Abstracts

6th European Set Theory Conference

July 3–7, 2017

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Monday

Plenary talks, Monday 9.00-12.10

	Main Lecture Hall
9.00-9.50	Justin T Moore: *Non σ-scattered linear orders*
10.20-11.10	Omer Ben Neria: *The failure of Diamond at a large cardinal*
11.20-12.10	Vera Fischer: *Definable maximal cofinitary groups*

Plenary talks, Monday 14.00-17.10

	Main Lecture Hall
14.00-14.50	Toshimichi Usuba: *Set theoretic geologies*
15.00-15.50	Slawomir Solecki: *Projective Fraisse Limits and topology*
16.20-17.10	Michal Doucha: *On some recent constructions in the metric Fraisse theory*

Contributed talks, Monday 17.20-19.00

	Main Lecture Hall	Seminar Room
17.20	Dominik T Adolf: *Derived models of mice below the least fix point of the Solovay Sequence.*	Grzegorz Plebanek: *Twisted sums of c_0 under MA*
17.40	Joan Bagaria: *Large cardinals beyond Choice*	Sandra Uhlenbrock: *Combinatorial variants of the Lebesgue density theorem*
18.00	Asaf Karagila: *Successors of measurable cardinals*	Timothy Trujillo: *A nonstandard proof of the Nash-Williams' theorem*
18.20	David Schrittesser: *Forcing, projective determinacy, and mad families*	Milette Riis: *The Generalised Shift Graph*
18.40	Sean D Cox: *Semiproperness of nonreasonable posets*	Paul McKenney: *Rigidity of corona algebras*

Program change:
18:40 Main Lecture Hall
Sean D Cox: *Semiproperness of nonreasonable posets* instead of
Monroe Eskew: *A New Interleaving*

Tuesday

Plenary talks, Tuesday 9.00-12.10

	Main Lecture Hall
9.00-9.50	Assaf Rinot: *Strong colorings and their applications*, Tutorial 1
10.20-11.10	Hausdorff Medal lecture
11.20-12.10	Maryanthe Malliaris: *Model theory and set theory via Keisler's order*

Plenary talks, Tuesday 14.00-17.10

	Main Lecture Hall
14.00-14.50	Benjamin D Miller: *Lacunary sets and actions of cli groups*
15.00-15.50	Spencer Unger: *Borel circle squaring*
16.20-17.10	Yair Hayut: *The tree property at a segment of successor of singular cardinals*

Contributed talks, Tuesday 17.20-19.00

	Main Lecture Hall	Seminar Room
17.20	Jeffrey Bergfalk: *Higher Rho Functions*	Dorottya Sziráki: *Open colorings on generalized Baire spaces*
17.40	Ari Brodsky: *Distributive Aronszajn trees*	Miguel Moreno: *Reflection principles and the generalized Baire spaces*
18.00	Chris Lambie-Hanson: *Super-Souslin trees from square and diamond*	Carlos A Martinez-Ranero: *Hereditary Interval Algebras and Cardinal Invariants*
18.20	Thilo V Weinert: *Cardinal Characteristics and Partition Relations*	Kaethe Minden: *The (Subcomplete) Maximality Principle and Resurrection Axiom*
18.40	Monroe Eskew: *A New Interleaving*	Ana S Meroño: *News about the Samuel realcompactification*

Program change:
18:40 Main Lecture Hall
Monroe Eskew: *A New Interleaving* instead of
Sean D Cox: *Semiproperness of nonreasonable posets*

Wednesday

Plenary talks, Wednesday 9.00-11.10

	Main Lecture Hall
9.00-9.50	Assaf Rinot: *Strong colorings and their applications*, Tutorial 2
10.20-11.10	Philipp M Lücke: *Partition properties for simply definable colourings*

Contributed talks, Wednesday 11.20-12.00

	Main Lecture Hall	Seminar Room
11.20	Natasha Dobrinen: *Applications of forcing to Ramsey theory on trees*	Michael J Lieberman: *Bootstrapping structural properties, via accessible images*
11.40	Jindrich Zapletal: *The coloring number of analytic graphs*	Miha Habic: *Restricting forcing axioms to ground models*

Excursion: 14.00-19.00

Thursday

Hajnal Memorial Session, Thursday 9.00-12.10

	Main Lecture Hall
9.00-9.50	Assaf Rinot: *Strong colorings and their applications*, Tutorial 3
10.20-11.10	Péter Komjáth: *Some problems of Erdős and Hajnal*
11.20-12.10	Daniel T Soukup: *How to make infinite combinatorics simple?*

Plenary talks, Thursday 14.00-15.50

	Main Lecture Hall
14.00-14.50	Alan S Dow: *Some new ultrafilters on the integers*
15.00-15.50	Michael Hrušak: *Filters and Ideals*

Contributed talks, Thursday 16.20-17.40

	Main Lecture Hall	Seminar Room
16.20	David Chodounsky: *There are no P-points in Silver extensions*	Rupert McCallum: *Which reflection principles are intrinsically justified?*
16.40	Borisa Kuzeljevic: *A long chain of P-points*	Artur K Giżycki: *Soft king spaces and tournaments.*
17.00	Peter Nyikos: *Special ultrafilters and cofinal subsets of* ω^ω	Jarosław J Swaczyna: *Haar-like smallness*
17.20	Wolfgang Wohofsky: *Any Laver forcing at uncountable kappa adds a kappa-Cohen real*	Philipp Schlicht: *A hierarchy of Ramsey-like cardinals*

Conference dinner: 19.00-22.00

Friday

Plenary talks, Friday 9.00-12.10

	Main Lecture Hall
9.00-9.50	Maciej M Malicki: *Generic representations in Polish groups*
10.20-11.10	Diego A Mejía-Guzmán: *Multiple dimensional finite support iterations*
11.20-12.10	Dilip Raghavan: *Boolean ultrapowers and iterated forcing*

Plenary talks, Friday 14.00-17.10

	Main Lecture Hall
14.00-14.50	Miloš Kurilić: *Relational structures: forcing by copies of reducts of definitional expansions*
15.00-15.50	Mohammad Golshani: *Equivalence of forcing notions: on a question of Williams*
16.20-17.10	Itay Neeman: *Between proper and strongly proper*

Tutorial

Strong colorings and their applications

Tu,We,Th
9.00–9.50

Assaf Rinot
Bar-Ilan University

Consider the following questions.

- Is the product of two κ-cc partial orders again κ-cc?
- Does there exist a regular hereditary separable topological space which is non-Lindelöf?
- Given an $\aleph_1$-sized Abelian group $(G,+)$, must there exist a unary function $f : G \to G$ such that any proper substructure of $(G,+,f)$ be countable?

