Antalya Algebra Days XXII

17-21 May, 2023

Şirince - İzmir - Turkey

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Invited Speakers

Simplicity of the automorphism groups of some saturated structures

Zoé Chatzidakis

(Joint work with Thomas Blossier (Lyon 1), Charlotte Hardouin (Toulouse) and Amador Martin-Pizarro (Freiburg))

D. Lascar proved in 1995 a very striking and surprising result: $Aut(\mathbb{C}/\mathbb{Q}^{alg})$ is simple. It was actually the continuation of an earlier paper (1992), on automorphism groups of countable saturated strongly minimal structures, and where the result was announced assuming CH. The proof given in the 1992 paper used topology (Polish group, Baire category), the proof in the 1995 paper was much more combinatorial.

Other similar results were proved by K. Tent and M. Ziegler on the isometry group of the Urysohn space (2013). (Simplicity of that group modulo the normal subgroup of bounded isometries).

R. Konnerth (2002) extended Lascar's result to automorphism groups of uncountable saturated differentially closed fields of characteristic 0 which fix the differential closure of $\mathbb{Q}$.

Our aim was to extract from the proof of Lascar and of Konnerth the ingredients of their proofs, and how they can be used to extend the existing results to other fields with operators.

These are the results I will present. I will conclude with some open questions.

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Strict pro-definability of geometric spaces and beautiful pairs

Pablo Cubides Kovacsics

Correspondences between geometric spaces and spaces of types arise in various algebraic contexts. In the case of algebraically closed valued fields, Hrushovski and Loeser strengthened this connection by demonstrating that the spaces of types under consideration have the structure of a strict pro-definable set. This means that they are a projective limit of definable sets with surjective transition maps, giving them a definable structure that strongly resembles familiar definable sets. This structural property enabled Hrushovski and Loeser to use several model-theoretic tools, resulting in striking applications regarding the homotopy type of the Berkovich analytification of an algebraic variety. Are there other geometric spaces with a model-theoretic counterpart possessing such a structural property? In this talk, I will discuss a positive answer to this question in certain geometric contexts, including Huber's analytification of an algebraic variety and Berkovich's analytification of a real semi-algebraic set. These results are achieved by studying certain theories of pairs, which we call beautiful pairs. This is joint work with Martin Hils and Jinhe Ye.

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Algebraic Curves, Computer Algebra and Integrable Systems

Türkü Özlüm Çelik

Recent advances in mathematics and computer science have stimulated the use of algebraic geometry in various scientific fields, including physics, statistics, cryptography, and optimization. In turn, these advancements have inspired new questions and algorithms in foundational math and have revealed connections between different branches of mathematics. This talk focuses on the importance of modern computational tools in studying algebraic curves and their applications in integrable systems. We explore various perspectives, including symbolic, numerical, and combinatorial. We showcase the significance of smooth algebraic curves in generating the solutions to the Kadomtsev-Petviashvili hierarchy, which is a universal integrable system. The solutions happen to be in terms of the corresponding Riemann theta function, which describe the locus of Jacobian varieties in the moduli space of abelian varieties, thus providing an answer to the Schottky problem. Additionally, we examine how the theta function and solution degenerate as the curves become more singular, leading to soliton and lump solutions. The Grassmannian classifies the soliton solutions, which are labelled by combinatorial objects indexing cells of the Grassmannian. Through the mentioned perspectives, we present new results and open problems in exploring these classical objects.

