Abstracts

- ALEXANDER VAN ABEL, *Variations on the Feferman-Vaught theorem and applications to* $\prod_{p\ prime} \mathbb{F}_p$.
City University of New York.
E-mail: avanabel@gradcenter.cuny.edu.

We prove via the Feferman-Vaught Theorem that a definable subset of a product structure is a Boolean combination of open sets in a natural product topology, and show how this implies certain subsets are undefinable. We also present a converse of the F.-V. Theorem for products of integral domains. Finally, we apply these results to an analysis of the structure $\prod_{p \text{ prime}} \mathbb{F}_p$.

- RACHAEL ALVIR, *Optimal complexity Scott sentences.*
University of Notre Dame.
E-mail: arubirurei@gmail.com.

A Scott sentence for a countable structure A is a sentence of $L_{\omega_1\omega}$ whose countable models are precisely the structures isomorphic to A. Such a sentence is computable when its infinite disjunctions and conjunctions are over computably enumerable sets. We consider when a structure with a given optimal Scott sentence will also have an optimal computable Scott sentence of the same complexity.

- ALBERT CHICCO, *Some primeness arguments in the lattice of interpretability types of varieties of universal algebras.*
McMaster University.
E-mail: chiccoa@mcmaster.ca.

- JIN DU, *Failure of diamond.*
University of Illinois at Chicago.
E-mail: jdu8@uic.edu.

I discuss a paper of mine from last year about the failure of diamond at $\aleph_{\omega^2}$.

- KYLE GANNON, *Generically stable measures and NIP theories.*
University of Notre Dame.
E-mail: kgannon1@nd.edu.

Finitely additive measures have become an important tool in analyzing NIP Theories. Hrushovski, Pillay, and Simon have shown that every generically stable measure over an NIP structure is finitely approximable. We provide a new proof of this result by understanding the space of smooth measures as a continuous structure (in the sense of continuous model theory).

- ALLEN GEHRET, *A tale of two Liouville closures....*
University of Illinois at Urbana-Champaign.
E-mail: agehret2@illinois.edu.

H-fields are ordered differential fields which serve as an abstract generalization of both Hardy fields (ordered differential fields of germs of real-valued functions at $+\infty$) and transseries (ordered valued differential fields such as $\mathbb{T}$ and $\mathbb{T}_{\log}$). A *Liouville closure* of an H-field K is a minimal real-closed H-field extension of K that is closed under integration and exponential integration. In 2002, Lou van den Dries and Matthias Aschenbrenner proved that every H-field K has exactly one, or exactly two, Liouville closures, up to isomorphism over K. Recently (in arxiv.org/abs/1608.00997), I was able to determine the precise dividing line of this dichotomy. It involves a technical property of H-fields called λ-freeness. In this talk, I will review the 2002 result of van

den Dries and Aschenbrenner and discuss my recent contribution.

▸ DANUL GUNATILLEKA, *When atomic models are (sufficiently) universal.*
University of Maryland at College Park.
E-mail: danulg@math.umd.edu.

We will present an AE axiomatization for a class of stable generic graphs. We will use the axiomatization to show that for some particular stable graphs, every model of the theory of such a graph embeds isomorphically in to an atomic model.

▸ JESSE HAN, *Reconstruction problems for ω-categorical structures.*
McMaster University.
E-mail: jessemhan@gmail.com.

A theorem of Coquand, Ahlbrandt and Ziegler states that ω-categorical structures can be reconstructed up to bi-interpretability from their topological automorphism groups. More generally one can consider 2-functors from the 2-category of ω-categorical theories, interpretations, and homotopies into (topological) groups, (topological) monoids, or (ultraproduct-equipped) categories of models and ask for conditions under which these 2-functors preserve (weak) equivalences. I will discuss the extent to which these questions have been answered, and link the Coquand-Ahlbrand-Ziegler reconstruction result with Tannakian-type reconstruction results by applying Grothendieck's formalism of Galois categories to an ω-categorical structure.

▸ MENG-CHE HO, *On the Scott sentence of finitely generated structures.*
University of Wisconsin-Madison.
E-mail: turboho@gmail.com.

Scott showed that for every countable structure A, there is an $L_{\omega_1,\omega}$ sentence, called the Scott sentence, whose models are isomorphic copies of A. Thus, the quantifier complexity of a Scott sentence of a structure is one invariant that measures the complexity of the "description" of the structure. Knight et al. have studied the Scott sentences of many structures, in particular, Knight and Saraph showed that a finitely generated structure always have a Σ_3 Scott sentence.In this talk, we will discuss a joint work with Matthew Harrison-Trainor, and another independent work by Alvir, Knight, and McCoy, where we give characterizations of finitely generated structures where the Σ_3 Scott sentence is optimal. Using these results, we also give a construction of a finitely generated group where the Σ_3 Scott sentence is optimal.