It turns out that all of the above questions can be decided (in one way), provided that there exists a certain "strong coloring" (or "wild partition") of a corresponding uncountable graph. In this tutorial, we shall present some of the techniques involved in constructing such strong colorings, and demonstrate how partial orders/topological spaces/algebraic structures may be derived from these colorings.

Plenary Talks

The failure of Diamond at a large cardinal

Mo 10.20–11.10

Omer Ben Neria
UCLA

In pursuit of an understanding of the relations between compactness and approximation principles, we address the following question: To what extent do compactness principles assert the existence of a diamond sequence? It is well known that a cardinal κ which satisfies a sufficiently strong compactness assumption must also carry a diamond sequence. However, other results have shown that certain weak large cardinal assumptions are consistent with the failure of the full diamond principle. We will discuss this gap and describe some known and recent results.

On some recent constructions in the metric Fraisse theory

Mo 16.20–17.10

Michal Doucha
Institute of Mathematics, Czech Academy of Sciences

In this talk, we will review recent progress in the Fraisse theory for metric structures. Although one of the first Fraisse-like objects, the Urysohn universal space, is in the metric category, not many examples of metric Fraisse-theoretic constructions have been known till recently. We will present several examples that we obtained in the last three years. Namely, we will present several metrically universal Polish groups and then focus on the recent result of constructing a universal action of the Hall's universal locally finite group on the Urysohn space by isometries, and a universal representation of the universal torsion abelian group in the Gurarii space. Finally, we will discuss which of these universal objects are generic in the Baire category sense. It turns out that some of them are generic and some of them are not.

Some new ultrafilters on the integers

Th 14.00–14.50

Alan S Dow
UNC Charlotte

We introduce a notion called an almost clopen subset of N* and discuss some properties

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Mo 11.20–12.10

Definable maximal cofinitary groups

Vera Fischer

Kurt Gödel Research Center, University of Vienna

Recently, it was proven by Horowitz and Shelah, that there is always a Borel maximal cofinitary group, which is necessarily of size $\mathfrak{c}$. Jointly, with Schrittesse and Törnquist, we obtained the existence of a Cohen indestructible co-analytic, maximal cofinitary group and so a model of large continuum in which there is a co-analytic maximal cofinitary group of size $\aleph_1$. In this talk, I will discuss the construction of a model in which the minimal size of a maximal cofinitary group is $\aleph_m$ witnessed by a Π^1_2 definable max. cof. group, while the size of the continuum is $\aleph_n$, where $m < n < \omega$. In addition, we will look at some further, closely related results.

Fr 15.00–15.50

Equivalence of forcing notions: on a question of Williams

Mohammad Golshani

Postdoctoral research fellow, IPM

It is well-known that if CH holds, then any countably closed forcing notion of size continuum is forcing isomorphic to Cohen forcing for adding a new Cohen subset of ω_1. Williams asked if the converse is true? We give a negative answer to his question. As an application of our method, we extend a consequence of PFA to higher cardinals. This is joint work with Saharon Shelah.

Tu 16.20–17.10

The tree property at a segment of successor of singular cardinals

Yair Hayut

The Hebrew University of Jerusalem

I will show that it is consistent (relative to large cardinals) that GCH holds and the every successor of singular cardinal in a countable initial segment of the cardinals has the tree property. This is a joint work with Mohammad Golshani.

Th 15.00–15.50

Filters and Ideals

Michael Hrušak

Centro de Ciencias Matemáticas, UNAM

We shall review recent results and open problems concerning filters and ideals on countable sets.

Some problems of Erdős and Hajnal

Th 10.20–11.10

Péter Komjáth

Eötvös University, Budapest

We survey some questions raised by Erdős and Hajnal.

Relational structures: forcing by copies of reducts of definitional expansions

Fr 14.00–14.50

Miloš Kurilić

Department of Mathematics, Faculty of Science, University of Novi Sad

If $\mathbb{P}(\mathbb{X}) = \langle \{f[X] : f \in \mathrm{Emb}(\mathbb{X})\}, \subset \rangle$ is the poset of copies of a relational structure $\mathbb{X}$ and $\mathbb{B}_{\mathbb{X}} = \mathrm{ro\ sq}\ \mathbb{P}(\mathbb{X})$ its Boolean completion, then the condition $\mathbb{B}_{\mathbb{X}} \cong \mathbb{B}_{\mathbb{Y}}$ is equivalent to the forcing equivalence of the posets $\mathbb{P}(\mathbb{X})$ and $\mathbb{P}(\mathbb{Y})$ and defines a coarse classification of structures. We will present some results concerning the role of definability and interpretability in this context, the difference between countable and uncountable structures and discuss several extreme situations.

Partition properties for simply definable colourings

We 10.20–11.10

Philipp M Lücke

University of Bonn

We say that an uncountable regular cardinal κ is Σ_n-*weakly compact* if every colouring $c : [\kappa]^2 \longrightarrow 2$ that is definable by a Σ_n-formula with parameters in $\mathrm{H}(\kappa) \cup \{\kappa\}$ has a homogeneous set of cardinality κ. We will discuss results that show that many canonical extensions of ZFC, like large cardinal axioms or forcing axioms, imply that ω_1 is Σ_1-weakly compact. In contrast, the Σ_1-weak compactness of ω_2 is not decided by large cardinal axioms and forcing axioms imply that ω_2 is not Σ_1-weakly compact. We will also discuss inaccessible Σ_1-weakly compact cardinals, their position in the large cardinal hierarchy and some interesting non-weakly compact examples of such cardinals, e.g. regular limits of measurable cardinals.

Fr 9.00–9.50

Generic representations in Polish groups

Maciej M Malicki

Warsaw School of Economics

A Polish group has ample generics if for every natural number $n > 0$ the action of G on G^n by diagonal conjugation has a comeager orbit. This property has very strong consequences, e.g. it implies that G has the automatic continuity property, and that there exists a unique Polish group topology on G. We will present various results related to this notion; in particular, we will consider situations when G does not have ample generics but it behaves as if it had this property. On the other hand, we will discuss some tools useful in disproving the existence of ample generics such as the notion of topological similarity classes. As a matter of fact, the notion of ample generics can be expressed in terms of representations of countable, discrete groups in Polish groups: G has ample generics if, for every $n > 0$, there exists a generic representation in the Polish space $Rep(F_n, G)$ of all representations of F_n in G, where F_n is the free group on n generators. We will discuss some results concerning the existence of generic representations of groups other than F_n, e.g. in the case G is the unitary group or the Urysohn space.

