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Newsletter of IMPAN

OPUS GRANTS

PH.D. THESES

CONFERENCES/ EVENTS

Polish Research Grants: OPUS

IMPAN's mathematicians have had numerous Polish individual and small team grants from the National Science Center (NCN), an agency of the Polish Ministry of Science and Higher Education, and from the Foundation for Polish Science (FNP).

The most prestigious competition of NCN is MAESTRO. There are 3 such programs at IMPAN and they were described in Newsletter of IMPAN number 4. In the current and upcoming issues, we will present the research topics of other selected grants. OPUS is an important competition of NCN for the funding of research projects. Currently 9 of this type of grants are implemented at IMPAN:

OPUS 5:

- prof. Jan Janas, *Spectral analysis and asymptotic methods for scalar and matrix difference operators*,
- prof. Zbigniew Jelonek, *Affine real and complex geometry*,
- prof. Adam Nowak, *Orthogonal expansions in harmonic analysis*,
- prof. Szymon Peszat, *Stochastic analysis and evolution equations*.

EARLIER EDITIONS OF OPUS:

- prof. Piotr M. Hajac, *Coefficients of cyclic homology and noncommutative geometry of C*-algebras and Dirac operators*,
- prof. Piotr Koszmider, *Applications of infinitary combinatorics and analytic topology in Banach spaces and related structures*
- prof. Krzysztof Bogdan, *Applications of stochastic analysis*,
- prof. Tomasz Andrzej Komorowski, *Long time, large scale properties of some transport phenomena*,
- prof. Łukasz Stettner, *Stochastic control problems with applications to mathematics of finance*.

Four of them are presented below.

Coefficients of cyclic homology and noncommutative geometry of C-algebras and Dirac operators*

Coordinator: Piotr M. Hajac, Principal co-investigators: Paul F. Baum and Andrzej Sitarz. (12.2011–12.2014)

One of the deepest principles in mathematics, going back to Descartes' La Geometrie in 1637, is the equivalence between geometry and algebra. Geometric objects can be studied by algebraic tools, and algebra can be studied by thinking about it geometrically. Noncommutative geometry is the study of geometry when the associated algebra is noncommutative. Far from being just a generalization of conventional geometry for its own sake, noncommutative geometry is in fact forced on us by the basic principles of quantum mechanics, which require physically observable quantities to correspond to noncommuting operators on a Hilbert space.

This project is focused on noncommutative differential and metric geometry (in the sense of Connes) and

on noncommutative algebraic topology and topological quantum groups, with particular attention to the sorts of noncommutative spaces needed for mathematical physics and with naturally occuring Hopf-algebraic symmetries. Since the algebras of continuous functions (vanishing at infinity) on locally compact spaces are exactly the same thing as commutative C*-algebras, the noncommutative spaces to be considered will generally be dual to C*-algebras or to dense subalgebras thereof (playing the role of smooth functions on a manifold). The main research goal of this project is to develop and apply new methods of noncommutative geometry to resolve fundamental issues prompted by concrete problems and being beyond the reach of the current paradigm, e.g., K-theory invariants beyond the index pairing (noncommutative vector bundles over quantum real projective spaces), cyclic cohomology with coefficients more general than stable anti-Yetter-Drinfeld modules (cup product constructions), and spectral triples beyond flat and equivariant geometries (new Dirac operators representing the same K-homology class as the previously constructed ones).

All the proposed tasks, are intimately related with each other. K-theory of C*-algebras provides important topological invariants of algebras (or spaces) and relates to cyclic homology via the Chern-Connes character. The dual theory, K-homology, has a natural geometrical presentation in terms of unbounded Fredholm modules (spectral triples and Dirac operators). The local index theorem of Connes and Moscovici is then a key tool allowing an effective computation of cyclic cocycles through analytic (and manageable) formulas. The generalization of symmetries given by Hopf algebras plays a significant role in the project, in particular for cyclic homology with coefficients.