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Arithmetic Progressions in Finite Fields

Haydar Göral

In 1927, van der Waerden [4] proved a theorem regarding the existence of arithmetic progressions in any partition of the positive integers with finitely many classes. In 1936, a strengthening of van der Waerden's theorem was conjectured by Erdős and Turán [2], which states that any subset of positive integers with a positive upper density contains arbitrarily long arithmetic progressions. In 1975 Szemerédi [3] developed his combinatorial method to resolve this conjecture, and the affirmative answer to Erdős and Turán's conjecture is now known as Szemerédi's theorem. As well as in the integers, Szemerédi-type problems have been extensively studied in subsets of finite fields. While much work has been done on the problem of whether subsets of finite fields contain arithmetic progressions, in this talk we concentrate on how many arithmetic progressions we have in certain subsets of finite fields. For this purpose, we consider squares and cubes in finite fields and we use the results on Gauss and Kummer sums. The technique is based on certain types of Weil estimates. We obtain an asymptotic for the number of k-term arithmetic progressions in squares with a better error term. Moreover our error term is sharp and best possible when $k \in \{4, 5\}$, owing to the Sato-Tate conjecture [1]. This work is supported by the Scientific and Technological Research Council of Turkey with the project number 122F027.

References

[1] Tom Barnet-Lamb, David Geraghty, Michael Harris and Richard Taylor, *A Family of Calabi–Yau Varieties and Potential Automorphy II*, Publ. Res. Inst. Math. Sci. **47** (2011) 29–98.

[2] Paul Erdős and Paul Turán, On some sequences of integers, J. Lond. Math. Soc. **11** (1936) 261–264.

[3] Endre Szemerédi, *On sets of integers containing no k elements in arithmetic progression*, Acta Arith. **27** (1975) 199–245.

[4] Bartel L. van der Waerden, *Beweis einer Baudetschen Vermutung*, Nieuw Arch. Wisk. **15** (1927) 212–216.

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Bohr compactifications of first-order structures

Grzegorz Jagiella

(Work in progress, joint with K. Krupiński) Among the classical objects associated with a topological group G are its *compactifications*, namely homomorphisms into a compact topological group with dense image. These include the universal (or "Bohr") compactification of G. Such compactifications can be obtained via model theory through a more general construction of "definable" compactifications. I will talk about a natural generalization of such construction to the category of (appropriately defined) "topological" $\mathcal{L}$-structures (for a fixed, but arbitrary language $\mathcal{L}$). I will show how the compactifications of a structure arise through quotients of its saturated extension by type-definable congruences of bounded index. In some cases, such universal definable compactifications correspond to compactifications studied in classic mathematics, i.e. Bohr ring compactifications, or Nachbin compactifications of ordered structures.

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Higher internal covers

Moshe Kamensky

Internal covers describe a situation where two definable sets admit a definable bijection over some additional parameters. In this case, the automorphism group of one of them over the other becomes definable, yielding a definable version of Galois theory. Hrushovski realized that it is more canonical to attach a groupoid, rather than a group to such covers, and there is an equivalence between such covers and definable groupoids in the base theory. I will suggest a notion of "higher" internal covers, corresponding to higher definable groupoids.

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Locally finite and pseudofinite groups of finite centraliser dimension

Ulla Karhumäki

A group is said to be of finite centraliser dimension if there is a finite bound on the length of any chain of centralisers. I will present similar structural theorems for locally finite groups of finite centraliser dimension and for pseudofinite groups of finite centraliser dimension. The former is joint work with Alexandre Borovik and the latter relies on results of John Wilson on pseudofinite groups. If time permits, I will also discuss different applications of these structural results.

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On locally compact models of approximate rings and their applications

Krzysztof Krupiński

By an 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 additive translates of X. I will discuss the theorem which says that each approximate subring X of a ring has a locally compact model, i.e. a ring homomorphism $f \colon \langle X \rangle \to S$ for some locally compact ring S such that $f[X]$ is relatively compact in S and there is a neighborhood U of 0 in S with $f^{-1}[U] \subseteq 4X + X \cdot 4X$ (where $4X := X + X + X + X$). This S is obtained as the quotient of the ring $\langle X \rangle$ interpreted in a sufficiently saturated model by its type-definable ring connected component, and the main point was to prove that this component always exists. The theorem leads (and may lead to more) structural or even classification results on approximate subrings, and I will present several nice applications.