Tu 11.20–12.10

Model theory and set theory via Keisler's order

Maryanthe Malliaris

University of Chicago

Keisler's order connects the set-theoretic study of regular ultrafilters to the model-theoretic study of first-order theories, allowing each to illuminate the structure of the other. Over the last few years, joint work of the speaker and S. Shelah has led to surprising theorems in both directions, involving e.g. cardinal invariants of the continuum, using large cardinals to build regular ultrafilters, Ehrenfeucht-Mostowski models, and new divisions of simple elementary classes. The talk will discuss a range of these results, emphasizing common themes, open problems, and current work.

Multiple dimensional finite support iterations

Fr 10.20–11.10

Diego A Mejía-Guzmán
Shizuoka University

In 1984, A. Blass and S. Shelah constructed the first example of a FS (finite support) iteration built through a two dimensional array of ccc posets to prove the consistency, with ZFC, of the existence of an ultrafilter base of size less than the dominating number but larger than $\aleph_1$. Since then, the so called *matrix iterations* turned out to be useful to construct models with large continuum. Quite recently the speaker, in a joint work with V. Fischer, S. Friedman and D. Montoya, constructed the first example of a FS iteration built through a three dimensional array of ccc posets to prove consistency results related to Cichoń's diagram.

In this talk, these forcing techniques are reviewed and it is shown how to build such two and three dimensional arrays so that restrictions to arbitrary sub-rectangles are allowed. It could be said that, in essence, these constructions yield infinite dimensional arrays of posets. Applications to the combinatorics of the real line are presented. For instance, it can be forced that many cardinal characteristics of the continuum are pairwise different while some of them are singular.

Lacunary sets and actions of cli groups

Tu 14.00–14.50

Benjamin D Miller
Kurt Gödel Research Center for Mathematical Logic, University of Vienna

We will discuss a common generalization of (1) Kechris's theorem that orbit equivalence relations induced by Borel actions of locally compact Polish groups have lacunary complete Borel sets, and (2) Hjorth-Kechris's theorem characterizing the essential countability of Borel orbit equivalence relations induced by Borel actions of non-archimedian tsi Polish groups.

Non σ-scattered linear orders

Mo 9.00–9.50

Justin T Moore
Cornell University

We show that it is consistent, relative to a supercompact cardinal, that there are no minimal non σ-scattered linear orders. In particular, Laver's result that the σ-scattered linear orders are WQO is sharp. We also show that PFA^+ implies that every non σ-scattered linear order contains either a real type, a Countryman type, a Baumgartner type, or its reverse. Here a Baumgartner type is a ladder system indexed by a stationary subset of ω_1, equipped with the lexicographic order. This is joint work with Hossein Lamei Ramandi.

Fr 16.20–17.10

Between proper and strongly proper

Itay Neeman
UCLA

We present some of the methods that go into the proof of the consistency of Baumgartner's isomorphism principle at $\aleph_2$. We concentrate on the countably closed part of the construction. The posets used there are proper for structures of size $\aleph_1$, in a specific way that comes close to being strongly proper with a countably closed quotient. We describe how this is used in iterating them and in maintaining a combinatorial principle that secures their properness.

Fr 11.20–12.10

Boolean ultrapowers and iterated forcing

Dilip Raghavan
National University of Singapore

We report on a new method for proving consistency results involving cardinal invariants, both at ω and at uncountable regular cardinals. Our method is based on the technique of Boolean ultrapowers from model theory, and involves forcing with the Boolean ultrapower of an iteration by a carefully constructed ultrafilter which ensures that the ultrapower is suitably saturated. All of our results require the consistency of a supercompact cardinal. This is joint work with Saharon Shelah.

Mo 15.00–15.50

Projective Fraisse Limits and topology

Slawomir Solecki
Cornell University

Fraisse limits is a methods of producing structures coming from Mathematical Logic. Irwin and myself dualized the method, to projective Fraisse limits, and used it to construct compact topological spaces as canonical quotients of projective Fraisse limits. Since then the method has been generalized and found a number of applications. I will describe recent results, due to several people, on connections between projective Fraisse limits and the structure of some canonical compact spaces and their homeomorphism groups (pseudoarc, Menger curve, Lelek fan, simplexes with the goal of developing a projective Fraisse homology theory).

How to make infinite combinatorics simple?

Th 11.20–12.10

Daniel T Soukup
Kurt Gödel Research Center for Mathematical Logic, University of Vienna

Solutions to combinatorial problems often follow the same head-on approach: enumerate certain objectives and then inductively meet these goals.

The methods to meet the goals are naturally problem specific, however the techniques for finding the right enumeration of infinitely or uncountably many objectives frequently involve the same idea: the use of elementary submodels. The goal of this talk is to explore a general technique due to R. O. Davies, based on trees of elementary submodels. While countable elementary submodels have been employed in such settings, we develop the corresponding structures based on countably closed models of size continuum as well. Our main purpose is to demonstrate the ease and wide applicability of these methods in a generally accessible form. We present short, highly simplified but still detailed proofs to various (hopefully entertaining) theorems on paradoxical decompositions of the plane, results on graph chromatic number and constructions from point-set topology. The talk is based on joint work with L. Soukup.

Borel circle squaring

Tu 15.00–15.50

Spencer Unger
UCLA

We give a completely constructive solution to Tarski's circle squaring problem. More generally, we prove a Borel version of a general equidecomposition theorem due to Laczkovich. This answers a question of Wagon. Our proof uses ideas from the study of flows in networks, and a recent result of Gao, Jackson, Khrone, and Seward on special types of witnesses to the hyperfiniteness of free Borel actions of $\mathbb{Z}^d$. This is joint work with Andrew Marks.

Set theoretic geologies

Mo 14.00–14.50

Toshimichi Usuba
Waseda University

Fuchs, Hamkins, and Reitz studied the structure of the ground models of the universe, it is now called a set theoretic geology. They proved that the structure of the grounds can be manipulated by class forcing arguments, but some important problem, the downward directedness of the grounds, is still open. The downward directedness of grounds is useful since it clarify the structure of the grounds, and has many interesting applications to generic multiverse, model logic of forcing, etc. We show that the downward directedness of the grounds is a theorem of ZFC. Moreover, we show that, if there is some very large cardinal, then the intersection of the grounds must be a ground of the universe. We also discuss some variants of set

theoretic geology. One is a set theoretic geology without the Axiom of Choice. It is unknown that grounds can be defined without the Axiom of Choice, but we prove that if there are many large cardinals, then all grounds of the universe are uniformly defined without the Axiom of Choice. Another one is a set theoretic geology of pseudo-grounds. We argue some connections between a geology of pseudo-grounds and Woodin's HOD-conjecture.