Long time, large scale properties of some transport phenomena
Tomasz Komorowski (07.2013–07.2016)

This grant focuses on mathematical aspects of large scale transport phenomena. The typical examples are: transport of particles and waves in a turbulent flow of fluid, heat conduction in crystals and homogenization in complex media. Usually, the relevant models employ some tools from theory of stochastic processes, or random fields. For example, dealing with a very complicated medium, e.g. a turbulent flow, a homogeneous random vector field can be used to model the Eulerian velocity of the fluid. In general, the dynamics of transport, superimposed on a given environment, is described by a system of differential equations e.g. it could be the Navier-Stokes system in the case of a turbulent diffusion. The fundamental problem is to derive a macroscopic description of the process involved from its microscopic dynamics.

The project concentrates on three types of problems. (1) First deals with the topic of transport of heat and waves in complex (typically random) environments. We investigate the problem of heat conduction in crystals in the presence of thermostats and the long time, large space-momentum scale limit of energy density for the Schrödinger equation with a random potential. In particular, our interest lies in the mesoscopic and macroscopic limits for the energy transfer. The main tool used is the notion of a *compensated wave function*, recently introduced by T. Komorowski, in collaboration with G. Bal (Columbia Univ.), S. Olla (CEREMADE, Paris) and L. Ryzhik (Stanford Univ.). (2) Next, we propose a new type of a problem in homogenization theory: the homogenization of cellular flows driven by fractional Brownian motions. We make a prediction of a surprising effect of such a stochastic perturbation. Namely, the net motion of a tracer is diffusive, even in the case of a subdiffusive fractional Brownian motion perturbation. Finally, we employ a new approach to the problem of proving the Einstein relation between the mobility and diffusivity tensors for particle transported in a gas being in the equilibrium state. The proof of the relation can be reduced to an estimate of the L2 norm of the invariant density, corresponding to a Frobenius-Perron operator. It is our hope that this approach yields a breakthrough in this difficult problem of the classical statistical mechanics.

Applications of infinitary combinatorics and analytic topology in Banach spaces and related structures
Piotr Koszmider (12.2011 – 12.2014)

The goal of the project is to contribute in several directions to the understanding of Banach spaces and related structures like algebras of operators on Banach spaces or associated compact spaces. The main methods we proposed are sensitive to logic, combinatorial in their nature, but reach the level of a Banach space, quite often, through a qualitative topological analysis. The interplay of the Banach space structure with the weak topology in the Banach space or with the weak* and weak topologies in the dual space provide a fertile environment for analytic topological arguments.

When working in this field one encounters quite striking situations when long-standing open problems are being solved applying extra set-theoretic assumptions which cannot be proved on the basis of the usual axiomatization of mathematics (ZFC). Moreover, the assumption of another extra set-theoretic principle may solve the problem in the opposite direction, establishing it as undecidable on the basis of ZFC. From an applied (in topology or Banach space theory) point of view, the extra set-theoretic principles may introduce pathological counterexamples making it difficult to obtain an elegant structural theory. Another class of axioms often implies the nonexistence of such examples and a nice structural theory characterized by the existence of canonical examples, decompositions of complex objects, extraction principles, dichotomies, etc.

The project has produced 11 papers including among them: with Antonio Avilés from Universidad de Murcia; A Banach space in which every injective operator is surjective; Bull. London Math. Soc.; with Antonio Avilés; A continuous image of a Radon-Nikodym compact space which is not Radon-Nikodym; Duke Math. J., where we answered in the negative a long standing question of Namioka if continuous images of Radon-Nikodym compacta (subspaces of dual balls of Asplund spaces with the weak* topology) must be Radon Nikodym; with Christina Brech from Universidade de Sao Paulo, l_∞-sums and the Banach space l_∞/c_0; Fund. Math., where we proved that it is consistent that l_∞/c_0 is not an l_∞-sum of any Banach space X which limits the use of the Pełczyński decomposition method in context of l_∞/c_0 (it is also consistent that l_∞/c_0 is the l_∞-sum is the of itself); with T. Kania, N. J. Laustsen from Lancater University, A weak*-topological dichotomy with applications in operator theory; Trans. London Math. Soc. ; with Cristobal Rodriguez-Porras from Universite Paris 7, On linear operators acting on the Banach space l_∞/c_0 where we investigated the question of lifting of automorphisms of l_∞/c_0 to l_∞; with Leandro Candido from Universidade de Sao Paulo, concerning projections in injective tensor products of Banach spaces.