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Difference fields with an additive character on the fixed field

Stephan Ludwig

Motivated by work of Hrushovski on pseudofinite fields with an additive character, we introduce the theory ACFA+ which is the model companion of the theory of difference fields with an additive character on the fixed field. In this talk, we will present some basic properties of ACFA+ and see that it is given as the limit theory of the algebraic closure of finite fields with the standard character on the fixed field. Afterwards we will focus on type-amalgamation in ACFA+ and explain how 3-amalgamation already differs from the classical context in ACFA. If the time permits, we will explain how this reflects in model-theoretic Galois groups, notably the Kim-Pillay group.

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Productive extreme amenability

Nadav Meir

From the early days of model theory, we have been observing strong connections between the "logical"/"structural" aspect of model theory and automorphism groups of models. Of particular interest is the case where a property of the automorphism group doesn't depend on the choice of a monster model; this is the case for *extreme amenability*.

We will review the notion of extreme amenability and its immediate connection to structural Ramsey theory (known as the Kechris-Pestov-Todorcevic correspondence).

We will present joint work with Krzysztof Krupiński on the behaviour of extreme amenability under various product constructions arising naturally in model theory, as well as group theory. In particular, we will present equivalent conditions for extreme amenability to be preserved under *infinite* products, extending the Kechris-Pestov-Todorcevic correspondence.

As motivation, we will present some recent connections of structural Ramsey theory and extreme amenability to model theory, including, as time allows, very recent results of joint work with Aris Papadopoulous and Pierre Touchard on generalised indiscernibles and products of structures.

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Ellis semigroups without definability of types

Daniel Palacin

A purely topological construction due to Ellis permits to associate a semigroup to a group action on a compact Hausdorff space. Newelski observed that this construction could be applied in model theory to study groups beyond the stable context. Among other results, he showed that the Ellis semigroup can be seen as a space of types with its usual operation under the assumption that all types are definable (i.e. by working in the language of externally definable sets).

In this talk I will present the construction from a very general model-theoretical perspective, without assuming definability of types. Afterwards, I will explain some consequences on the Ellis semigroup in o-minimality. This is joint work with Elías Baro.

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Model theory and the Lazard Correspondence

Nick Ramsey

The Lazard Correspondence is a characteristic p analogue of the correspondence between nilpotent Lie groups and Lie algebras, associating to every nilpotent group of exponent p and nilpotence class c a Lie algebra over F_p with the same nilpotence class (assuming $c < p$). We will describe the role that this translation between nilpotent group theory and linear algebra has played in an emerging program to understand the first order properties of random nilpotent groups. In this talk, we will focus on connections to neostability theory, highlighting the way that nilpotent groups furnish natural algebraic structures in surprising parts of the SOP_n and n-dependence hierarchies. This is joint work with Christian d'Elbée, Isabel Müller, and Daoud Siniora.

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Model theory of differential fields in positive characteristic.

Omar León Sánchez

While the model theory of differential fields in characteristic zero has been vastly studied since the late 60s, its positive characteristic counterpart has has not received as much attention. There are a series of papers of Carol Wood from the early 70's where she investigates the class of differentially closed fields in characteristic $p > 0$. This theory DCF_p is complete and stable; and one can think of it as the differential analogue of ACF_p. The question that I will address in this talk is: what is the differential analogue of the theory of separably closed fields SCF_p. Somewhat surprisingly, to my knowledge, this has not been dealt with elsewhere. This is joint work with Kai.

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Product-free sets and distality

Atticus Stonestrom

Recall that a subset X of a group G is 'product-free' if $X^2 \cap X = \varnothing$, ie if $xy \notin X$ for all $x, y \in X$. Suppose G is definable in a distal theory; for example, G may be any semialgebraic group. We will present a few results on product-free subsets of G, showing that structured subsets of G tend to have large product-free subsets, in various senses. More specifically:

1. There are constants $c > 0$ and $\delta \in (0, 1)$ such that every finite k-approximate subgroup of G distinct from $\{1\}$ contains a product-free subset of density at least δ/k^c.
2. If G is definably amenable, then every f-generic definable subset of G contains a definable non-algebraic product-free subset.
3. If G is fsg, with translation-invariant Keisler measure μ, then every definable subset of G of positive measure under μ contains a definable product-free subset of positive measure under μ.

