MMM CONFERENCE - ABSTRACTS

Lovkush Agarwal. On non-forking spectra.
Abstract: Given a first-order theory T, the stability function f is a function which maps a cardinal κ to the cardinality of the maximum number of types over a model of T of size κ. For example, if T is the theory of DLO, then $f(\aleph_0) = 2^{\aleph_0}$. The stability function is well-understood.

The non-forking spectrum of a theory T is a generalisation of the stability function which takes as inputs two cardinals κ and λ, and outputs the maximum number of 1-types over a model of size of λ that do not fork over a submodel of size κ. In this talk, I will present results obtained by Chernikov, Kaplan and Shelah about non-forking spectra. (The results were first put on Arxiv in 2012, but a second version was uploaded in Aug 2015).

Robert Barham. Automatic Homeomorphicity of Locally Moving Groups and Clones.
Abstract: Ahlbrandt and Ziegler showed that if two models have homeomorphic automorphism groups, then they are bi-interpretable. If we assume some extra constraints on the models, and ask that not only the groups, but the larger transformation algebras (e.g. the endomorphism monoid or the polymorphism clone) are homeomorphic, then we know that the bi-interpretation uses formulas of low complexity. We discuss a recent generalization of Rubin's work on locally moving groups to show for a number of familiar models (e.g. $(\mathbb{Q}, <)$), every isomorphism of the polymorphism clone is already a homeomorphism.

David Bradley-Williams. Maximally closed Jordan groups" and propose the following abstract.
Abstract: Jordan groups are a certain class of permutation groups which act in a certain highly symmetric way. Intricate work of Adeleke, Macpherson and Neumann provides us with a powerful way to study infinite primitive Jordan groups when they are viewed as groups acting on structures as automorphisms. In particular, the major theorem of Adeleke and Macpherson tells us that when an infinite primitive Jordan group acts as a permutation group, there is an invariant relation falling into one of various descriptions which can then be further analysed. In this talk we will discuss how this body of work has been recently applied, and hopefully could be applied further, in finding some closed subgroups G of $\mathrm{Sym}(\omega)$ which are maximally closed, in that any closed permutation group containing G also contains $\mathrm{Sym}(\omega)$.

Pantelis E. Eleftheriou. Topological properties for semi-linear sets.
Abstract: Let R be an ordered vector space over an ordered division ring. Sets definable in R are called semi-linear, and they are the boolean combinations of sets defined by linear equations and inequalities. Semi-linear sets lack basic topological properties, such as the triangulation theorem and embedding theorems of definable manifolds into the affine space. On the other hand, the positive results known for them are often sharper than their analogues in the o-minimal field setting. In this talk, we will survey some of these results and discuss the proof of a recent theorem: every semi-linear set is a finite union of relatively open subsets that are definably simply-connected.

Javier de la Nuez González. What are Makanin-Razborov diagrams?
Abstract: We present some of the intuitions behind the so called Makanin-Razborov diagrams, used to describe the set of solutions of a system of equations over the free group, as well as an overview of Zlil Sela's approach to construct them.

Arthur Forey. Motivic local density.
Abstract: Let K be a field endowed with a distance and a measure μ. The local density of a set $X \subseteq K^n$ of dimension d, at a point $x \in K^n$ is the limit if it makes sense

$$\Theta_d(X, x) = \lim_{r \to 0} \frac{\mu_d(X \cap B(x, r))}{\mu_d(B_d(x, r))},$$

where $B(x, r)$ is the ball of center x and radius r.

Studied in the real case by Kurdyka and Raby, this definition is adapted to the p-adic case by Cluckers, Comte and Loeser in [CCL12]. I will define a similar notion for definable sets in a tame Henselian valued field of characteristic zero (and any residue characteristic), using the motivic measure of Cluckers and Loeser [CL15].

As in the previous cases, there is a notion of distinguished tangent cone on which one can compute the local density if we attach the appropriate motivic multiplicities. This implies in particular a uniform version of the theorem of Cluckers, Comte and Loeser in the p-adic case.

References

[CCL12] Raf Cluckers, Georges Comte, and François Loeser. Local metric properties and regular stratifications of p-adic definable sets. *Comment. Math. Helv.*, 87(4):963–1009, 2012.

[CL15] Raf Cluckers and François Loeser. Motivic integration in all residue field characteristics for Henselian discretely valued fields of characteristic zero. *J. Reine Angew. Math.*, 701:1–31, 2015.