Stochastic control problems with applications to mathematics of finance
Coordinator: Łukasz Stettner, Pricipal investigator: Jan Palczewski (University of Leeds). 07.2013 – 07.2016

The purpose of the project is to study a variety of stochastic control problems with potential applications to mathematics of finance and insurance. The research project objectives are properties of optimal controls and value functions for various control problems. The aspect of feasibility and applicability is an important part of the project.

The following problems are supposed to be studied:

- *Stochastic control and analysis of stochastic differential equations with fractional Brownian motion.* We would like to know whether an optimal control is of Markov form. This in particular in the case, when the controlled proces is a solution to stochastic differential equation with Brownian or more general

Levy noise. The situation is very different when we model the state evolution using stochastic differential equations with fractional Brownian motion – such process is no longer Markov (when Hurst parameter differs from 0.5). Another important aspect is regularity of the value function. Continuous time controls are rather hard to implement in practice (besides of technical problems with the solutions to state dynamics equations, when we use optimal control, which is only Borel measurable), therefore quite natural to approximate control problem using feasible control in the form of impulses.

- *Analysis of ergodic stochastic control problems.* While control theory over finite horizon or with discounted cost is well developed the problems over long run horizon (average cost per unit time problems or long run risk sensitive) remain in general still open. The study of such problems requires an analysis of ergodic properties of controlled Markov processes.
- *Risk modelling and application of stochastic control to problems of mathematics of finance and insurance.* Risk modelling is a one of fundamental problems of finance and insurance. We would like to choose optimal investment strategies taking into account possible risk. In particular we are interested to study markets with friction (illiquidity or transaction costs), and problems of optimal dividend payments from insurance company surplus.

Selected Ph.D. theses

Generating of o-minimal structures

Zofia Ambroży, thesis advisor: prof. dr hab. Wiesław Pawłucki

http://www.impan.pl/~zambrozy/nauka.html

O-minimal structures are families Sn of Rn, for n>0, such that they are closed under taking boolean operations, cartesian products, projections. Moreover, all sets of S1 are finite sums of points and intervals. Sets from such structures are "tame" from topological point of view, i.e. they have finite number of connected components, admit cell decompositions. The best known examples of o-minimal structures are semialgebraic and subanalytic structures, expansions of real field generated by certain Denjoy-Carleman classes and Pfaffian closures of any o-minimal structure.

Studying of o-minimal structures can be divided in two main branches. The first is developing a geometry of o-minimal structures from axioms. The second one concentrates on discovering new such structures. In our work we focus on this second activity. It is well known that o-minimal structures can be generated by zero sets of certain algebras of functions and definable functions of one variable create a Hardy field (closed under differentation). Therefore in our research we try to answer the following questions:

let S be an o-minimal structure and *f* a function of one variable; does there exists an o-minimal structure S' containing S and a graph of *f*?

let H be a Hardy field; does it lie in any o-minimal structure S?

all known so far o-minimal structures are exponentially bounded; does there exist an o-minimal structure S which is transexponential,. i. e. with a definable function of one variable, whose growth is bigger than any finite composition of exp?