The proofs of 1 and 3 use an iterated application of Chernikov and Starchenko's distal regularity lemma, while the proof of 2 uses the existence of G^{00}-invariant types. In the case $G = \mathrm{GL}_n(\mathbb{C})$, the statement of 1 also follows, again with polynomial dependence on k, from Breuillard, Green, and Tao's classification of the approximate subgroups of $\mathrm{GL}_n(\mathbb{C})$.

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Residue Domination

Mariana Vicaria

Haskell, Hrushovski and Macpherson developed the theory of stable domination: a notion that captures when a structure is controlled by its stable part. A prime example is ACVF, where the stable part coincides with all the sets that are internal to the residue field (which is strongly minimal). In this talk we present residue field domination statements for henselian valued fields of equicharacteristic zero, which in essence captures the notion that the structure is controlled by the sorts internal to the residue to the residue field. If time allows us, we present residue domination results for sigma-henselian valued fields (this is joint work with D. Haskell).

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Some model theory of pseudofinite difference fields

Tingxiang Zou

Let F be a non-principal ultraproduct of finite difference fields. The theory of F and its model theoretic properties vary vastly when one takes different ultraproducts. In this talk, I will focus on some classes of F and discuss what we know about their first-order theories and their definable sets.

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Contributed Talks

A Hahn-like construction for mixed characteristic valued fields: the "twisted" power series

Anna De Mase

In their paper ([2]), Ax and Kochen give a complete axiomatization of the theory of the class of formally p-adic fields, by having the following properties:

- the value group is a $\mathbb{Z}$-group;
- the residue field is $\mathbb{F}_p$;
- $v(p)$ is the minimal positive element of the value group.

Thus, a valued field K is formally p-adic if and only if it is elementarily equivalent to $\mathbb{Q}_p$. Moreover, assuming the Continuum Hypothesis, they give a characterization of ω-pseudo complete formally p-adic fields with a fixed value group G of cardinality $\aleph_1$, using a Hahn-like construction over $\mathbb{Q}_p$ that preserves the residue field. In this construction, the elements of the field are "twisted" power series over $\mathbb{Q}_p$, i.e. power series whose product is defined by having a power of p as an extra factor. In this talk, we generalize this construction to the more general setting of mixed characteristic henselian valued fields with finite ramification and valued in a discrete ordered abelian group G. Then we show that an analogous characterization holds for ω-pseudo complete valued fields elementarily equivalent to some extensions of the p-adics.

References
[1] Ax, J., and Kochen, S. Diophantine problems over local fields. I. Amer. J. Math. 87 (1965), 605-630.
[2] Ax, J., and Kochen, S. Diophantine problems over local fields II. A complete set of axioms for p-adic number theory.*. American Journal of Mathematics 87 (1965), 631.

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Shortly on Model Completeness of SL(2,R)

Daniel Max Hoffmann

I will present some results from my joint project with Chieu Minh Tran and Jinhe Ye. Model completeness is a weakening of quantifier elimination. The main task here is to define a field in the structure of the pure group, but in such a way that this definition transfers over some group extensions. I will recall basic facts from the model theory needed here and similar recent results in the field, then - hopefully - I will be able to sketch the idea of the proof, which is quite geometric.

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Abstract Class Field Theory

Ruslan Muslumov

The Green biset functor theory is a powerful tool in the study of finite groups, providing a bridge between representation theory and algebraic topology. In recent years, there has been a growing interest in generalizing this theory to the setting of profinite groups, which are infinite groups that can be viewed as limits of finite groups. This generalization has the potential to significantly advance the study of class field theory, which concerns the behavior of abelian extensions of global fields.