[For15] Arthur Forey. Motivic local density. *ArXiv.1512.00420*, 2015.

Dario García. Pseudofinite dimensions and simplicity.
Abstract: The concept of pseudofinite dimension for ultraproducts of finite structures was introduced by Hrushovski and Wagner. In this talk, I will present joint work with Macpherson and Steinhorn in which we explored conditions on the (fine) pseudofinite dimension that guarantee simplicity or supersimplicity of the underlying theory of an ultraproduct of finite structures, as well as a characterization of forking in terms of droping of the pseudofinite dimension. Also, under a suitable assumption, it can be shown that a measure-theoretic condition is equivalent to local stability.

Zaniar Ghadernezhad. An NTP_2+NSOP generic structure that is not simple.
Abstract: In this talk we first introduce a new method to build a new class of generic structures. This method generalizes the usual construction method of generic structures that is based on a pre-dimension function. Using this new method we build a generic structure that its theory is not simple but NTP_2 and NSOP. This gives a partial answer to a question by Chernikov about the existence and hierarchy of such theories. This is a joint work with Massoud Pourmahdian.

Lorna Gregory. Interpretation functors, representation type and decidability.
Abstract: In this talk I will give an overview of recent developments in the model theory of representations of finite-dimensional algebras.

The results will connect representation type with decidability of theories of modules and interpretation functors, an additive version of the model theoretic notion of interpretation.

The representation type of a finite-dimensional k-algebra is a measure of how hard it is to classify its finite-dimensional indecomposable modules. Roughly, a finite-dimensional k-algebra is of wild representation type if classifying its finite-dimensional indecomposable modules is as hard as classifying those of the polynomial ring in two non-commuting variables. On the other hand, a finite-dimensional algebra is tame if for every dimension d, all but finitely many of the finite-dimensional indecomposable modules of dimension d are in finitely many 1-parameter families. According to Drozd, when k is algebraically closed, a finite-dimensional k-algebra is either tame or wild.

I will focus on results in

[1] L. Gregory, M.Prest - Representation embeddings, interpretation functors and controlled wild algebras - arXiv:1411.3221v2

[2] L. Gregory - Decidability of theories of modules over canonical algebras of tubular type - arXiv:1603.03284

Yatir Halevi. Generically Stable Varieties and Groups in ACVF.
Abstract: Generically stable groups and more specifically algebraic groups with generically stable generics were studied by Hrushovski in "Valued fields, Metastable Groups". We'll talk about a class of group schemes over the valuation ring definable in ACVF and show that they are generically stable. In fact, we define a functor between the category of algebraic varieties with a Zariski dense generically stable type concentrated on it to generically stable definable schemes over the valuation ring. If everything is over a model, algebraic groups get sent to group schemes. If time permits we may say a few words about strongly stably dominated types.

Gwyneth Harrison-Shermoen. Embedded asymptotic classes.
Abstract: A *one-dimensional asymptotic class* (defined by Macpherson and Steinhorn) is a class of finite structures with uniform bounds on the sizes of definable sets. We will discuss some of the background definitions and results of the theory of one-dimensional asymptotic classes (and related notions) before introducing the definition of an *embedded asymptotic class*: roughly, a class of pairs $(\mathcal{M}, A)$ - where $\mathcal{M}$ is an infinite structure and A is finite substructure of $\mathcal{M}$ - with uniform bounds on the sizes of M-definable subsets of A. We will present the initial results and examples of embedded asymptotic classes. This is a work in progress, joint with Dugald Macpherson.

Rémi Jaoui. New examples of types in $\mathbf{DCF}_0$ orthogonal to the constants.
Abstract: Let (S) be an absolutely irreducible system of differential equations over a field k of constants (of characteristic 0). A very interesting problem arising in the model theory of differentially closed fields is to determine whether the generic type of the system (S) is orthogonal to the constants or not.

Such a system (S) can be represented by his phase space (X, v) which is an absolutely irreducible algebraic variety X over the field k endowed with an algebraic vector field v. Moreover, when $k = \mathbb{R}$ is the field of real numbers and under some smoothness condition on X, one can consider the real flow $(X(\mathbb{R})^{an}, (\phi_t))$ associated to the vector field v.

