorem. Both of these theorems can be viewed as characterizations of, respectively, sets of positive measure and sets of the second category with the Baire property.

One can consider a generalization of these facts in which we take a set A given σ-algebra, not contained in a certain σ-ideal, and ask whether the algebraic sum $A + A$ has nonempty interior. The main object of analysis is the Baire space $\mathbb{Z}^\omega$, i.e., the space of all sequences of integers with coordinate-wise addition. Within this space, we consider the σ-algebra of Borel sets and study properties relative to σ-ideals arising in combinatorial set theory, such as the σ-ideal $\mathcal{M}_-$ (a subideal of the meager sets), or the σ-ideal referred to as "fake-null," analyzed, among others, in the work by Mazurkiewicz, Michalski, Rałowski, and Żeberski "On Algebraic Sums, Trees and Ideals in the Baire Space."

Mateusz Lichman

Lodz University of Technology
Title: On generalizations of Scott analysis.
Abstract. In 1965, D. Scott proved that for every countable structure of a countable language, there is a sentence of infinitary logic that describes it up to isomorphism. In order to obtain this result, Scott developed what is now known as the Scott analysis: a way of approximating the isomorphism relation via a descending transfinite sequence of equivalence relations that stabilizes at a countable step within each isomorphism class. We present a new way of approximating abstract equivalence relations on topological spaces that was introduced by S. Solecki and compare it with the metric Scott analysis defined in [I. Ben Yaacov, M. Doucha, A. Nies, T. Tsankov, Metric Scott analysis, Advances in Mathematics 318 (2017) 46-87]. This is joint work with S. Solecki and J. Swaczyna.

Abstract.

Adam Morawski

Charles University & the Czech Academy of Sciences
Title: The Rudin–Blass Ordering of Measures
Abstract. Presented study arose as an effort to lift the rich, set-theoretic results around ultrafilters to the realm of (finitely additive) measures. One of the most fruitful approaches to study the structure of ultrafilters on ω is through Rudin–Keisler and Rudin–Blass orderings. We extend these notions to measures and propose a generalization of the notions of a Q-point and a selective ultrafilter: Q-measures and selective measures. Many symmetries between Q-points and Q-measures hold, however we were also able to find instances where they break. In particular we present an example of a measure which is minimal in the sense of Rudin–Blass but which is not a Q-measure. We also explore the relation between existence of measures and ultrafilters of certain types. Of particular interest is the fact that the existence of a non-atomic Q-measure is closely tied to the number of Q-points and selective ultrafilters in the model.

The presented results are a joint work with Piotr Borodulin-Nadzieja, Arturo Martinez-Celis and Jadwiga Świerczyńska. See arxiv.org/abs/2504.14678.

Michał Pawlikowski

Lodz University of technology
Title: Combinatorial covering properties in countable and uncountable contexts
Abstract. Combinatorial covering properties such as Rothberger's, Hurewicz's and Menger's are procedures for generating a cover of a given topological space from a sequence of covers of this space.

We present the most celebrated such properties together with the most important examples in a classical countable case and compare them with generalized combinatorial covering properties, where the initial sequence of covers has length κ for some uncountable cardinal κ. In this generalized setting, we replace the classical Baire space ω^ω with the generalized Baire space κ^κ.

This is joint work with Piotr Szewczak (Institute of Mathematics, Faculty of Mathematics and Natural Science College of Sciences, Cardinal Stefan Wyszyński University in Warsaw) and Lyubomyr Zdomskyy (Institut für Diskrete Mathematik und Geometrie, Technische Universität Wien). The research was funded by the National Science Center, Poland (NCN) and Austrian Science Fund (FWF) under programme Weave-UNISONO, project: Set-theoretic aspects of topological selections 2021/03/Y/ST1/00122 .

