Book of Abstracts

European Conference in Interdisciplinary Model Theory

MÜNSTER, 07/03/2022 · 11/03/2022

ECIMT is a week-long conference happening in Münster, aiming to bring together young researchers interested in Model Theory, and to explore interactions between Model Theory and other mathematical fields, most notably Combinatorics, Algebra and Number Theory.

For any question, contact ecimt [at] uni-muenster [dot] de.

SCHEDULE

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 - 9:30		Bradley-Williams			
09:30 - 10:00	REGISTRATIONS		COFFEE	COFFEE	COFFEE
10:00 - 11:00	Halupczok	Mantova	Anscombe†	Mantova	Mantova
11:15 - 12:15	~~Bradley-Williams~~	Müller†	Chatzidakis†	Lösch	Colla
12:30 - 14:00	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
14:00 - 15:00	Anscombe†	Anscombe†	Halupczok	Halupczok	Aranda
15:15 - 16:15	Marimon	Kamsma	Hempel	Braunfeld	Bleybel†
16:30 - 17:00	BREAK	BREAK	BREAK	BREAK	BREAK
17:00 - 18:00	Lavi	Gavrilovich†	Konečný†	Chevalier	Bodor

All talks will take place in the M2 ROOM in the Lecture Hall Building at Einsteinstrasse 64.
Talks with the symbol † will be given remotely and broadcasted in M2.

TUTORIALS

Sylvy Anscombe: *Shelah's conjecture and Johnson's theorem* (remote)

The "Shelah Conjecture" proposes a description of fields whose first-order theories are without the Independence Property (IP): they are finite, separably closed, real closed, or admit a non-trivial henselian valuation.

One of the most prominent dividing lines in the contemporary model-theoretic universe, IP holds in a theory if there is a formula that can define arbitrary subsets of arbitrarily large finite sets. In 2020, Johnson gave a proof of the conjecture in an important case; namely, the case of dp-finite theories of fields. Combined with a result of Halevi–Hasson–Jahnke, Johnson's Theorem completely classifies the dp-finite theories of fields.

We will introduce IP and dp-rank, Shelah's Conjecture and related conjectures, and discuss the main themes of the proof of Johnson's Theorem, especially the construction of the canonical topology.

Immanuel Halupczok: *Introduction to Hensel minimality*

In real closed fields, o-minimality has been extremely successful as a tameness condition for definable sets. In this minicourse, I will present an analogue notion for (Henselian) valued fields, called ”Hensel minimality”, or ”h-minimality”, for short. (This is a collaboration with Cluckers, Rideau and Vermeulen.) Like o-minimality, h-minimality imposes a condition on definable subsets of the line, which has many geometric consequences, like the existence of a notion of dimension, cell decomposition, almost everywhere differentiability of definable functions, and more. In addition, there are ”resplendency” results, stating that h-minimality is preserved under expansions of the langauge on the value group and on the residue field. In the minicourse, I will explain and motivate the definition and various consequences. While I might give one or two proofs to illustrate some techniques, the main focus will be on intuition and on examples, since proofs tend to be rather fiddly (as in o-minimality).

Vincenzo Mantova: *Surreal numbers and transseries*

Surreal numbers are a ”canonical” monster model of the real field, as well as the real field with exponentiation and restricted analytic functions. Moreover, it is a canonical universal model for the theory of the differential field transseries. I will define in what sense such structures are canonical and reframe some results about transseries by Aschenbrenner, van den Dries and van der Hoeven using bornologies (from Berarducci-Freni) and Rayner structures (Krapp-Kuhlmann-Serra). This is partly work in progress with Berarducci, Kuhlmann and Matusinski.

INVITED TALKS

Zoé Chatzidakis: *Measures on perfect PAC fields* **(remote)**

This is work in progress, joint with Nick Ramsey (UCLA).

A conjecture, now disproved by Chernikov, Hrushovski, Kruckman, Krupinski, Pillay and Ramsey, asked whether any group with a simple theory is definably amenable. It is well known that the counting measure on finite fields gives rise to a non-standard counting measure on pseudo-finite fields (the infinite models of the theory of finite fields). It was unknown whether other PAC fields possessed a reasonable measure, and in this talk, we will show that some of them do, although the measure we define does not have all the nice properties of a counting measure when the field is not pseudo-finite.

This result can be used to show that if G is a group definable in an e-free perfect PAC field, then G is definably amenable. It extends to groups definable in omega-free PAC fields. I will also discuss possible extensions to wider classes of perfect PAC fields.