The goal of our work is to generalize the ideas of Jurgen Neukirch on abstract class field theory to the biset functors and Green biset functors. The focus is on extending the notion of the Green biset ring to profinite groups. The study of biset functors and Green biset functors has proven to be a powerful tool for understanding the algebraic structure of groups and their associated rings. The extension of these concepts to profinite groups is a natural next step, as profinite groups arise naturally in the study of Galois theory and number theory. The goal is to develop a theory of Green biset functors for profinite groups that can be used to study the Galois cohomology of fields, in particular, the cohomology of infinite Galois extensions. This work has the potential to lead to new insights and applications in the study of abstract algebra and number theory.

Overall, this work has the potential to deepen our understanding of the relationship between profinite groups, class field theory, and the Green biset functor theory. It also has important implications for a wide range of other areas of mathematics, including algebraic geometry, algebraic topology, and representation theory.

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Expansion of the Group of Integers by a Beatty Sequence

Melissa Özsahakyan

In this talk, we give some model theoretic results about the structure $(\mathbb{Z}, +, 0, P_r)$, where $r > 1$ is an irrational number and P_r is a predicate that stands for the set consisting of elements of the form $\lfloor nr \rfloor$ for some nonzero integer n. The elements of the form $\lfloor nr \rfloor$ give us a sequence called the Beatty sequence generated by r. Finally, we show the connection between Beatty sequences and oriented abelian groups.

References

[1] Ayhan Günaydın, Melissa Özsahakyan, Expansions of the group of integers by Beatty sequences, Annals of Pure and Applied Logic, Volume 173, Issue 3, 2022.

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Monadic NIP in monotone classes of relational structures

Aris Papadopoulos

In recent joint work with S. Braunfeld, A. Dawar, and I. Eleftheriadis we prove that the monotone classes of relational structures which admit fixed-parameter tractable model checking are precisely those that are (monadically) NIP. This generalises a known result for graphs and answers a question of Adler and Adler from [1]. The key ingredient in our proof is that (monadic) NIP for a monotone class of relational structures coincides with nowhere-density of its Gaiffman class, and thus is a natural generalisation of graph-theoretic sparsity to higher-arity structures. This work can also be seen as a contribution towards the conjecture of Bonnet et al. from [2] that the hereditary classes of structures admitting fixed-parameter tractable model-checking are precisely those that are monadically NIP.

In my talk, I will introduce all the terminology required for the previous paragraph to make sense. I will also discuss the tools and structure of our proof, and, time permitting, I will outline some of our arguments.

References
[**1**] Hans Adler and Isolde Adler, *Interpreting nowhere dense graph classes as a classical notion of model theory*, ***European Journal of Combinatorics***, vol. 36 (2014), pp. 322-330.
[**2**] Bonnet, Edouard and Giocanti, Ugo and de Mendez, Patrice Ossona and Simon, Pierre and Thomasse, Stephan and Torunczyk, Szymon, *Twin-width IV: ordered graphs and matrices*, ***arXiv preprint***, 2102.03117 (2021).

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On transfer principles for ordered abelian groups

Pierre Touchard

The Ax-Kochen-Ershov theorem states that a henselian valued field K of equicharacteristic 0 is model complete relative to its residue field k and its valued group Γ. This theorem is a transfer principle: a model theoretic property P ("embeddings are elementary") holds in K if and only if it holds in k and Γ. This philosophy has inspire many recent works on model theory of valued fields (related to this talk: [1], [2], [3]).

In this talk, we will take a look at transfer principles in other structures namely ordered abelian groups. There, the spines (certain colored orders associate to ordered abelian groups) and ribs (certain regular ordered abelian groups) can play similar roles as respectively the value group and residue field for valued fields. For instance, the celebrated theorem of Gurevich and Schmitt can be seen as a transfer principle: any ordered abelian groups is dependant because the spines are always dependant.

We will discuss a certain subclass of ordered abelian groups, where transfer principles can be more easily stated and proved. Then, in this class, we will see a characterisation of *stable embeddedness* (property that we will define) in terms of stably embeddedness of the spines and ribs. This will allow us to partially answer the following question: in which ordered abelian groups the externally definable sets (i.e. definable with parameters in an elementary extension) are precisely the (internally) definable sets?

This is a joint work with Martina Liccardo and Martin Hils.