Z. Ambroży

Application of variational methods and fixed point theorems in researching Dirichlet Boundary Value Problems

Piotr Kowalski
thesis advisor: Marek Galewski

http://stud.ics.p.lodz.pl/~dyschem/

The research concerns application of variational methods and critical point theory to solvability of boundary value problems. Thus we have to find a functional corresponding to an equation under consideration in the sense that equating the Fréchet derivative to zero provides solutions to this equation. Given the functional, one uses some abstract tools in order to find its critical points. Next, one examines properties of a solution once it is obtained as a critical point, namely: uniqueness, dependence on parameters, multiplicity, regularity. Critical point theorems are combined with some fixed point approach in our research. Namely, we use variational methods to define an operator of solution to an auxiliary problem, and apply a chosen fixed point theorem afterwards. The methods allow proving the existence of a solution to very nonlinear problems.

P. Kowalski

Combinatorial and descriptive properties of ideals on countable sets

Adam Kwela
thesis advisor: Prof. Piotr Zakrzewski
and Dr. Marcin Sabok

http://www.impan.pl/~kwela/

An ideal on a countable set D is a collection of its subsets closed under taking subsets and finite unions. By identifying subsets of D with their characteristic functions we also treat the power set P(D) as the space 2D. Therefore we can talk about descriptive complexity of ideals.

We investigate relations between various combinatorial properties of ideals and the influence of such properties on the descriptive complexity. In particular we examine ideals represented by s-ideals (for instance the ideal null consists of all subsets of rationals whose closure is of Lebesgue measure zero). We give a combinatorial characterization of such ideals and show that they are Fsd-complete.

We study ideal convergence of sequences of functions. A sequence (xn)n of reals is I-convergent to x if for every e>0 the set {n: |xn-x|>e} is in the ideal I (if I consists of all finite subsets of integers we obtain the usual convergence). Similarly, a function f is an I-pointwise limit of a sequence of functions (fn)n if (fn(x))n is I-convergent do f(x) for each x. Given an ideal I we investigate the class of functions which can be represented as I-pointwise limits of sequences of continuous fuctions.

Moreover, we find critical ideals for some combinatorial properties and characterize those properties in terms of preorderings on the set of ideals. We apply those results to obtain a characterization of I-pointwise limits of sequences of quasi-continuous fuctions.

A. Kwela (Ph.D.)

Construction of shadow price for the market w proportional transaction costs

Tomasz Rogala
thesis advisor: prof. Łukasz Stettner

Assume an investor who is allowed to keep his wealth in safe bank account and in risky stock account is facing transaction costs. More precisely, at each time moment he can trade stocks but he has the ask price higher than the bid price. At each time moment the investor takes some money from the bank account for consumption.

The problems of maximization of the expected utility from consumption is one of the most important in the mathematics of finance. Such problems can be solved by the method of backward induction and Bellman equations.

In recent papers it has been found that in some situations there exists a market without transaction costs with price process, so called shadow price, lying into the bid and ask spread such that the optimal value of expected utility and optimal strategy for this market are the same as in the market with transaction costs. This means that in these cases markets with transaction costs can be studied by the tools we use to deal with markets without transaction costs.

In my Ph.D. thesis I proved the existence of shadow price in discrete time for a very general set of bids and ask processes and for general utility function. Moreover, my construction of shadow price is very natural and it shows the connection between optimal strategy and shadow price.

T. Rogala

Calderón-Zygmund operators in harmonic analysis of classical orthogonal expansions

Tomasz Zachary Szarek
thesis advisor: dr hab. Adam Nowak

http://www.impan.pl/~szarek/

The dissertation contributes to the branch of mathematics called *harmonic analysis of orthogonal expansions*, which has its roots in the very classical harmonic analysis of Fourier series and integrals. This flow deals with various classical, but in principle non-trigonometric orthogonal expansions. In the thesis we consider a few frameworks related to particular orthogonal expansions, which have recently been intensively investigated from harmonic analysis perspective. In each of them we study, in a unified way, fundamental harmonic analysis operators such as maximal operators, Riesz transforms, multipliers, square functions and Lusin area integrals. In the classical situation, all these objects have significant applications, for instance in the study of almost everywhere and non-tangential convergence, potential and Sobolev spaces and problems related to conjugacy and regularity of solutions to some partial differential equations. Thus there are deep motivations to study them in other, non-trigonometric frameworks. To analyze them in our settings we employ the general theory of Calderón-Zygmund operators. Since the associated kernels are given by complicated formulas involving transcendental special functions, the main implicit aim and achievement of the thesis is to establish possibly transparent methods for proving kernel estimates. The thesis is based on joint papers with A.J. Castro, A. Nowak and P. Sjögren, which have already been published.