Daria Perkowska

Politechnika Wrocławska

Title: Operation* in the Baire space

Abstract. We will work in the Baire space $\mathbb{Z}^\omega$ with the addition operation by coordinates. For a family $\mathcal{F} \subseteq \mathcal{P}(\mathbb{Z}^\omega)$ we define:

$$\mathcal{F}^* = \{A \subseteq \mathbb{Z}^\omega : \forall F \in \mathcal{F}\ A + F \neq \mathbb{Z}^\omega\},$$

where $A + F = \{a + f : a \in A, f \in F\}$.

Let $I = \{I_n\}_{n\in\omega}$ be an interval partition of ω. For $x \in \mathbb{Z}^\omega$, define

$$M(x, I) = \{y \in \mathbb{Z}^\omega : \forall^\infty n\ y \restriction I_n \neq x \restriction I_n\}.$$

We denote by $\mathcal{M}_-$ the σ-ideal generated by sets of this form.

We also consider the following σ-ideals:

- $\mathcal{SMZ}^+$ consisting of sets $X \subseteq \mathbb{Z}^\omega$ such that for every interval partition there exists $z \in \mathbb{Z}^\omega$ such that:
$$\forall x \in X \quad \exists^\infty n \quad x \restriction I_n = z \restriction I_n$$
- $\mathcal{ED}$, generated by eventually different sets
$$E_f = \{x : \forall^\infty n\ x(n) \neq f(n)\},$$
- $\mathcal{IE}$, generated by infinitely equal sets
$$I_g = \{x : \exists^\infty n\ x(n) = g(n)\},$$
- $\mathcal{H}$, generated by sets
$$H_{I,f} = \{x : \forall^\infty n\ \exists m \in I_n\ x(m) = f(m)\},$$
- $\mathcal{G}$, consisting of sets $X \subseteq \mathbb{Z}^\omega$ such that for every interval partition I there exists z satisfying
$$\forall x \in X\ \exists^\infty n\ \forall m \in I_n\ x(m) \neq z(m).$$

It turns out that if we rewrite these definitions to the Cantor space 2^ω, we have $\mathcal{H} = \mathcal{M}_- = \mathcal{M}$ and $\mathcal{G} = \mathcal{SMZ}^+ = \mathcal{SMZ}$, where $\mathcal{M}$ is a σ-ideal of meager sets and $\mathcal{SMZ}$ is a σ-ideal of strong measure zero sets. It turns out that in the Baire space, we can separate some of these families in ZFC or by assuming $add(\mathcal{M}) = \mathfrak{c}$.

Our main theorem states that $\mathcal{M}_-$ preserves all classical cardinal invariants of the meager ideal $\mathcal{M}$:

$$\begin{gathered}\mathrm{add}(\mathcal{M}_-) = \mathrm{add}(\mathcal{M}), \quad \mathrm{cov}(\mathcal{M}_-) = \mathrm{cov}(\mathcal{M}),\\ \mathrm{non}(\mathcal{M}_-) = \mathrm{non}(\mathcal{M}), \quad \mathrm{cof}(\mathcal{M}_-) = \mathrm{cof}(\mathcal{M}).\\ \mathrm{cov}_t(\mathcal{M}_-) = \mathrm{cov}(\mathcal{M}).\end{gathered}$$

Galvin-Mycielski-Solovay Theorem says that on the real line we have $\mathcal{M}^* = \mathcal{SMZ}$. It was proved by Wohofsky that the Galvin-Mycielski-Solovay theorem does not hold in the Baire space, but it works in the Cantor space. We managed to prove that in the Baire space it holds:

$$\mathcal{M}_-^* = \mathcal{SMZ}^+.$$

We also proved the following relationships between other σ-ideals:

$$\mathcal{ED}^* = \mathcal{IE}, \qquad \mathcal{IE}^* = \mathcal{ED},$$

$$\mathcal{H}^* = \mathcal{G}.$$

Mariaclara Ragosta

Charles University
Title: Monochromatic sums and quotients in $\mathbb{N}$
Abstract. One of the most studied open problems in Arithmetic Ramsey Theory is whether the quadruple $a, b, a+b, ab$ is partition regular (PR for short), i.e. whether, for a given finite coloring of the naturals, one can always find two distinct integers a, b such that the quadruple $a, b, a+b, ab$ is monochromatic.