▸ ELLIOT KAPLAN, *An introduction to HT-fields.*
University of Illinois at Urbana-Champaign.
E-mail: eakapla2@illinois.edu.

In this talk, I will introduce the class of HT-fields. Let T be an o-minimal theory extending RCF and let K be a model of T which is also equipped with a nontrivial derivation $x \mapsto x'$, making it an H-field (a particularly nice class of ordered differential fields). We require that this derivation interact nicely with the o-minimal structure on K. The class of H-fields has been thoroughly explored by Aschenbrenner, van den Dries, and van der Hoeven. I will establish some analogues of their results on H-fields for the class of HT-fields.

▸ CHANDRA KETHI-REDDY, *The contradiction conundrum.*
University of Central Florida.
E-mail: chan.dra@knights.ucf.edu.

We are far from settling the question of the role that contradictions play in mathematical logic. I demonstrate that one can use the law of non-contradiction in conjunction with material implication to generate an infinite number of true statements composed of nothing but syntactic contradictions. By the definition of material implication, if an implicatory sentence's antecedent is false, then the full implication is true. Given a proposition p, a contradiction C = p & p is assumed to be false by the law of non-contradiction. If C implies any formulable sentence, then it also implies the metacontradiction C & C. The sentence C ⇒ C & C is an example of an infinite number of true sentences composed of nothing but contradictions that can be propositionally generated from any proposition p. I call these sentences C-theorems. Indeed, using very simple infinitary arithmetic, it can be proven that there are as many vacuously true C-theorems as there are valuable theorems in any mathematical system hosting both the law of non-contradiction and material implication. This sinister paradox of material implication is called the contradiction conundrum, and I will argue that is an essential task of logicians to eliminate the logical clutter created by this error. Different syntactic and semantic ways are proposed to escape this paradox. After presenting the conundrum and some possible ways to avoid it, I introduce ω-metalogic, where ω is the smallest infinite surreal ordinal. ω-metalogic is the system of logic I developed in order to analyze these infinitely iterated stacks of metasentences. It is possible that the game-theoretic construction of surreal numbers will prove to be relevant in unveiling the structures that make possible the arithmetization of syntax. Mathematics must be able to account for its use and understanding of contradictions. It is not enough to simply reject the possibility of a relationship between contradiction and truth. This talk will make clear that taking an approach that looks at the contradictions themselves will prove to be useful in the development of foundational mathematics.

▶ VICTORIA LEWIS, *Realizability models and logical relations.*
Indiana University Bloomington.
E-mail: `vialewis@indiana.edu`.

"Realizability has many faces, each of them turned towards different areas of Logic, Mathematics and Computer Science [...] Like a venomous carcinoma, Realizability stretches out its tentacles to ever more remote fields: Linear Logic, Complexity Theory and Rewrite Theory have already been infected. [...] Proof Theory is suffering. Intuitionism is dead." -Jaap Van Oosten, Realizability: a Historical Essay. While dramatic, Van Oosten hints at a real problem in Realizability. The subject has taken so many forms for each new application's own specific purpose, with little attention given to connecting these notions to one another. For example, it's not immediately obvious how the programming languages approach of logical relations relates at all to topos theory, or what the effective topos has to do with Kleene's original Realizability paper. There is a clear need to formally link these ideas into one cohesive theory. In this talk we present one such link– a simplified approach to realizability that aims to connect logical relations and realizability categories through the use of internal logics.

▶ ETHAN MCCARTHY, *Cototal enumeration degrees and the Turing degree spectra of minimal subshifts.*
University of Wisconsin-Madison.
E-mail: `mccarthy@math.wisc.edu`.

A set $A \subseteq \omega$ is *cototal* under enumeration reducibility if $A \leq_e \overline{A}$, in which case we also call the enumeration degree of A cototal. We will look at several natural classes of mathematical objects whose enumeration degrees are characterized by cototality, and use these characterizations to identify corresponding Turing degree spectra.

▸ TRAVIS NELL, *Distal expansions.*
University of Illinois at Urbana-Champaign.
E-mail: tnell2@illinois.edu.

I will consider certain non-distal expansions of $\mathbb{R}$. Distality is not preserved under reducts, so one may ask whether a distal expansion exists. Even moreso, one may attempt to classify the non-distality in terms of behavior of types in M^{eq}, which then also informs the distal expansion. Note that by results of Chernikov and Starchenko, certain combinatorial regularity holds in every distal structure. This good behavior is preserved under reducts.

▸ VICTORIA NOQUEZ, *Uncountable categoricity in continuous logic.*
University of Illinois at Chicago.
E-mail: vnoque2@uic.edu.

