

Fourth Young Set Theory Workshop 2011,
Königswinter

Scientific Report

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June 13, 2011

Summary

The Young Set Theory Workshop 2011 took place March 21 - March 25, 2011 in Königswinter near Bonn. This was the fourth such workshop after the series originated in Bonn in January 2008. Since then, the Young Set Theory Workshop has been established as an important annual event in set theory with many participants from Europe and overseas. At this year's workshop there were 75 participants.

The goal of this workshop was to bring together postgraduates and postdocs in set theory in order to learn from senior researchers in the field, hear about the latest research, and discuss research issues in small focused groups. This was achieved through the unique format of tutorials, postdoc talks, and discussion sessions. The participants had the opportunity to meet and exchange ideas with fellow set theorists in their area of research in a friendly cooperative environment.

Four senior set theorists each gave four hour tutorials on new results in different areas of set theory. The tutorials naturally fell into two groups, those in pure set theory and forcing, and those in applied set theory, specifically Borel equivalence relations and Polish group actions. Each tutorial began with an introduction to the topic and then moved quickly towards recent results.

Six outstanding postdocs presented recent research in several different areas of set theory ranging from descriptive set theory and forcing to combinatorics and inner model theory. In all these areas, there are interesting new developments and results which were presented in the talks.

The afternoons were devoted to discussion sessions which focused on a wide range of topics, many of them related to the talks. Participants asked senior researchers and other participants to discuss their recent research, discussed questions and open problems, and presented their own work in informal talks.

Description of the scientific content of and discussion at the event

The goal of this workshop was to bring together postgraduates and postdocs working in set theory in order to learn from senior researchers in the field, hear about the latest research, discuss research issues in small focused groups, and to give participants the opportunity to exchange ideas with fellow set theorists and talk about research problems in a friendly cooperative environment. Similar to the previous years, the format of the workshop consisted of tutorials in the morning and several parallel discussions in the afternoon, concluded by a talk.

Tutorials

- Professor Joel David Hamkins gave a lucid introduction to the method of Boolean ultrapowers of models of set theory and elaborated on the connections between Boolean valued forcing extensions and ultrapower constructions. The goal of his recent research is to characterize various large cardinal axioms by Boolean ultrapowers.
- Professor Slawomir Solecki gave an introduction to Borel equivalence relations and Polish groups which led to the solution of the abelian case of a deep conjecture concerning a dichotomy for Polish group actions.
- Professor Ali Enayat gave fascinating lectures on connections between the model theory of arithmetic and set theory, in particular nonstandard models of set theory and automorphisms of such models.
- Professor Juris Steprans taught a course on amenability of discrete group actions and presented results about discrete groups with unique amenable actions on the integers and their connection with cardinal invariants.

Postdoc Talks

- Katherine Thompson gave a talk on the existence of a finite basis for the uncountable linearly ordered topological spaces assuming the hypothesis of the Proper Forcing Axiom (joint work with Alexander Primavesi). This was inspired by Justin Moore's result stating that in the case of

the uncountable linear orders there is in fact such a basis under the aforementioned hypothesis.

- Assaf Rinot gave a talk about various guessing principles similar to Jensen's square principle.
- Samuel Coskey gave a talk about Borel equivalence relations and the conjugacy problem and presented his analysis of the conjugacy problem for some of the most famous groups in logic such as the automorphism group of the rationals and the random graph.
- Dilip Raghavan presented his proof, inspired by a similar result for the square principle by Todorcevic, that the P-ideal-dichotomy precludes a weak square principle above ω_1 .
- David Schritterser presented a forcing construction to obtain a model in which all projective sets are Lebesgue measurable, but not all have the property of Baire.
- Grigor Sargsyan gave a talk on the recent development, goals and future prospects of the theory of inner models. His talk inspired more questions than the average talk, thus witnessing the fact that, even after several days of intense discussions, people were still very curious.

Description of discussions

- Monday
 - Beside his activity as a tutorial speaker, Professor Joel David Hamkins led a discussion session on set-theoretic geology and the modal logic of forcing, two aspects of research inspired by the set-theoretic multiverse perspective and covering meta-aspects of the forcing method which became interesting after it proved to be a flexible and widely applicable method.
 - Vincenzo Dimonte led a discussion session on the topic of very large cardinal axioms. Vincenzo gave an introduction to the strongest known large cardinal axioms and this led to a discussion of work of Hugh Woodin on this topic.

- Hiroaki Minami led a discussion session about topics related to his recent work on F_σ -ideals and maximally almost disjoint families of sets of natural numbers.
- Tuesday
 - Sean Cox, Matteo Viale and Christoph Weiss led a discussion session centered around the Proper Forcing Axiom with a focus on questions about its consistency strength. Recent results by Matteo Viale about Laver functions for \aleph_2 had incited some interest in this topic.
 - Norman Perlmutter led a discussion session on elementary embeddings and HOD.
 - Luz Maria Garcia Avila led a discussion session on proofs of theorems in Ramsey theory employing the language of forcing, illustrated by a proof of Ramsey’s theorem using Mathias forcing.
- Wednesday
 - Jonathan Verner and Thilo Weinert discussed Ramsey properties of ultrafilters on ω and their relation to other properties of ultrafilters, most particular being a P-point. This was inspired by an old letter of Fred Galvin and organized on short notice.
 - Peter Krautzberger led a discussion session concerned with algebraic questions about the Stone-Cech-compactification of the set of integers.
 - Dilip Raghavan led a discussion session on the P -ideal dichotomy, weak squares and related topics, thus continuing lines of thought of his talk before lunch.
- Thursday
 - Dilip Raghavan led a discussion sessions on ultrafilters on ω .
 - Peter Krautzberger led a discussion session dealing with online research collaboration tools and platforms for research. Following this discussion, Samuel Coskey and Peter Krautzberger have now set up a website (<http://settheorytalks.wordpress.com>) collecting information about upcoming talks in set theory in several set theory and logic seminars around the world.