Contributed Talks

Derived models of mice below the least fix point of the Solovay Sequence.

Mo 17.20–17.40
Main Hall

Dominik T Adolf
WWU Muenster

Modern methods of inner model theory, notably Woodin's Core Model Induction (see [1]), produce models of determinacy. A possible measure for the strength of a given determinacy is the length β of its Solovay Sequence $(\theta_\alpha : \alpha \leq \beta)$. The immediate question is: how do determinacy theories relate to ZFC theories, specifically theories that belong to the large cardinal hierarchy? In this talk we will discuss a method of how to, under the right circumstances, canonically relate a mouse to a model of determinacy using Woodin's Derived Model Theorem ([2],[3]). We will then represent a mouse whose associated model's Solovay sequence has length at least ω_2 ([4]). We believe that this mouse is the least such. If time permits (it won't!), we will show how to generalize the above methods to possibly generate models of many theories below the least model whose Solovay Sequence contains a fixed point. This is joint work with Grigor Sargsyan.

[1] Ralph Schindler and John Steel: *The Core Model Induction*. Online at http://wwwmath.uni-muenster.de/u/rds/core_model_induction.pdf.

[2] John Steel: *The derived model theorem*. In "Logic Colloquium 2006", Cambridge University Press, 2009.

[3] John Steel: *Derived models associated to mice*. Online at https://math.berkeley.edu/∼steel/papers/sporejul07.pdf.

[4] Dominik Adolf and Grigor Sargsyan: *Derived models of mice below the least fix point of the Solovay Sequence*. submitted, online at http://math.rutgers.edu/∼gs481/LosThetas.pdf.

Mo 17.40–18.00
Main Hall

Large cardinals beyond Choice

Joan Bagaria
ICREA and UB

I will present some results about large cardinals whose existence contradicts the Axiom of Choice but are not known to be inconsistent with ZF. In particular, I will consider two kinds of such cardinals, namely those in the Reinhardt and the Berkeley hierarchies, and I will show what is known about their relative consistency strength. I will also explain, briefly, why the study of such cardinals is relevant to the foundations of set theory. This is a joint work with Peter Koellner and W. Hugh Woodin.

Tu 17.20–17.40
Main Hall

Higher Rho Functions

Jeffrey Bergfalk
Cornell University

Todorcevic's (2-argument) rho functions articulate much of the core combinatorics of ω_1. We describe some higher-dimensional analogues, and the ZFC structures they engender, in particular, on ω_2.

Tu 17.40–18.00
Main Hall

Distributive Aronszajn trees

Ari Brodsky
Bar-Ilan University

Ben-David and Shelah showed that for a singular cardinal λ, assuming GCH, the existence of a special λ^+-Aronszajn tree implies the existence of a normal, λ-distributive λ^+-Aronszajn tree. We address a conjecture saying that "special" may be removed from the hypothesis in the above statement. This is joint work with Assaf Rinot.

Th 16.20–16.40
Main Hall

There are no P-points in Silver extensions

David Chodounsky
Institute of Mathematics CAS

We prove that after adding a Silver real no ultrafilter from the ground model can be extended to a P-point, and this remains to be the case in any further extension which has the Sacks property. We conclude that there are no P-points in the Silver model. In particular, it is possible to construct a model without P-points by iterating Borel partial orders. We also show that the same argument can be used for the side-by-side product of Silver forcing. This provides a model without P-points with the continuum arbitrary large. Joint work with Osvaldo Guzmán.

Semiproperness of nonreasonable posets

Mo 18.40–19.00
Main Hall

Sean D Cox
Virginia Commonwealth University

Shelah proved that a certain form of Strong Chang's Conjecture is equivalent to semiproperness of Namba forcing. I will present some related results about semiproperness of so-called "nonreasonable" posets.

Applications of forcing to Ramsey theory on trees

We 11.20–11.40
Main Hall

Natasha Dobrinen
University of Denver

We will present an overview of some recent results using forcing to prove new Ramsey theorems in the style of Halpern-Lauchli. This includes work of Dobrinen and Hathaway obtaining from a $\kappa + d$ strong cardinal, a model in which the Halpern-Lauchli theorem holds for d many strong κ-trees. In a different vein, we present work of Dobrinen building new Ramsey theory on trees coding the universal triangle-free graph to solve a problem regarding the big Ramsey degrees of the universal triangle-free graph.

A New Interleaving

Tu 18.40–19.00
Main Hall

Monroe Eskew
Virginia Commonwealth University

We describe a technique involved in getting a model where the nonstationary ideal is locally saturated at every regular cardinal. A typical way to force things around $\aleph_\omega$ that have large cardinal strength is to use Prikry forcing that interleaves collapses between the points. Typically, if α_n is a Prikry point, then for some finite m, the n^{th} interleaved poset will be α_n^{+m}-closed and have its conditions living in $V_{\alpha_{n+1}}$. We present a way of interleaving posets between points of a (supercompact) Prikry sequence, where the n^{th} poset can be larger than α_{n+1}.

Soft king spaces and tournaments.

Th 16.40–17.00
Seminar Room

Artur K Giżycki
Faculty of Mathematics and Information Science, Warsaw University of Technology

The article "On the existence of kings in continuous tournaments" of Nagao and Shakhmatov, shows various theorems about king spaces. We are going to show similar theorems but in the context of soft sets. To do this we want to use the topological theorems about soft sets from the articles of Won Keun Min.

We 11.40–12.00
Seminar Room

Restricting forcing axioms to ground models

Miha Habic
The Graduate Center, CUNY

We investigate restrictions of forcing axioms to ground models of the universe of the appropriate kind (e.g. a version of Martin's axiom for posets from a ccc ground model). These principles still retain some of the combinatorial consequences of the full forcing axiom, but also tend to be more robust under mild forcing; for example, the restriction of Martin's axiom interacts well with adding a Cohen or a random real.

Mo 18.00–18.20
Main Hall

Successors of measurable cardinals

Asaf Karagila
The Hebrew University of Jerusalem

We will discuss some historical problems about successors of measurable cardinals, and recent results in a joint work with Yair Hayut.

Th 16.40–17.00
Main Hall

A long chain of P-points

Borisa Kuzeljevic
Mathematical Institute SANU

We will construct, using CH, a chain of P-points whose order type is the second uncountable cardinal (under both Rudin-Keisler and Tukey ordering of ultrafilters). This is joint work with Dilip Raghavan.