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Compactness in Team Semantics

Davide Emilio Quadrellaro

Team semantics offers a generalization to the standard Tarksi semantics of first-order logic by considering *sets of assignments* instead of single assignments. This intuition is due to Wilfred Hodges, who introduced it in the first-order context to analyse slash quantifiers and provide a compositional semantics for Hintikka and Sandu's IF-logic. Team semantics was then employed by Jouko Väänänen in [1] to define first-order dependence logic, where the slash quantifier is replaced by suitable dependence atoms. In this talk we present some novel result on the model-theory of (in)dependence logic and related logics based on team semantics.

In first-order logic, the following formulations of the compactness theorem can be easily proved from one another:

(i) *Every set of sentences that is finitely satisfiable is satisfiable*;

(ii) *Every set of formulas that is finitely satisfiable is satisfiable.*

For (in)dependence logic, the first version of compactness is a well-known result and was proved by Väänänen in [1] using the translation between (in)dependence logic and the existential fragment of second-order logic Σ^1_1. However, in the context of team semantics, one cannot derive (ii) from (i) by replacing variables with constants, as it is the case for first order logic.

The second version of compactness (ii) has been recently considered by Kontinen and Yang in [2], who used the translation from (in)dependence logic to Σ^1_1 to show that "*every set of formulas with countably many free variables that is finitely satisfiable is satisfiable*". In this talk, we provide two proofs of the second version of compactness (ii) for arbitrary sets of formulas. First, we build upon Lück's ultraproduct construction for team semantics [3] and prove a suitable version of Los' Theorem. Second, we show that by working with enough saturated models, we can generalize the proof of Kontinen and Yang to sets of formulas with arbitrarily many variables.

Finally, we will also mention how one can introduce a suitable notion of morphism between models that preserve formulas of (in)dependence logic and we show that a suitable version of the amalgamation property holds in this context.

This talk is based on a joint work with Joni Puljujarvi.

References
[**1**] Jouko Väänänen, *Dependence Logic: A New Approach to Independence Friendly Logic*, Cambridge University Press, 2007.
[**2**] Juha Kontinen and Fan Yang, *Complete logics for elementary team properties*, Journal of Symbolic Logic, 1-38, 2022, doi:10.1017/jsl.2022.80.
[**3**] Martin LÃ¼ck, *Team Logic Axioms, Expressiveness, Complexity*, PhD thesis, University of Hannover, 2020.

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Inner homogeneous groups and definable homogeneity

Tomasz Rzepecki

Let us say that a group G is inner (ultra)homogeneous if every finite partial automorphism can be extended to an inner automorphism.

For example, Hall's universal group (the Fraisse limit of the class of finite groups) has this property (this is basically due to Phillip Hall), as does the Fraisse limit of the class of finitely presentable groups.

It follows that the centre of G has at most two elements, and if G has more than 2 elements, then it is infinite and not $\aleph_0$-categorical. Under some mild assumptions, it is (group-theoretically) uniformly simple and divisible, has both the strict order property and the independence property (in fact, the tree property of the second kind) and its age has the extension property of partial automorphisms, which (under suitable amalgamation hypotheses) can be used to show the existence of ample generic automorphisms (for Hall's universal group, this was done independently by Daoud Siniora and Shichang Song).

Depending on time constraints, I will describe some of the examples and show some of the properties described above.

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Subprojectivity domain of finitely generated modules

Arbsie Yasin

In a recent paper of Holston, López-Permouth, Mastromatteo and Simental-Rodriguez, a ring R is defined to have no subprojective middle class if the subprojectivity domain of any R-module is the smallest or largest possible. In this work, we continue to use this idea of restricting the class of subprojectivity domains to classify rings. A finitely generated module is called finitely generated p-indigent (or fingp-indigent) if its subprojectivity domain consists of only finitely projective modules. We give a characterization of rings over which finitely generated modules are either projective or fingp-indigent.