In my talk, I will define a topological property of the real flow $(X(\mathbb{R})^{an}, (\phi_t))$ which, under natural hypothesis on the phase space (X, v), implies that the generic type of (S) is orthogonal to the constants. Using results of topological dynamics of hyperbolic flows, I will explain how to deduce from this criteria, new examples of systems (S) of dimension 3, whose generic types are orthogonal to the constants.

Aleksandra Kwiatkowska. Homeomorphism groups and their universal minimal flows.
Abstract: I will discuss homeomorphism groups of compact connected metric spaces like the Lelek fan and the pseudo-arc, focusing on their universal

minimal flows. In particular, I will describe the universal minimal flow of the homeomorphism group of the Lelek fan. The topic connects topological dynamics and the structural Ramsey theory. This is joint work with Dana Bartosova.

Gabriel Lehéricy. C-structures and quasi-orders on abelian groups.
Abstract: Quasi-orders (see [2]) and C-relations (see [1]) can both be used to generalize the notions of group order and group valuation. The aim of my talk is to present these two approachs and study the connection between them.

In [2] Fakhruddin considered what he called quasi-ordered fields, which are fields endowed with a quasi-order compatible with the field operations. He proved that in this case the quasi-order is always either a field valuation or a field order.

Following Fakhruddin's idea, we would like to consider abelian groups $(G, +)$ endowed with a quasi-order compatible with $+$; we call it a compatible q.o.a.g (quasi-ordered abelian group). Ordered groups and groups with a valuation are both examples of compatible q.o.a.g's, but they are not the only ones. In my talk I will describe the structure of a compatible q.o.a.g and show that every compatible q.o canonically induces a C-structure on G compatible with $+$. I will also show that every C-relation on an abelian group canonically induces a quasi-order on G, and I will describe the general structure of an abelian C-group through its associated quasi-order.

References

[1] Françoise Delon : *C-minimal structures without the density assumption*, In Raf Cluckers, Johannes Nicaise et Julien Sebag, éditeurs : Motivic Integration and its Interactions with Model Theory and Non-Archimedean Geometry. Cambridge University Press, Berlin, 2011.

[2] Syed M.Fakhruddin,*Quasi-ordered fields*, Journal of Pure and Applied Algebra 45 (1987) 207-210

Nadav Meir. Infinite products of ultrahomogeneous structures.
Abstract: In our previous work regarding the lexicographic product of two structures, we have shown that if two structures admit quantifier elimination, then so does their product (two be defined). This also implies closedness two ultrahomogeneity, stability and more. In this talk we regard products of structures and take them to the infinity. We apply this to find a rigid elementarily indivisible structure, giving a negative answer to the last open question from a paper by A. Hasson, M. Kojman, and A. Onshuus. If time allows, we will apply some of the techniques to give a simpler proof of a result by Lachlan and Shelah of a uniform bound on $CR(p, 2)$ for all countable stable ultrahomogeneous structures in a finite language.

Omer Mermelstein. Symmetrizing Hrushovski's construction.
Abstract: When thinking of directed graphs, an easy idea for a definable reduct is forgetting the direction of the edges. Quite often, we cannot recover the lost information. Hrushovski's non-collapsed ab-initio construction, albeit a hypergraph, also begs to be symmetrized. Do we lose information in this case as well? In the non-collapsed case, this reduct is indeed proper. We show, however, that the resulting structure is no less complex and in fact interprets the (non-symmetrized) original. In the collapsed case, possibly even less is lost. We show an adversarial choice of multiplicity that renders the construction and its symmetrization interdefinable.

Isabel Müller. Fraïssé Structures with Universal Automorphism Groups.
Abstract: If M is a Fraïssé structure equipped with a notion of stationary independence, then for any substructure $X \subseteq M$, there exists a re-embedding $f(X) \subseteq M$, such that the automorphisms of $f(X)$ extend categorically to automorphisms of M. In particular, the automorphism group of M is universal for the class of automorphism groups of substructures of M. We will introduce the notion of stationary independence and present an outline of the proof. This gives a partial answer to a question posed by Eric Jaligot.

Victoria Noquez. Some Notions of Minimality in Continuous Logic.
Abstract: Currently, there are no good notions of minimality for continuous logic.