In this work we use nonstandard methods to produce a short and elegant proof of the related problem in which the product ab is replaced by the quotient b/a, that is the partition regularity of the quadruple $a, b, a+b, b/a$. We also generalize this result in different ways. In particular, we obtain an infinitary version of the same problem that extends Hindman's Theorem for the sum of natural numbers.

This is a joint work with Mauro Di Nasso, Lorenzo Luperi Baglini, Rosario Mennuni and Alessandro Vegnuti.

Julia Ścisłowska

University of Warsaw
Title: Ultrafilter orders on chainable continua
Abstract. The poster will be devoted to discuss families of ultrafilter orders on a given chainable continuum X (such as e.g. arc, the Warsaw sine curve, the Knaster continuum etc.). These orders depend on a fixed sequence of chains, covering X (obtained from chainability of X), and on a fixed nonprincipal ultrafilter on $\mathbb{N}$. Alternatively ultrafilter orders may be defined using representation of X as an inverse limit of a sequence of arcs and a fixed nonprincipal ultrafilter on $\mathbb{N}$. During the presentation I will show some known results in this topic. In particular, I will mention some ideas how we can express the "level of complexity" of a given chainable continuum in the language of ultrafilter orders. This is a joint work with Witold Marciszewski and Benjamin Vejnar, preprint is available at: https://arxiv.org/abs/2510.14577.

Filip Turoboś

Instytut Informatyki Technicznej i Stosowanej PAN
Title: Paving the way for mathematical formalism in the context of LLM hallucinations.
Abstract. Large language models (LLMs) have become widely deployed in scientific, industrial, and commercial environments, yet their tendency to generate factually incorrect or unverifiable information remains a major reliability challenge. This presentation lays foundation for a mathematically rigorous framework for formalizing and measuring hallucination phenomena in LLMs.

A language model is treated as a mapping

$$LM : S^* \times \mathbb{N} \to S^*,$$

where S^* denotes the set of finite token sequences and the second argument represents stochastic inference conditions. To formalize factual correctness, we introduce a ground-truth multifunction

$$f : Q_e \to \mathcal{P}(G),$$

assigning to each empirically verifiable query a set of admissible correct responses. A hallucination is then defined as any generated response violating the condition

$$LM(w, n) \in f(w).$$

The presentation distinguishes two principal categories of hallucinations. *Intrinsic hallucinations* correspond to outputs directly contradicting the factual reference set, whereas *extrinsic hallucinations* arise when the model generates unverifiable or unsupported information not contained in the reference space.

A major part of the presentation concerns the mathematization of hallucination measurement. Classical n-gram-based evaluation metrics are analyzed from a formal perspective. We demonstrate that high lexical overlap does not guarantee factual correctness, implying that purely syntactic similarity measures are insufficient for reliable hallucination detection.

To overcome these limitations, the presentation investigates semantically informed evaluation frameworks based on contextual embeddings and transformer architectures. We additionally discuss question-answering-based verification methodologies such as QAGS, which approximate human factual verification through generated interrogative reasoning and semantic consistency analysis.

The presentation also examines mathematically motivated mitigation strategies aimed at reducing hallucination frequency without modifying model architecture. These include Retrieval-Augmented Generation (RAG), SELF-REFINE, Chain-of-Thought prompting, and self-consistency decoding. Each method is interpreted as a transformation of the inference process through information augmentation, iterative refinement, or aggregation over stochastic reasoning trajectories.

The proposed framework connects all those elements into a unified mathematical perspective on hallucination analysis. The results contribute toward the development of more reliable, interpretable, and verifiable large language model systems.

