Set theory and its applications
Théorie des ensembles et ses applications
(Org: **Spencer Unger** (University of Toronto) and/et **Andy Zucker** (University of Waterloo))

JASHAN BAL, University of Waterloo
Projectivity in topological dynamics

Motivated by Gleason's result on projective compact spaces we study projectivity in the category of G-flows and affine G-flows for Polish groups G. We present a characterization of extreme amenability and amenability for closed subgroups $H \leq G$ in terms of the Samuel compactification of G/H being projective. Then we introduce a new notion of extensions between affine G-flows, called proximally irreducible, and use it to prove an analogues result characterizing strong amenability of subgroups. This answers an open question of Zucker and provides a structure theorem for when the universal minimal proximal flow is metrizable or contains a comeager orbit.

JORGE CRUZ CHAPITAL, University of Toronto

RONNIE CHEN, University of Florida
Structurable equivalence relations, Borel combinatorics, and countable model theory

The theory of countable Borel equivalence relations (CBERs) provides a global framework for discussing and comparing all locally countable Borel combinatorics problems (graph colorings, group actions, etc.) at once. We present a result showing that in a precise sense, all such combinatorial problems on CBERs can be reduced to syntactic definability problems in the infinitary logic $\mathcal{L}_{\omega_1\omega}$ on countable structures. This provides a rigorous explanation of a well-known heuristic in Borel combinatorics, that many arguments amount to "doing countable combinatorics in a uniformly Borel way", while also allowing finer distinctions to be made between different classically equivalent combinatorial problems. This talk is based on joint works with Alexander Kechris and Rishi Banerjee.

ISABELLA NEGRINI, University of Toronto
An Erdős–Rado theorem for perfect trees

The Erdős–Rado theorem states that any equivalence relation on $[\omega]^k$ can be reduced to a *canonical* equivalence relation on $[M]^k$ for some infinite M. In this joint work in progress with Unger, we establish an analogous result for equivalence relations on certain finite trees inside perfect trees.

BO PENG, McGill University
Anti-classification results in dynamical systems

Classification theory plays an important role in dynamical systems. In recent years, the focus has shifted towards so-called anti-classification results. By applying techniques from descriptive set theory, we can prove that specific types of classifications are impossible. In this talk, I will discuss some recent anti-classification results regarding classifying topological and smooth dynamical systems by topological conjugacy and classifying measure-preserving transformation by measure isomorphism.

JULIAN CAMILO CANO RAMOS, Universidad de Los Andes
Combinatorics of Ramsey ideals

In this talk, we primarily study several combinatorial properties of Ramsey–type ideals on countably infinite sets. Specifically, we show new combinatorial characterizations of Ramsey ideals through various partition and convergence properties. Furthermore, we analyze ideal versions of some relevant high–dimensional Ramsey–type theorems, in order to research ideals related to finite colorings of fronts on the natural numbers as well as ideals associated with finite partitions of any family of finite subsets of the natural numbers. In particular, Galvin ideals are introduced as an intermediate combinatorial concept between Ramsey ideals and semiselective ideals. Finally, we also prove that under CH and $\neg SH$ there is a semiselective coideal that does not contain any selective ultrafilter, although it is also consistent that every semiselective coideal contains a selective ultrafilter.

NARMADA VARADARAJAN, University of Toronto

Circle-squaring with low Borel complexity

Laczkovich famously showed in 1990—answering a long-standing question of Tarski—that a circle and a square of the same area are equidecomposable using only translations. This has been steadily improved upon over the past decade by a series of results showing that the pieces, originally chosen in a non-constructive way, can have stronger regularity properties. The first completely constructive equidecomposition is due to Marks and Unger, who proved that the pieces can be Borel; Máthé, Noel, and Pikhurko later improved this to pieces with low Borel complexity (Δ^0_3). In this talk, I will sketch an argument that, in fact, the pieces can be as low complexity as Δ^0_2. The main new idea in our proof comes from a recent paper of Gao, Jackson, Krohne, and Seward. We generalize their definition of a weakly orthogonal decomposition to construct a low complexity (Δ^0_2) "toast", and then use network flows and graph theory (as in previous works) to achieve a low complexity equidecomposition.

This talk is based on joint work with Spencer Unger and Felix Weilacher.