We will discuss results motivated by questions about uncountable categoricity in the continuous setting. We give a continuous analogue of Vaught's Two Cardinal theorem, and use this to show the forward direction of the Baldwin-Lachlan characterization of uncountable categoricity: if a theory is uncountably categorical, then it is ω-stable and has no Vaughtian pairs. We use this result to show that uncountable categoricity is not preserved by Kiesler randomizations.

▸ JAMES ROONEY, *Exploring the metaquestion in constraint satisfaction problems.*
McMaster University.
E-mail: rooneyjp@mcmaster.ca.

▸ IVAN ONGAY VALVERDE, *The Cichon's diagram and its relation to other cardinal invariants.*
University of Wisconsin-Madison.
E-mail: ongay@math.wisc.edu.

This will be an introductory talk to understand how the cardinal invariants of evasion, prediction and rearrangement relate to the Cichon's Diagram. This cardinal characteristics, even if less widely known, have interesting techniques to work with and led to nice computability theory analogs. This talk is a prelude to results obtained on the computability theory analogs (which will be presented by Paul Tveite).

▸ NIGEL PYNN-COATES, *Differential-henselian extensions of valued differential fields.*
University of Illinois at Urbana-Champaign.
E-mail: pynncoa2@illinois.edu.

The general motivating question is: What aspects of valuation theory can be adapted to the setting of valued differential fields? In valuation theory, henselian fields play an important role. I will concentrate on differential-henselian fields, introduced by Scanlon and developed in a more general setting by Aschenbrenner, van den Dries, and van der Hoeven. What do we know about uniqueness of differential-henselian extensions? Do differential-henselizations exist? After introducing the subject, I will discuss my ongoing work towards answering these questions.

▸ MINH TRAN, *Tame structures via multiplicative character sums on varieties over finite fields.*
University of Illinois at Urbana-Champaign.
E-mail: mctran2@illinois.edu.

We study the model theory of the structure $(\mathbb{F}; <)$ where $\mathbb{F}$ is the algebraic closure of the field of p elements and $<$ is an ordering on $\mathbb{F}^\times$ induced by an injective group homomorphism $\chi : \mathbb{F}^\times \to \mathbb{C}^\times$. Various notions of model theoretic tameness of the

structure turn out to be consequences of number theoretic behaviors of the character map χ. The results obtained are attempts to bring number theoretic phenomena of this type into model theory, following a suggestion by van den Dries, Hrushovski and Kowalski.

▸ PAUL TVEITE, *Computable analogs of lesser-known cardinal characteristics.*
University of Wisconsin-Madison.
E-mail: tveite@math.wisc.edu.

There has recently been work by multiple groups in extracting the properties associated with small cardinal characteristics and translating these properties into similar analogous combinatorial properties of computational oracles. Each property yields a highness notion in the Turing degrees. We will study the highness notions that result from translation of the evasion number and its dual, the prediction number, as well as two versions of the rearrangement number. When translated appropriately, these yield four new highness notions. We will define these new notions, show some of their basic properties and place them in the computability-theoretic version of the Cichoń diagram.

▸ DOUGLAS ULRICH, *Keisler's order need not be linear.*
University of Maryland at College Park.
E-mail: ds_ulrich@hotmail.com.

I discuss various new results on Keisler's order, namely: if there is a supercompact cardinal, then Keisler's order is not linear; low is a dividing line in Keisler's order; and there is a minimal nonlow theory. These are all obtained using machinery developed by Malliaris and Shelah.

▸ ERIK WALSBERG, *Questions.*
University of Illinois at Urbana-Champaign.
E-mail: erikw@illinois.edu .

I will discuss a number of questions that I have accumulated over the years. Most of them are model-theoretic, some come from other areas of Logic.

▸ BIN WU, *Decision structure of risky choice.*
Institute of Psychology of the Chinese Academy of Sciences.
E-mail: wub@psych.ac.cn.

As we know, there is a controversy about the decision making under risk between economists and psychologists. We discuss to build a unified theory of risky choice, which would explain both of compensatory and non-compensatory theories. Obviously, decision strategy is not stuck in a rut, but based on the things, in the real life, and experiment materials, in the laboratory. We believe that human has a decision structure, which has constant and variable, interval, concepts of probability and value. Namely, according to cognition ability, we argue that people could not build a continuous and accurate subjective probability world, but several intervals of probability perception. More precisely, decision making is an order reduction process, which is simplifying the decision structure. However, we are not really sure which reduction path will occur during decision making process. It is why preference reversal always happens when making decisions. The most efficient way to reduce the order of decision structure is mathematical expectation. We also argue that the deliberation time at least has four parts, which are consist of substitution time, $\tau''(G)d\tau$ time, $\tau'(G)d\tau$ time and calculation time. Decision structure can simply explain the phenomenon of paradoxes and anomalies.