Tu 18.00–18.20
Main Hall

Super-Souslin trees from square and diamond

Chris Lambie-Hanson
Bar-Ilan University

In 1982, Shelah and Stanley introduced the notion of a κ^{++}-super-Souslin tree, where κ is an infinite cardinal. Super-Souslin trees are characterized by a highly absolute property and necessarily contain Souslin subtrees. Shelah and Stanley proved that, if $2^\kappa = \kappa^+$ and there is a $(\kappa^+, 1)$-morass, then there is a κ^{++}-super-Souslin tree, indicating that the consistency strength of $2^\kappa = \kappa^+$ together with Souslin's Hypothesis at κ^{++} is at least an inaccessible cardinal. We show that the existence of a κ^{++}-super-Souslin tree follows from the conjunction of $\square_{\kappa^+}$ and $\diamondsuit_{\kappa^+}$. For uncountable κ, this improves the lower bound for the consistency strength of $2^\kappa = \kappa^+$ and Souslin's Hypothesis at κ^{++} to a Mahlo cardinal.

This is joint work with Assaf Rinot.

Bootstrapping structural properties, via accessible images

We 11.20–11.40
Seminar Room

Michael J Lieberman
Department of Mathematics, Masaryk University

Joint work with Jiří Rosický and Sebastien Vasey.

We discuss recent joint work with J. Rosicky, [LR], involving new applications of an as-yet-underappreciated tool for the analysis of categories of structures arising in abstract model theory, namely that, under the assumption of sufficiently strongly compact cardinals, the (powerful) image of any accessible functor is accessible ([MP], refined in [BrR]). Although some of these applications are very technical (tameness of abstract elementary classes, i.e. AECs, in [LR16]; strong metric tameness of metric AECs in [LR17]), we focus on two very simple ones: the amalgamation and joint embedding properties. The basic insight is that each property amounts to a question of the following form: given a diagram of shape A in category of structures K, can it be completed to a diagram in K of shape A'?

We can then rephrase this problem in terms of the forgetful functor $U : K^{A'} \to K^{A}$, whose (powerful) image consists precisely of the completable diagrams. As U is accessible, the theorem of [BrR] implies that this image is κ-accessible for sufficiently strongly compact κ, from which it follows that completability of diagrams involving objects of size up to κ implies the completability of diagrams of objects of arbitrary size. That is, this is precisely what one needs to bound the Hanf numbers for amalgamation and joint embedding. This generalizes the results of [BaBo] from AECs to general accessible categories, thereby encompassing e.g. metric AECs, mu-AECs, and so on, with the added benefit of being almost purely visual, replacing delicate syntactic manipulations with simple questions about diagrams in well-behaved categories.

[BaBo] J. Baldwin and W. Boney, *Hanf numbers and presentation theorems in AECs*. To appear in ***Beyond First Order Model Theory***, CRC Press.

[BrR] A. Brooke-Taylor and J. Rosický, *Accessible images revisited*, ***Proc. Amer. Math. Soc.***, vol. 145 (2017), pp. 1317–1327 .

[LR] M. Lieberman and J. Rosický, *Hanf numbers via accessible images*. To appear in ***Log. Meth. in Comp. Sci.***. arXiv:1610.07816.

[LR16] M. Lieberman and J. Rosický, *Classification theory for accessible categories*, ***J. of Symb. Log.***, vol. 81 (2016), no. 1, pp. 151–165.

[LR17] M. Lieberman and J. Rosický, *Metric abstract elementary classes as accessible categories*, ***J. of Symb. Log.***, pp. 1-19, 2017. doi:10.1017/jsl.2016.39.

[MP] M. Makkai and R. Paré, *Accessible Categories: The Foundations of Categorical Model Theory*, ***AMS***, 1989.

Tu 18.00–18.20
Seminar Room

Hereditary Interval Algebras and Cardinal Invariants

Carlos A Martinez-Ranero
University of Concepcion

An *interval algebra* is a Boolean algebra which is generated by a linearly order set (relative to the Boolean order). This class is not closed under taking substructures. In fact, it was shown by Nikiel, Purisch and Treybig (and independently by Odintsov) that there is a σ-centered interval algebra of cardinality $\mathfrak{c}$ which is not hereditary. On the other hand, Bekkali and Todorcevic proved that σ-centered subalgebras of interval algebras of cardinality less than $\mathfrak{b}$ are interval themselves. We study the minimal cardinality of a σ-centered interval algebra which is not hereditary. We show that this cardinal invariant is less than $\mathfrak{d}$ and $non(\mathcal{M})$ and we also show that a combinatorial variation of this cardinal invariant is consistently bigger than $\mathfrak{b}$.

Th 16.20–16.40
Seminar Room

Which reflection principles are intrinsically justified?

Rupert McCallum
last position at University of Tübingen

Reflection principles involving formulas with second-order parameters lead to various types of indescribable cardinals, but it has long been known, and was first observed by Reinhardt, that reflection with third-order parameters leads to inconsistency. William Tait has done work investigating more limited forms of reflection with third-order parameters or higher, some of which are provably consistent relative to an ω-Erdős cardinal, seeking to motivate the view that these reflection principles are intrinsically justified (in the sense that they unfold what is already implicit in the iterative conception of set). Peter Koellner investigated further extensions of these forms of reflection and proved these stronger axioms also consistent relative to an ω-Erdős cardinal. We shall present some still stronger axioms that are provably consistent relative to an ω-Erdős cardinal and show that these imply all the reflection principles previously considered by Tait and Koellner, and also imply the large-cardinal property introduced by Ralf Schindler of being a remarkable cardinal. We shall try to motivate the view that they too should be seen as reflection principles, and as intrinsically justified. We shall also note that a slight modification to this type of reflection principle leads to an enormous jump in consistency strength, an observation that was first made by Victoria Marshall. We shall consider whether these much stronger reflection principles should also be seen as intrinsically justified and defend a sceptical stance about that. We hope that this work sheds further light on the question of what can be seen as a reflection principle and what are the strongest reflection principles that can be intrinsically justified.

Rigidity of corona algebras

Mo 18.40–19.00
Seminar Room

Paul McKenney
Miami University of Ohio

I will discuss recent progress in the rigidity of certain quotient C*-algebras in the presence of strong forcing axioms.

News about the Samuel realcompactification

Tu 18.40–19.00
Seminar Room

Ana S Meroño
Universidad Complutense de Madrid

The Samuel realcompactification of a uniform space is defined as the smallest realcompactfication, in the order of all the realcompactifications, such that every uniformly continuous real-valued function can be continuously extended to it. This realcompactification can be considered the most appropriate extension of the concept of Hewitt realcompactification υX to the frame of uniform spaces. It has being studied recently by the author in collaboration with Isabel Garrido.