- Marek Wyszowski discussed combinatorial difficulties in iterated forcing construction, most particular in the case of splitting tree forcing.
 - Professor Ali Enayat led a discussion session on Willard van Orman Quine’s axiomatic theory NF (New Foundations). Other than Zermelo-Fraenkel set theory, NF avoids Russell’s paradox in a syntactic way. The immense progress of the last decades in the area of semantic methods of relative consistency proofs still left the search of relative consistency results between ZF and NF unsuccessful. The tutorial yielded an overview on what is known today and the most important open questions.
- Friday
 - Grigor Sargsyan led a question and answer session about inner model theory.
 - Andrew Brooke-Taylor led a discussion session about proper class forcing.
 - Dilip Raghavan, together with interested colleagues, continued to discuss issues about ultrafilters on ω .

Assessment of results and impact of the event on the future direction of the field

The workshop was clearly a success. Most obviously, this is shown by the fact that the number of participants has increased in comparison with the previous workshops, which took place in Bonn in January 2008, in Bellaterra near Barcelona in April 2009, and in Raach near Vienna in February 2010. After 41 participants in Bonn, 63 in Bellaterra and 70 in Raach now in total 76 people came to Königswinter.

The participants came from all over the world. We had people attending from Austria, Brazil, Canada, Colombia, the Czech Republic, Finland, France, Germany, Hungary, Iran, Italy, Israel, Japan, Poland, Portugal, Spain, Switzerland, the United Kingdom, and the United States.

We received a variety of positive feedback. Participants frequently mentioned that they appreciated the various opportunities to talk to fellow participants about research questions. Senior set theorists complimented on the presence of a large number of young researchers, thus confirming the appropriateness of both aim and title of this still young but already very successful series of conferences.

What seemed to work particularly well is the conference structure which featured the following.

- Tutorials giving a general overview on and a quick introduction into certain subfields of contemporary set theory, providing a strong motivation to study the topics and emphasizing open questions in the area.
- Talks by outstanding postdocs highlighting some interesting recent developments in a more focused way.
- Discussion sessions which allowed students and researchers to interact in a not too formal way and to engage in discussions both related and unrelated to the topics of the tutorials and postdoc talks.

The workshop has a beneficial impact on the set theory community as a forum for current research in set theory especially geared towards young researchers. Undoubtedly, the workshop will lead to more collaborations between participants from research groups in different countries.

Final programme of the meeting

The detailed programme is available at the *Download the booklet* link on the workshop website <http://www.math.uni-bonn.de/people/logic/events/young-set-theory-2011>.

MONDAY, MARCH 21

- 8:40-10:30 Joel David Hamkins
“An introduction to Boolean ultrapowers”, part 1
- 10:30-10:50 *Coffee break*
- 10:50-12:40 Slawomir Solecki
“Borel equivalence relations and Polish groups”, part 1
- 12:40-13:40 *Lunch*
- 14:10-17:10 Discussion session with coffee at 16:00
- 17:10-18:00 Katie Thompson
“LOTS (of) embeddability results”
- 18:30-19:30 *Dinner*

TUESDAY, MARCH 22

- 8:40-10:30 Joel David Hamkins
“An introduction to Boolean ultrapowers”, part 2
- 10:30-10:50 *Coffee break*
- 10:50-12:40 Slawomir Solecki
“Borel equivalence relations and Polish groups”, part 2
- 12:40-13:40 *Lunch*
- 14:10-17:10 Discussion session with coffee at 16:00
- 17:10-18:00 Assaf Rinot
“Around Jensen’s square principle”
- 18:30-19:30 *Dinner*

WEDNESDAY, MARCH 23

- 8:40-10:30 Ali Enayat
“Arithmetic, Set Theory, and their models”, part 1
- 10:30-10:50 *Coffee break*
- 10:50-11:40 Samuel Coskey
“Borel equivalence relations and the conjugacy problem”
- 11:50-12:40 Dilip Raghavan
“ P -ideal dichotomy and weak squares”
- 12:40-13:40 *Lunch*
- 14:10-15:30 Discussion session
- 15:30-18:30 *Excursion*
- 18:30-19:30 *Dinner*

THURSDAY, MARCH 24

- 8:40-10:30 Ali Enayat
“Arithmetic, Set Theory, and their models”, part 2
- 10:30-10:50 *Coffee break*
- 10:50-12:40 Juris Steprans
“Unique amenability of subgroups of the symmetric group
acting on the integers”, part 1
- 12:40-13:40 *Lunch*
- 14:10-17:10 Discussion session with coffee at 16:00
- 17:10-18:00 David Schrittesser
“Projective measure without projective Baire”
- 19:30 *Conference Dinner in Bonn*

FRIDAY, MARCH 25

- 8:40-10:30 Juris Steprans
“Unique amenability of subgroups of the symmetric group
acting on the integers”, part 2
- 10:30-10:50 *Coffee break*
- 10:50-11:40 Grigor Sargsyan
“An invitation to inner model theory”
- 11:50-12:40 Discussion session
- 12:40-13:40 *Lunch*
- 14:00 *Departure*