Nadja Hempel: *Connected Component in n-dependent groups*

1-dependent theories, better known as NIP theories, are the first class of the hierarchy of n-dependent structures. The random n-hypergraph is the canonical object which is n-dependent but not $(n-1)$-dependent. Thus the hierarchy is strict. In a joint work with Chernikov, we proved the existence of strictly n-dependent groups for all natural numbers n and we started studying their properties. The connected component over A, inspired by the definition of the connected component of algebraic group, is the intersection of all A-type definable subgroups of bounded index. A crucial fact about (type)definable groups in 1-dependent theories is the absoluteness of their connected components, namely, given a definable group G and a small set of parameters A, we have that the connected component of G over A coincides with the one over the empty set. We will give examples of n-dependent groups and discuss a generalization of absoluteness of the connected component to n-dependent theories.

Isabel Müller: *An omega-categorical large Polish Structure* (remote)

Polish groups are a well studied object in Model Theory, since they arise naturally as the automorphism groups of countable first order structures M. Model Theory provides tools to investigate the consequences of first order properties of M on the algebraic and topological structure of its automorphism group. This interaction is particularly close if M is homogeneous, carries a strong notion of independence or is tame in a model theoretic sense. If M is omega stable, for instance, there are only countably many orbits of types over M. In this talk, we will prove that this does not generalise to omega categorical, strictly stable structures M (joint work with Shahar Oriel) and exhibit further interactions between model theoretic properties of M and their effects on its automorphism group.

CONTRIBUTED TALKS

Andres Aranda: *All those Fraïssé theorems*

A countable structure M belongs to the morphism extension class XY if all homomorphisms of type X with finite domain are restrictions of an endomorphism of M of type Y. For example, homomorphism-homogeneous structures are HH-homogeneous and ultrahomogeneous structures are IA-homogeneous. We present a uniform way to derive Fraïssé theorems for all XY-morphism extension classes.

Ali Bleybel: *The causal automorphism group of a two-dimensional globally hyperbolic Lorentzian manifold* (remote)

We study the causal automorphism group of a two-dimensional globally hyperbolic Lorentzian manifold with non-compact Cauchy surfaces. Using back-and-forth, we provide a classification of the groups of causal automorphisms of two-dimensional globally hyperbolic Lorentzian manifolds.

Bertalan Bodor: *Structures with at most $(2-\varepsilon)$-exponential unlabelled growth*

For a structure $\mathfrak{A}$ we denote by $f_n(\mathfrak{A})$ the number of orbits of the natural action of $\mathrm{Aut}(\mathfrak{A})$ on the n-element subsets of A. Let us denote by $\mathcal{S}$ the class of all structures for which there exists an $\varepsilon > 0$ such that $f_n(\mathfrak{A}) < (2-\varepsilon)^n$ if n is large enough. By combining some recent results by Braunfeld and Simon we can conclude that all structures in $\mathcal{S}$ are covers of hereditarily cellular structures with fibers isomorphic to finite covers of first-order reducts of $(\mathbb{Q}, <)$.

In this talk I will present a complete classification of structures in $\mathcal{S}$ in terms of their automorphism groups. As a consequence of this classification we can show that all structures in $\mathcal{S}$ satisfy some interesting model-theoretical properties: they are all interdefinable with a finitely bounded homogeneous structure, and they all satisfy Thomas' conjecture, i.e., they have finitely many reducts up to interdefinability.

David Bradley-Williams: ***On limits of betweenness relations***

I will present a joint work with John Truss (Leeds) in which we give a flexible method for constructing a wide variety of limits of betweenness relations. This unifies work of Adeleke, who constructed a Jordan group preserving a limit of betweenness relations, and Bhattacharjee and Macpherson who gave an alternative method using a Fraïssé-type construction. A key ingredient in their work is the notion of a tree of B-sets. We employ this, and extend its use to a wider class of examples.

Samuel Braunfeld: ***Monadic dividing lines and hereditary classes***

A theory T is monadically NIP if every expansion of T by unary predicates is NIP. We will discuss how monadic NIP manifests in the theory T itself rather than just in unary expansions, and how this can be used to produce structure or non-structure in hereditary classes. Monadic stability and monadic NFCP may also make some appearance.