In this talk we will relate our results to some old results of Rice and Reynolds, providing parallel constructions of this realcompactification. The main result about the Samuel realcompactification is a Katětov-Shirota type theorem that states that a uniform space is Samuel realcompact if and only if every uniformly discrete subspace has non-measurable cardinal and it is Bourbaki-complete. Recall that to be Bourbaki-complete is a completeness type property of uniform spaces that was also defined by the author and Garrido. We will see that this theorem implies that, in absence of measurable cardinals, the Hewitt realcompactification υX and the Samuel realcompactification of a uniform space are equivalent realcompactifications if and only if the space is Bourbaki-complete. We ask now if we can get rid of this condition of non-measurability, at least on the frame of metric spaces.

The (Subcomplete) Maximality Principle and Resurrection Axiom

Tu 18.20–18.40
Seminar Room

Kaethe Minden
The Graduate Center, CUNY

I compare the countably closed maximality principle to the subcomplete maximality principle. Since countably closed forcing is subcomplete, this is a natural comparison. Many of the results about the countably closed maximality principle also hold for the subcomplete one; for example, the boldface appropriate notion of subcomplete maximality is equiconsistent with a fully reflecting cardinal. However, it is not the case that the subcomplete and countably closed maximality principles directly imply one another.

I also discuss the resurrection axiom. I argue that the subcomplete resurrection axiom should naturally be considered relative to H_{ω_2}, indeed this makes the

subcomplete resurrection axiom is equiconsistent with the existence of an uplifting cardinal.

A question reasonable to ask about any class of forcings is whether or not the resurrection axiom and the maximality principle can consistently both hold for that class. I originally had this question about the full principles, not restricted to any class. I answer the question positively for subcomplete forcing using a strongly uplifting fully reflecting cardinal, which is a combination of the large cardinals needed to force the principles separately. Indeed the boldface versions of subcomplete maximality and resurrection is equiconsistent with the existence of a strongly uplifting fully reflecting cardinal.

Tu 17.40–18.00
Seminar Room

Reflection principles and the generalized Baire spaces

Miguel Moreno
University of Helsinki

One of the motivations to study Borel reducibility in the generalized Baire spaces is the connection with model theory. Precisely the connection between the Borel reducibility hierarchy and the classification of theories in Shelah's stability theory. The complexity of a theory is measured by determining the place of the isomorphism relation of models of size κ in the Borel-reducibility hierarchy.

The connection we study is related to Shelah's Main Gap Theorem; stability theory tells us that classifiable theories are less complex than non-classifiable theories and also that their complexity are far apart.

The equivalence relation modulo the non-stationary ideal associated with a stationary set is very useful when it comes to studying the complexity of the isomorphism relation of first order theories. These relations have been used to give a total or partial characterization in the Borel-reducibility hierarchy of the different kind of theories (classifiable, unstable, strictly stable, etc). Recently, it was used to show a Borel-reducibility counterpart of Shelah's main gap theorem: it is consistent that for every classifiable and every non-classifiable theory we can embed the partial order $(P(\kappa), \subset)$ to the Borel-reducibility partial order strictly between the isomorphism relations of these theories.

This shows us a connection between the equivalence relation modulo the non-stationary ideal and the classification of theories in Shelah's stability theory. This also motivates the study of the Borel-reducibility properties of the equivalence modulo the non-stationary ideal.

In this talk we will see results connecting large cardinals and the Borel-reducibility properties of the equivalence relation modulo the non-stationary ideal. One of those is: If κ is a Π^1_2-indescribable cardinal, then the equivalence relation modulo the non-stationary ideal is Σ^1_1-complete.

This is a joint work with D. Asperó, T, Hyttinen and V. Kulikov.

Special ultrafilters and cofinal subsets of ω^ω

Th 17.00–17.20
Main Hall

Peter Nyikos
University of South Carolina

These long-unpublished results have to do with ultrafilters with bases of cardinality $< \mathfrak{d}$ and $P_{\mathfrak{b}+}$ ultrafilters, and their contrasting interplay with unbounded and cofinal subsets of the family of sequences of natural numbers under the eventual domination order. In particular, if there exist simple P-points with bases of different cofinalities, one cofinality must be $\mathfrak{b}$ and the other must be $\mathfrak{d}$. The first paper announcing the existence of a model with such P-points had a hole, but that seems to have been fixed recently.

Twisted sums of c_0 under MA

Mo 17.20–17.40
Seminar Room

Grzegorz Plebanek
Mathematical Institute, University of Wroclaw

We investigate the following problem posed by Cabello Sanchez, Castillo, Kalton, and Yost:

Let K be a nonmetrizable compact space. Does there exist a nontrivial twisted sum of c_0 and $C(K)$, i.e., does there exist a Banach space X containing a non-complemented copy Z of c_0 such that the quotient space X/Z is isomorphic to $C(K)$?

We show that under $MA(\omega_1)$ the answer is 'no' for $K = 2^{\omega_1}$ and for K being the compact space constructed from an almost disjoint family of size ω_1. The proof is based on an auxiliary result on asymptotic properties of functions on Boolean algebras.

The Generalised Shift Graph

Mo 18.20–18.40
Seminar Room

Milette Riis
University of Leeds

In 1968, Erdös defined the Shift Graph as the graph whose vertices are the k-element subsets of $a_1 < b_1 = a_2 < b_2 = a_3 < \cdots < b_{n-1} = a_n < b_n$. In the paper "On the Generalised Shift Graph", Avart, Luczac and Rödl extend this definition to include all possible arrangements of the ai's and bi's, known as types. I will consider a selection of these types and study the corresponding graphs.

Th 17.20–17.40
Seminar Room

A hierarchy of Ramsey-like cardinals

Philipp Schlicht
Universität Bonn

We introduce a hierarchy of large cardinals between weakly compact and measurable cardinals, that is closely related to the Ramsey-like cardinals introduced by Victoria Gitman, and is based on certain infinite filter games, however also has a range of equivalent characterizations in terms of elementary embeddings. This is joint work with Peter Holy.

Th 17.00–17.20
Seminar Room

Haar-like smallness

Jarosław J Swaczyna
Institute of Mathematics, Łódź University of Technology

In locally compact Polish groups there is a very natural σ-ideal of null sets with respect to Haar-measure. In non locally compact groups there is no Haar measure, however Christensen introduced a notion of Haar-null sets which is an analogue of locally compact case. In 2013 Darji introduced a similar notion of Haar-meager sets. During my talk I will present some equivalent definition of Haar-null sets which leads us to joint generalization of those notions. This is joint work with T. Banakh, Sz. Głąb and E. Jabłońska.