Recall that a module M is called finitely projective in case for every epimorphism $g : N \to M$ and any homomorphism $f : C \to M$ with C a finitely generated module, there exists $h : C \to N$ such that $f = gh$.

As an opposite to finitely generated projective modules, a finitely generated module M is said to be fingp-indigent, if its subprojectivity domain is the smallest possible, namely, consisting of exactly the finitely projective modules. Our first result states that a right Kasch ring R has no simple finitely subprojective middle class if and only if it has no simple subprojective middle class if and only if there is a ring direct sum $R \cong S \times T$, where S is semisimple Artinian ring and T is an indecomposable matrix ring over a local QF-ring. Our second result states that a right nonsingular ring R has no (simple) finitely subprojective middle class if and only if R is a right finitely σ-CS, right C, right semihereditary ring with unique (up to isomorphism) singular simple module.

References

[**1**] H. Amzil, D. Bennis, J. R. Rozas, H. Ouberka, and L. Oyonarte, Subprojectivity in abelian categories, *Applied Categorical Structures* **29(5)** (2021) 889–913.
[**2**] G. Azumaya, Finite splitness and finite projectivity, *J. Algebra* **106** (1987) 114–134.
[**3**] D. Bennis, J. R. Rozas, H. Ouberka, and L. Oyonarte, A new approach to projectivity in the categories of complexes, *Annali di Matematica Pura ed Applicata*, (2022) 1–19.
[**4**] J. Clark, C. Lomp, N. Vanaja, R. Wisbauer, *Lifting modules: supplements and projectivity in module theory.* (Springer, 2008).
[**5**] F Couchot, Flat modules over valuation rings,*Journal of Pure and Applied Algebra* **211(1)** (2007) 235–247.
[**6**] N. V. Dung, D. V. Huynh, P. F. Smith, and R. Wisbauer, *Extending modules* (Longman Scientific& Technical, Harlow, 1994).
[**7**] Y. Durğun, Rings whose modules have maximal or minimal subprojectivity domain, *J. Algebra Appl.* **14(6)** (2015).
[**8**] Y. Durğun, Subprojectivity domains of pure-projective modules, *J. Algebra Appl.* **19(5)** (2020).
[**9**] Y. Durğun, Projectivity relative to closed (neat) submodules, *J. Algebra Appl.* **21(06)** (2022).
[**10**] C. Faith and D. V. Huynh, When self-injective rings are QF: a report on a problem., *J. Algebra Appl.* **1(01)** (2002), 75-105.
[**11**] C. Holston, S. R. López-Permouth, J. Mastromatteo, and J. E. Simental-Rodriguez, An alternative perspective on projectivity of modules, *Glasgow Math. J.* **57(1)** (2016) 83–99.
[**12**] M.F. Jones, F-projectivity and flat epimorphisms., *Communications in Algebra* **9(16)** (1981) 1603–1616.
[**13**] L. Mao, A generalization of Noetherian rings,*Taiwanese Journal of Mathematics*, **12(2)** (2008) 501–512.
[**14**] W. K. Nicholson, M. F. Yousif. *Quasi-Frobenius Rings, 158.* (Cambridge University Press, 2003).
[**15**] F. L. Sandomierski, Nonsingular rings, *Proc. Amer. Math. Soc.* **19** (1968) 225–230.

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Posters

Structures of Lang-type and the links between Number Theory and Model Theory

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O-minimality has proved a useful tool in proving certain number theoretic special point conjectures, such as the Mordell-Lang conjecture. In 1998, Pillay showed that these special point conjectures can be used to construct model stable structures by expanding algebraically closed fields by a predicate identifying special points. Pillay called structures of this form 'structures of Lang-type'. These structures form a link between o-minimality, number theory and stability theory. Recent effective and uniform proofs of special point conjectures can be used to prove decidability and allow us to study the common theory of families of structures of Lang-type. Furthermore, weak forms of quantifier elimination can often be obtained from such structures.

References

[1] The model-theoretic content of Lang's conjecture, Pillay, 1998.
[2] Stable theories with a new predicate, Casanovas and Ziegler, 2001.

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