We will consider the following characterization of strong minimality for continuous logic, proposed by Isaac Goldbring: A continuous theory T is strongly minimal if in every $\mathcal{M} \vDash T$, whenever $P(x)$ is a definable predicate, either the zero set of P is totally bounded, or its complement is totally bounded. If we view a classical theory as a continuous theory via the identification of T with 0, F with 1 and $=$ with d, this characterization coincides with the classical definition of strong minimality. However, in the continuous setting, it implies that $\mathcal{M} \vDash T$ is locally compact at a point. This eliminates many examples that should be strongly minimal in some sense, such as infinite dimensional Hilbert spaces.

Time permitting, we will discuss efforts towards finding a robust characterization of dp-minimality in the continuous setting.

Alfonso Ruiz. Zariski geometries and functors of algebraic geometry.
Abstract: Zariski geometries give a model theoretic approach to algebraic varieties over an algebraically closed field. It is an open question if there is an appropriate generalization of Zariski geometry to more modern objects of algebraic geometry defined by functors such like schemes, algebraic spaces or algebraic stacks. I will present some partial results on this problem.

Lubna Shaheen. A model for the representation theory of rings of integers.
Abstract: The aim of this project is to attach a geometric structure to the ring of integers and to understand Spec($\mathbb{Z}$) from the point of view of stability theory. In his work, Y.I. Manin asked several questions about the dimension of Spec($\mathbb{Z}$). Recently A.Connes and C.Consani introduced a much more complex structure called the arithmetic site which includes Spec($\mathbb{Z}$). Our approach for the same purpose is based on the generalization of constructions applied by Boris Zilber in non-commutative (and commutative) algebraic geometry. We describe a category of certain representations of integral extensions of $\mathbb{Z}$ and establish its tight connection with the space of elementary theories of pseudo-finite fields. From model-theoretic point of view the category of representations is a multi-sorted structure which we prove to be super-stable with pre-geometry of trivial type. We formally have answered two of Manin's questions about Dimension of Spec($\mathbb{Z}$) being 1 and infinity.

Peter Sinclair. Immediately Algebraically Closed Fields.
Absrtact: One method towards understanding the structure of a field is to study the valuations that can be put on the field. We say that a field K is immediately algebraically closed (IAC) if its algebraic closure is an immediate extension with respect to any valuation v on K; this is equivalent to saying that (K, v) has a divisible value group and an algebraically closed residue field. In his thesis, Jizhan Hong proposed a topological characterization of IAC fields; I will show that his characterization only holds in certain cases, and explain how the IAC assumption can be strengthened to match the topological condition. I will also give some examples of IAC fields, and suggest some reasons why they may be of interest to model theorists.

Daoud Siniora. The Universal bowtie-free graph and generic automorphisms.
Abstract: A bowtie is a graph of five vertices constructed by glueing two copies of a triangle at a common vertex. It was shown by Cherlin-Shelah-Shi that the class of countable graphs which have no subgraphs isomorphic to a bowtie contains a universal existentially-closed graph. I will introduce this universal bowtie-free graph and try to show that its automorphism group has a generic automorphism.

Dmitry Sustretov. Strongly minimal reducts of algebraic varieties
Abstract: This talk will be devoted to strongly minimal structures interpretable in ACF. Their geometry was conjectured by Zilber to be essentially determined by an interprtable group or field, an instance of more general trichotomy principle. I am going to give a brief overview of the case when the universe is interpreted by a one-dimensional set and the structure is non locally modular (recent joint work with Assaf Hasson), and the case of a higher-dimensional universe.

Ali Valizadeh. Some model theoretic properties of non-AC generic structures.

Abstract: In the context of Hrushovski constructions we take a language $\mathcal{L}$ with a ternary relation R and consider the theory of the generic models M^*_α, of the class of finite $\mathcal{L}$-structures equipped with predimension functions δ_α, for $\alpha \in (0,1] \cap \mathbb{Q}$. The theory of generic structures of non-AC smooth classes have been investigated from different points of view, including decidability and their power in interpreting known structures and theories. For a rational $\alpha \in (0,1]$, in one hand we prove that the theory of M^*_α admits a quantifier elimination down to a meaningful class of formulas, called *closure formulas*. And on the other hand we prove that $Th(M^*_\alpha)$ does not have the finite model property.

Erik Walsberg. Tame Topology over dp-minimal Structures.

Abstract: We discuss topological properties of definable sets and functions in dp-minimal expansions of ordered abelian groups and valued fields. Some of this is joint with Pierre Simon.