T. Z. Szarek

Conferences

ALEKSANDER PEŁCZYŃSKI MEMORIAL CONFERENCE *July 13–19, Będlewo*

The conference was co-organized by the Stefan Banach International Mathematical Center at the Institute of Mathematics of the Polish Academy of Science and Warsaw Center of Mathematical and Computer Science.

Almost 90 mathematicians from 20 countries came to celebrate the memory of one of the leading personalities in Polish mathematics whose influence on the development of Functional Analysis in the last century was more than significant. The main aim of the conference was to put together his friends, collaborators, students and all associated with his scientific heritage.

Perhaps for the first time all 8 of the PhD students of Pełczyński was present at the same time in the same place. In the (approximately) chronological order: W. Wojtyński, A. Szankowski, N. Tomczak-Jaegermann, N. Nielsen, P. Wojtaszczyk, T. Figiel, S. Szarek, M. Wojciechowski. Due to the memorial character of the conference, there were special guests: Professor Aleksander Pełczyński's family (3 persons: the wife, the daughter and a grandson) and the wife of late Professor Piotr Mankiewicz (who was invited to take part in the conference himself)

The Scientific Committee consisted of T. Figiel, B. Johnson, S. Kwapień, V. Milman, D. Preiss and N. Tomczak – Jaegermann.

The conference brought together many mathematicians working in areas of mathematics close to scientific interest of Aleksander Pełczyński: Functional Analysis, Topology, Harmonic Analysis and Classical Analysis. The talks presented at the conference reflected the current development in these areas.

About a half of participants delivered talks at the conference. The spectrum of topics was impressive: probabilistic methods (A. Giannopoulos, M. Rudelson, S. Szarek, A. Litvak, A. Koldobsky, P.F.X. Muller), approximation property (B. Johnson, E. Oja, O.I. Reinov, V.N. Temlyakov), harmonic analysis and Banach and, more general, topological algebras (M. Bożejko, P. Ohrysko, G. Pisier, W. Żelazko, K. Piszczek, K. Jarosz, P. Domański), function spaces (T. Iwaniec, S.V. Kislyakov, H. Koenig, L. Maligranda, V. Troitsky, D. Vogt, W.Wnuk), reforming and embeddings properties (S. Dilworth, R. Haydon, V. Montesinos, T. Schlumprecht, A. Zsak) operators theory and operators ideals (M. Junge, K. Lesnik, M. Mastylo, B. Mityagin, A. Paszkiewicz, A. Pietsch, R. Szwedek, L. Weis), nonlinear analysis (D. Kutzarowa, S. Lajara, V. Milman). The overview of the field of interest of A. Pełczyński was very extensive and "up to date". Especially the young participants had the rare opportunity to be introduced into the vibrant and gorgeous world of Banach spaces.

Due to the memorial character of the conference, besides the above mathematical lectures, there were 3 special talks of historical and memorial character. They were delivered at Aleksander Pełczyński Memorial Session on Thursday July 17. The speakers were S. Kwapień, L. Maligranda and W. Żelazko.

Michał Wojciechowski

→ PhD students of Aleksander Pełczyński, from left: Niels J. Nielsen, Tomasz Szankowski, Tadeusz Figiel, Wojciech Wojtyński, Michał Wojciechowski, Nicole Tomczak-Jaegermann, Stanisław Szarek, Przemysław Wojtaszczyk.