Alexis Chevalier: ***A hypergraph regularity lemma in*** ACFA

In his 2012 paper 'Expanding Polynomials...', Tao proves a Szemeredi-style algebraic regularity lemma for definable graphs in finite fields, and asks if this result can be generalised to definable hypergraphs. We will see that this is possible, and we will show that the result holds more generally for definable hypergraphs in ACFA of finite total dimension. Our main tool is the model theory of ACFA and Hrushovski's twisted Lang-Weil estimates. This is joint work with Elad Levi.

Eugenio Colla: ***Classification of Ramsey monoids***

Recently, Solecki defined Ramsey monoids and Y-controllable monoids to generalize celebrated results in Ramsey theory. In modern terms, Hindman's theorem, infinitary Hales-Jewett theorem, and Gowers' FIN_k theorem state that some monoids are Ramsey. The fact that certain monoids are Y-controllable implies Furstenberg-Katznelson Ramsey theorem. We prove that a monoid is Ramsey if and only if it is finite, aperiodic, and has a certain linear order. We obtain analogous partial results for Y-controllable monoids. These theorems improve those of Solecki and connect these notions with Schützenberger's theorem, one of the most influential theorems in automata theory. The proof uses rather basic notions from model theory, such as coheir and coheir sequence.

Misha Gavrilovich: *A category-theoretic interpretation of NTP and NSOP* **(remote)**

Combinatorial reformulations of the Shelah's dividing lines of NTP_i (no tree property), NOP (no order property), NSOP_i, and others, can be expressed as commutative diagrams in a certain category containing, as full subcategories, that of topological spaces, of uniform spaces, and of simplicial sets. I shall explain this observation.

Mark Kamsma: *Bilinear spaces over a fixed field are simple unstable*

We study the model theory of vector spaces with a bilinear form over a fixed field. For finite fields this can be, and has been, done in the classical framework of full first-order logic. For infinite fields we run into issues with compactness and we need a different logical framework. In this talk we will take the approach of positive logic, a framework that is very close to full first-order logic, but where negation is not built in (but can be added as desired). Positive logic allows us to study bilinear spaces over any fixed field. The arising positive theory turns out to be simple unstable. We also fully characterise its existentially closed models. Time permitting, we will also discuss some other interesting facts about this theory, concerning elimination of quantifiers and omega-categoricity.

Matěj Konečný: *Big Ramsey degrees of hypergraphs* **(remote)**

When the vertex set of a homogeneous structure is enumerated, complicated combinatorial phenomena emerge. Studying them is the content of big Ramsey theory. In this talk I will give a brief introduction into the area and outline some recent results about big Ramsey degrees of hypergraphs of arbitrary arity.

Noa Lavi: *New irreducible generalised power series*

A classical tool in the study of real closed fields are the fields $K((G))$ of generalised power series (i.e., formal sums with well-ordered support) with coefficients in a field K of characteristic 0 and exponents in an ordered abelian group G. A fundamental result of Berarducci ensures the existence of irreducible series in the subring $K((G_{\leq 0}))$ of $K((G))$ consisting of the generalised power series with non-positive exponents. We generalize previous results and show that for certain order types almost all series are irreducible or irreducible up to a monomial.

Michael Lösch: *Transfer of internality and additive covers*

Baldwin and Lachlan showed that uncountably categorical theories are controlled by a strongly minimal set. For example, every uncountably categorical infinite simple group is almost strongly minimal, i.e. algebraic over a strongly minimal set.

There is a natural way to produce uncountably categorical structures which are no longer almost strongly minimal in terms of covers of a strongly minimal set, where each fiber is in definable bijection with a fixed strongly minimal set, i.e. internal to it.

This talk will present two properties, which already appeared in Chatzidakis's work on the canonical base property (CBP), regarding a descent of internality. These properties (or rather the lack thereof) allow a structural study of the CBP in additive covers of the complex numbers.

Paolo Marimon: ***Non-measurability in ω-categorical Hrushovski constructions***

A structure is MS-measurable if it admits a dimension-measure function on its definable sets satisfying certain definability, additivity and Fubini conditions. MS-measurable structures are necessarily supersimple of finite SU-rank. Elwes and Macpherson (2008) asked whether the converse is true in an omega-categorical context. In this talk I will present some non-measurability results concerning omega-categorical Hrushovski constructions. Especially, generalizing unpublished results of Evans, I will show that various classes of omega-categorical Hrushovski constructions (supersimple of finite SU-rank) are not MS-measurable. I will further discuss ongoing work in the context of invariant Keisler measures.