Mo 18.20–18.40
Main Hall

Forcing, projective determinacy, and mad families

David Schrittesser
University of Copenhagen

In recent joint work with Asger Törnquist and Karen Bakke Haga, we develop new viewpoints on the existence mad families which are definable as projections of (possible large) trees, i.e., Suslin. We also strike a connection to forcing and forcing absoluteness. As an application we prove that there are no projective mad families under the Axiom of Projective Determinacy.

Open colorings on generalized Baire spaces

Tu 17.20–17.40
Seminar Room

Dorottya Sziráki
Alfréd Rényi Institute and Central European University

We study the uncountable version of a natural variant of the Open Coloring Axiom. More concretely, suppose that κ is an uncountable cardinal such that $\kappa^{<\kappa} = \kappa$ and X is a subset of the generalized Baire space κ^κ (the space of functions from κ to κ equipped with the bounded topology). Let OCA*(X) denote the following statement: for every partition of $[X]^2$ as the union of an open set R and a closed set S, either X is a union of κ many S-homogeneous sets, or there exists a κ-perfect R-homogeneous set. We show that after Lévy-collapsing an inaccessible $\lambda > \kappa$ to κ^+, OCA*(X) holds for all κ-analytic subsets X of κ^κ. Furthermore, the Silver dichotomy for $\Sigma^0_2(\kappa)$ equivalence relations on κ-analytic subsets also holds in this model. Thus, both of the above statements are equiconsistent with the existence of an inaccessible $\lambda > \kappa$. We also examine games related to the above partition properties.

A nonstandard proof of the Nash-Williams' theorem

Mo 18.00–18.20
Seminar Room

Timothy Trujillo
Sam Houston State University

The Nash-Williams' theorem extends Ramsey's theorem to fronts and barriers of infinite rank. We present a new proof of the Nash-Williams' theorem using the tools and methods of nonstandard analysis. We conclude with a discussion of some connections to topological Ramsey theory and local Ramsey theory.

Combinatorial variants of the Lebesgue density theorem

Mo 17.40–18.00
Seminar Room

Sandra Uhlenbrock
KGRC (University of Vienna)

Following a suggestion of Thilo Weinert we introduce alternative definitions of density points in Cantor space (or Baire space) which coincide with the usual definition of density points for the uniform measure on ${}^\omega 2$ up to a set of measure 0, and which depend only on the ideal of measure 0 sets but not on the measure itself. This allows us to define the density property for the ideals associated to tree forcings analogous to the Lebesgue density theorem for the uniform measure on ${}^\omega 2$. The main results show that among the ideals associated to well-known tree forcings, the density property holds for all such ccc forcings and fails for the remaining forcings. In fact we introduce the notion of being stem-linked and show that every stem-linked tree forcing has the density property.

This is joint work with Philipp Schlicht and David Schrittesser.

Tu 18.20–18.40
Main Hall

Cardinal Characteristics and Partition Relations

Thilo V Weinert
Ben-Gurion-University of the Negev

Let α, β, and γ be ordinals and let n be a natural number. Recall that $\alpha \longrightarrow (\beta, \gamma)^n$ asserts that for every hypergraph $E \subseteq [\alpha]^n$:

- There is a $B \in [\alpha]^\beta$(i.e. B is a subset of α of order-type β) such that $[B]^n \subseteq E$ or
- there is a $C \in [\alpha]^\gamma$ such that $[C]^n \subseteq [\alpha]^n \setminus E$.

If $\alpha \longrightarrow (\beta, \gamma)^n$ fails, this may be written as $\alpha \not\longrightarrow (\beta, \gamma)^n$ and is called a *negative partition relations* while $\alpha \longrightarrow (\beta, \gamma)^n$ may be called a *positive partition relation*.

In the past, many partition relations, mostly negative ones, were shown to follow from the generalised continuum hypothesis. Sometimes this hypothesis could be weakened. Recall that for a cardinal κ, the cardinal $\mathfrak{b}_\kappa$ denotes the least size of an unbounded family of functions in ${}^\kappa\kappa$, the cardinal $\mathfrak{d}_\kappa$ denotes the least size of a dominating family of functions in ${}^\kappa\kappa$ and $\mathfrak{r}(\kappa)$ denotes the least size of a subfamily of $[\kappa^+]^\kappa$ which is dense under the $\subset$-relation.

For example:

- In 1971, Erdős and Hajnal showed that for regular κ, $2^\kappa = \kappa^+$ implies $\kappa^+\kappa \not\longrightarrow (\kappa^+\kappa, 3)^2$. In 1987, Takahashi proved that $\mathfrak{d} = \aleph_1 = \mathfrak{r}$ implies $\omega_1\omega \not\longrightarrow (\omega_1\omega, 3)^2$ and in 1998 Jean Larson showed that for every regular κ the statement $\mathfrak{d}_\kappa = \kappa^+$ implies $\kappa^+\kappa \not\longrightarrow (\kappa^+\kappa, 3)^2$.
- In 1987, Baumgartner and Hajnal showed that for regular κ, $2^\kappa = \kappa^+$ implies $(\kappa^+)^2 \not\longrightarrow (\kappa^+\kappa, 4)^2$.

It turned out that for regular κ, both $\kappa^+\kappa \not\longrightarrow (\kappa^+\kappa, 3)^2$ and $(\kappa^+)^2 \not\longrightarrow (\kappa^+\kappa, 4)^2$ follow from both $\mathfrak{d}_\kappa = \kappa^+$ and $\mathfrak{b}_\kappa = \kappa^+ = \mathfrak{r}(\kappa)$.

This is joint work with William Chen

Th 17.20–17.40
Main Hall

Any Laver forcing at uncountable kappa adds a kappa-Cohen real

Wolfgang Wohofsky
Universität Hamburg

I will discuss the question under which circumstances forcings which add a kappa-dominating real (i.e., an element of the generalized Baire space κ^κ that is eventually above all ground model elements) also add a kappa-Cohen real. Using a game-theoretic idea of H. Woodin, we show that this is indeed the case for a large class of forcing notions, among them all Laver type forcings on $\kappa^{(<\kappa)}$. This is very different from the classical setting where it is easy to add (omega-)dominating reals without adding (omega-)Cohen reals, e.g., by ordinary Laver forcing. This is part of joint work with Yurii Khomskii, Marlene Koelbing, and Giorgio Laguzzi.

