Mathematical Logic in Canada

(Org: **Ross Willard** and/et **Andy Zucker** (University of Waterloo))

JANANAN ARULSEELAN, McMaster University

Computability in Continuous Logic with Applications to Operator Algebras

We study the use of computability theoretic ideas in the framework of continuous logic. To demonstrate the utility of such a study, we explain a few applications to operator algebras. We survey some recent work and new directions in the subject. This is joint work with Isaac Goldbring, Bradd Hart and Thomas Sinclair.

BARBARA CSIMA, University of Waterloo

Measurements of complexity of mathematical notions

As mathematicians, we often strive to quantify and compare different objects. As logicians, we have the tools to quantify and compare various mathematical objects. From Turing degrees to Scott Sentences, and Reverse Mathematics to Algorithmic Randomness, the choices abound. In this talk, we discuss these various tools and their relationships to one another.

CHRISTOPHER EAGLE, University of Victoria

Cohomology of co-existentially closed continua

Although traditional model theory is not well-suited for handling topological structures, for a compact Hausdorff space X, Gelfand duality provides a way of studying X by instead studying the C*-algebra $C(X)$ of continuous complex-valued functions on X. Real-valued logic for metric structures then provides a suitable setting for the model-theoretic treatment of these C*-algebras. In this talk I will present some recent results in the model theory of compact connected Hausdorff spaces that have been obtained in this way; in particular, I will describe joint work with J. Lau concerning cohomological properties of X when $C(X)$ is an existentially closed model of the theory of continua.

NICOLAS CHAVARRIA GOMEZ, University of Waterloo

Abelian structures in continuous logic

In classical logic, the 1-based groups are, in some sense, exactly the abelian structures, i.e. abelian groups with distinguished subgroups of its powers. Thanks to B.H. Neumann's lemma, an abelian structure (in fact, the base group need not be abelian) admits elimination of quantifiers down to so-called positive primitive formulas. From this it can be seen that its definable sets are Boolean combinations of cosets of definable subgroups, from which 1-basedness follows. We advance the study of the corresponding notions in continuous first-order model theory. This is joint work with Anand Pillay.

ELLIOT KAPLAN, McMaster University

Constant power maps on Hardy fields and Transseries

We study H-fields (certain ordered differential fields generalizing Hardy fields and Transseries) equipped with "constant power maps". We show that this class has a model companion, the models of which include the field of LE-transseries and any maximal Hardy field. We study the induced structure on the constant field, prove a relative decidability result, and give some applications to certain systems of differential equations.

RAHIM MOOSA, Waterloo

Permutation groups in differentially closed fields

Within the community of people studying finite Morley rank groups (to which I do not belong), the study of definable permutation groups has become central. They have posed questions and formulated conjectures that are of general interest to model theorists. This talk is about the specialisation of some of these questions (and their answers) to one particular theory: the theory of differentially closed fields. This is joint work with Jim Freitag and Leo Jimenez.

BO PENG, McGill University
The complexity of pointed minimal and transitive systems in different spaces

We will talk about several results regarding classification problems for pointed minimal and transitive systems in symbolic, Hilbert cube and Cantor spaces. Those equivalent relations are intensively connected with "topological type" of sequences. As consequences, we are able to show that conjugacy relation of minimal systems is not classifiable by countable structures, conjugacy relation of transitive symbolic Subshift is not amenable, etc. This is joint work with Konrad Deka, Ruiwen Li and Marcin Sabok.

ASSAF SHANI, Concordia University
Generic dichotomies for Borel homomorphisms for the finite Friedman-Stanley jumps

Abstract: The talk will begin by discussing the basic definitions and general goals behind the theory of Borel equivalence relations. We focus on the Friedman-Stanley jumps $=^{+n}$, for $n = 1, 2, ...$ and $n = \omega$. These Borel equivalence relations represent the notions of being classifiable using invariants which are countable sets of reals, countable sets of countable sets of reals, and so on.

We consider the problem of constructing a Borel reduction from $=^{+n}$ to some other equivalence relation. For $n = 1$ the situation is well understood and there are many such results. We present a new technique for finding such a reduction, when $n > 1$, based on Baire-category methods.

IIAN SMYTHE, University of Winnipeg
A descriptive approach to manifold classification

We propose a unified descriptive set-theoretic framework for studying the complexity of classification problems arising in geometric topology. We establish several precise complexity results, such as for the classification of surfaces up to homeomorphism, and for classes of hyperbolic manifolds up to isometry. The latter is intimately connected with the conjugation actions of certain Lie groups on their spaces of discrete subgroups. This work is joint with Jeffrey Bergfalk.

ROSS WILLARD, University of Waterloo
Residually finite equational theories

An equational theory T is said to be *residually finite* if every model of T can be embedded in a product of finite models of T. Equivalently, T is residually finite if and only if its irreducible models (those that cannot be embedded in products of "simpler" models) are all finite. If one looks "in nature" for equational theories which are residually finite AND have a finite signature, one invariably finds that, except in "extreme" cases, the theory has a stronger property: there is a finite upper bound to the sizes of its irreducible members. In this lecture I will describe some conjectures about this phenomenon and some recent progress on one of them. This is joint work with Keith Kearnes and Agnes Szendrei.

ANDY ZUCKER, University of Waterloo
Recurrent big Ramsey structures

This talk primarily serves as an introduction to the concept of a big Ramsey structure, an expansion of a given infinite structure which correctly encodes the big Ramsey degrees of every finite substructure. While a priori there is no reason to expect that finite big Ramsey degrees implies the existence of a big Ramsey structure, this happens in every known example. Not only that, but for almost all known examples, one can build big Ramsey structures with further desirable properties, such as recurrence. In recent joint work with Jan Hubicka, we shed some light on why this is, proving a result of the form that any proof of finite big Ramsey degrees using the "standard" methods is guaranteed to imply the existence of a recurrent big Ramsey structure.