Grzegorz Wełyczko

Wrocław University of Science and Technology

Title: Topology idealized

Abstract. Given a topological space (X, τ) and an ideal I on X, one can consider the associated ideal topological space (X, τ, I), whose basic open sets are of the form $U \setminus A$, where $U \in \tau$ and $A \in I$. Such spaces were studied, among others, by Aleksandar Pavlović; in particular, his paper "Local function versus local closure function in ideal topological spaces" served as an inspiration for this work. We study general properties of continuous functions between spaces of the form (X, τ) and (X, τ, I), as well as relationships between classical cardinal invariants of topology and cardinal characteristics associated with the ideal.

Ange Zugmeyer

Mathematical institute of the Czech academy of sciences and arts

Title: Approximating zero-dimensional dynamics by subshifts.

Abstract. Suppose that we have a continuous action from a totally disconnected locally compact group on the Cantor space, then we can show that this action is conjugate to an inverse limit of subshifts. The poster will present this construction as well a some possible application, using symbolical dynamical methods to solve more general topological dynamical problems (in particular the existence of a comeager congugacy class in the space of all actions from a given group to the Cantor space).

3 Participants

- Igor Angrot
- Marek Balcerzak
- Adam Bartoš
- Wojciech Bielas
- Jana Blobner
- Piotr Borodulin-Nadzieja
- Krzysztof Caban
- Arturo Martinez Celis
- Ruiyuan Chen
- Jakub Cieplechowicz
- Aleksander Cieślak
- Patryk Danieluk
- Ramesh Kumar Devaraj
- Michal Doucha
- Włodzimierz Fechner
- Rafał Filipów
- Takehiko Gappo
- Joanna Garbulińska-Węgrzyn
- Szymon Głąb
- Jacek Hejduk
- Michal Hevessy
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- Aleksander Iwanow
- Eliza Jabłońska
- Jan Jurka
- Bartosz Kamiński
- Tomasz Kania
- Jana Káňová
- Paweł Klinga
- Maciej Korpalski
- Ziemowit Kostana
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- Katarzyna W. Kowalik
- Krzysztof Kowitz
- Adrian Krawczyk
- Krzysztof Krupinski
- Andrzej Kucharski
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- Adam Kwela
- Marta Kwela
- Kuba Kwela
- Aleksandra Kwiatkowska
- Dominik Kwietniak
- Dorota Lesner
- Mateusz Lichman
- Adam Majewski
- Maciej Malicki
- Witold Marciszewski
- Marcin Massalski
- Łukasz Mazurkiewicz
- Marcin Michalski
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- Patryk Nitkowski
- Michał Pawlikowski
- Daria Perkowska
- Michał Popławski
- Mariaclara Ragosta
- Robert Rałowski
- Ernest Rożniakowski
- Tomasz Rzepecki
- Marcin Sabok
- Julia Ścisłowska
- Szymon Smolarek
- Jakub Sokołowski
- Sławomir Solecki
- Robert Stegliński
- Jarosław Swaczyna
- Alessandro Andretta
- Aleksandra Świątczak-Kolenda
- Filip Szustak
- Małgorzata Terepeta
- Paul Toussaint
- Jacek Tryba
- Filip Turoboś
- Yusuf Uyar
- Artur Wachowicz
- Maksymilian Wesoły
- Grzegorz Wełyczko
- Agnieszka Widz
- Renata Wiertelak
- Itaï BEN YAACOV
- Piotr Zakrzewski
- Jindrich Zapletal
- Szymon Żeberski
- Tomasz Żuchowski
- Ange Zugmeyer

4 Organizers

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Funding

The conference is supported by the **Foundation of Łódź University of Technology**.
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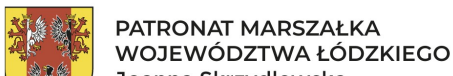

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