The coloring number of analytic graphs

We 11.40–12.00
Main Hall

Jindrich Zapletal
University of Florida

In a joint work with Francis Adams, we show that an analytic graph has countable coloring number just in case it does not contain a continuous injective image of a certain fixed graph. This means that countable coloring number is a coanalytic condition on an analytic graph and an analytic graph has countable coloring number if and only if it has countable list-chromatic number.

Posters

Open colorings in topological spaces

José Antonio Corona García
PCCM UNAM-UMSNH

Open colorings in topological spaces

Let X be a topological space. We say that $OCA(X)$ holds if and only if for every open partition $[X]^2 = K_0 \cup K_1$ either:

1. There exists an uncountable $H \subseteq X$ such that $[H]^2 \subseteq K_0$, or
2. There is a family $\langle H_n : n \in \omega \rangle$ such that $X = \bigcup_{n\in\omega} H_n$ and $[H_n]^2 \subseteq K_1$ for every $n \in \omega$.

This statement is due to Todorčević and holds for the real line. In 80's, Todorčević showed that it is relative consistent with ZFC that: $OCA(X)$ holds for every subspace X of the real line (OCA). In order to generalize this statement, Todorčević conjectured that the following is relative consistent with ZFC: If X is a regular space with no uncountable discrete subspace, then $OCA(X)$ holds.

The purpose of this poster is shows the situation of $OCA(X)$ for others topological spaces, *e.g.* subspaces of the Sorgenfrey line and subspaces of the Niemytzki plane among others.

Woodin for strong compactness cardinals

Stamatis Dimopoulos
University of Bristol

Generalization of θ-closure in ideal topological spaces

Aleksandar Pavlović

Faculty of Sciences, Department of Mathematics and Informatics, University of Novi Sad

Let $\langle X, \tau \rangle$ be a topological space and $\mathcal{I}$ an ideal on X. θ-closure of a set A (see (4)) is defined by $\mathrm{Cl}_\theta(A) = \{x \in X : \mathrm{Cl}(U) \cap A \neq \emptyset \text{ for each } U \in \tau(x)\}$, and its local function (see (2)) by $A^* = \{x \in X : A \cap U \notin \mathcal{I} \text{ for each } U \in \tau(x)\}$.

Generalizing the notions of θ-closure and the local function in an ideal topological space $\langle X, \tau, \mathcal{I} \rangle$, Al-Omari and Noiri (1) defined the **local closure function**

$$\Gamma_{(\tau,\mathcal{I})}(A) = \{x \in X : \mathrm{Cl}(U) \cap A \notin \mathcal{I} \text{ for each } U \in \tau(x)\}.$$

Differences and similarities between local function and local closure function are examined varying several common ideals on X, like ideal of countable sets, scattered sets, relatively compact sets, nowhere dense sets, meager sets and finite sets (3).

(1) A. Al-Omari, T. Noiri, Local closure functions in ideal topological spaces. Novi Sad J. Math. 43(2) (2013), 139-149.

(2) D. Janković, T.R. Hamlett, New topologies from old via ideals. Amer. Math. Monthly 97(4) (1990), 295-310.

(3) A. Pavlović, Local function versus local closure function in ideal topological spaces, Filomat 30(14) (2016), 3725-3731.

(4) N.V. Veličko, H-closed topological spaces. Mat. Sb. (N.S.) 70 (112) (1966), 98-112 (in Russian); in: American Mathematical Society Translations, vol. 78, American Mathematical Society, Providence, RI, 1969, 103-118.

Magic Sets

Salome Schumacher

ETH Zürich

Expansive dynamics in the sense of free ultrafilters

Samuel G. da Silva

Federal University of Bahia - Brazil (UFBA)

We introduce the notion of *freely expansive dynamics*. Given a compact metric space M and a homeomorphism $f : M \to M$, we say that the dynamics (M, f) is *freely expansive* if there is some $\alpha > 0$ such that for every distinct points $x, y \in M$ there is some free ultrafilter p over the set $\mathbb{N}$ of all natural numbers such that $d(f^p(x), f^p(y)) > \alpha$ or $d(f^{-p}(x), f^{-p}(y)) > \alpha$ (where, given a point $z \in M$, $f^p(z)$ denotes the p-limit of the iterates of z for the future, i.e. the p-limit of the sequence $\{f^n(z) : n \in \mathbb{N}\}$, and $f^{-p}(z)$ denotes the p-limit of the iterates of z for the past, i.e. the p-limit of the sequence $\{f^{-n}(z) : n \in \mathbb{N}\}$). We investigate several relationships between such notion and the (equi)continuity of the iterates f^p and f^{-p} (for p varying over the the family of all free ultrafilters). We also want to determine precisely which compact subsets of $\mathbb{R}$ may be the underlying set of some freely expansive dynamics. This is an ongoing work, joint with Jorge Groisman (UdelaR, Uruguay)

Divisibility of ultrafilters

Boris Šobot

Faculty of Sciences,University of Novi Sad, Serbia

A semigroup operation on a discrete space S can be extended to its Stone-Čech compactification βS so that a right-topological semigroup is obtained. Using the extension of the multiplication on the set N of natural numbers to βN we find several ways to extend the divisibility relation.

One of these relations turns out to have a number of properties resembling the properties of divisibility on N. For example, there are minimal elements (divisible only by 1 and themselves), which we call prime ultrafilters (more precisely, there are $2^{\mathfrak{c}}$ of them). There are prime ultrafilters below any other, and we can classify all ultrafilters according to the set of primes they are divisible by. In this way a hierarchy is defined. There are countably many levels of ultrafilters divisible by finitely many primes (and there is a subdivision of levels according to the prime factors), but there are also those divisible by infinitely many. There are even maximal ultrafilters, divisible by all others.

The product of ultrafilters works in accordance with this hierarchy: $p \cdot q$ is divisible exactly by those primes that p and q are divisible by. The most interesting problem seems to be determining the number of ultrafilters divisible by given primes. Being a Ramsey ultrafilter, a P-point etc. has a certain effect on this.

The RK-ordering of P-points

Jonathan Verner
Charles University

We show, assuming CH, that the RK-ordering of rapid P-points is upwards $\mathfrak{c}^+$-closed. We also investigate other properties of the RK- ordering. The results are joint work with D. Raghavan (and partially also with B. Kuzeljevic).

List of Participants

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Philipp Moritz Lücke, *University of Bonn*
Maciej Michal Malicki, *Warsaw School of Economics*
Maryanthe Malliaris, *University of Chicago*
Carlos Azarel Martinez-Ranero, *University of Concepcion*
Rupert McCallum, *University of Tübingen*
Paul McKenney, *Miami University of Ohio*
Diego A. Mejía, *Shizuoka University*
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Dilip Raghavan, *National University of Singapore*
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