↑ CAF 2014

CONSTRUCTIVE APPROXIMATION OF FUNCTIONS

29.06.2014–05.07.2014, Będlewo

The conference focused on topics associated with different aspects of complex analysis, especially: approximation theory, constructive theory of functions, pluricomplex analysis, (pluri)potential theory, polynomial inequalities and holomorphic functions.

The conference gathered 45 participants from Europe (Bulgaria, France, Germany, Hungary, Iceland, Italy, Poland, Sweden, Turkey), America (USA), Africa (Morocco) and Asia (Japan).

Apart from the plenary lectures, there were also 12 shorter talks delivered by other participants and it was a special pleasure to have among them Pierre Dolbeault (University Pierre et Marie Curie, France). During the conference there was also a poster session with a range of interesting presentations.

The organizing committee of the conference consisted of Mirosław Baran (chair), Leokadia Białas-Cież, Marta Kosek, Grzegorz Lewicki, Paweł Ozorka, Alicja Skiba and Jerzy Szczepański (Jagiellonian University and State Higher Vocational School in Tarnów).

Sponsors of the conference were: Warsaw Center of Mathematics and Computer Science, Stefan Banach International Mathematical Center, Committee of Mathematics of the Polish Academy of Sciences and Jagiellonian University.

The conference was also an opportunity to honour Professor Wiesław Pleśniak on the occassion of his 70th birthday. He was the special honour guest of the meeting. The organizing committee consisted of scientific descendants of Professor Pleśniak and most of the participants have been not only outstanding mathematicians but also his friends for a long time.

INVITED SPEAKERS OF THE CONFERENCE WERE:

- Hans-Peter Blatt (Eichstätt University, Germany);
- Len Bos (University of Verona, Italy);
- Jean-Paul Calvi (University of Toulouse, France);
- Alexander Goncharov (Bilkent University, Turkey);
- Christer Kiselman (Uppsala University, Sweden);
- Maciej Klimek (Uppsala University, Sweden);
- Janina Kotus (Warsaw University of Technology, Poland);
- Norm Levenberg (Indiana University, USA);
- Mieczysław Mastyło (Adam Mickiewicz University, Poland):
- Wiesław Pawłucki (Jagiellonian University, Poland);
- Evgeny Poletsky (Syracuse University, USA);
- Feliks Przytycki (Polish Academy of Sciences, Poland);
- Szilard Revesz (Hungarian Academy of Sciences, Hungary);
- Nikolay Shcherbina (Wuppertal University, Germany);
- Ragnar Sigurdsson (University of Iceland, Iceland);
- Vyacheslav Zakharyuta (Sabanci University,Turkey);
- Anna Zdunik (University of Warsaw, Poland);
- Ahmed Zeriahi (University of Toulouse, France).

During the conference we had a barbecue and the conference banquet. We also had an excursion too: we visited Kórnik Castle, the Kórnik Arboretum and the Museum of Arkady Fiedler in Puszczykowo.

More information and the conference photos can be found at http://caf2014.im.uj.edu.pl

Marta Kosek

EMS SCHOOL ON STOCHASTIC ANALYSIS WITH APPLICATIONS IN BIOLOGY, FINANCE AND PHYSICS

6 October – 11 October 2014, Będlewo

The school gathered 59 scientists: 11 professors, 5 postdocs and 43 students (mostly from Berlin and Potsdam, Poland and Kiev). The school was organized jointly with the meeting of the Research Training Group (RTG) from Berlin. The program of the school consisted of two 10 hours lectures and 19 student contributed talks. The lectures were delivered by Frank den Hollander, Universiteit Leiden – "Metastability of interacting particle systems at low temperature" and Jan Obloj, University of Oxford – "On aspects of the Skorokhod embedding problem and its applications".

The school was financed by RTG (German participants), EMS (Ukrainian participants) and Banach Center (usingWarsaw Center of Mathematics and Computer Science support).

Łukasz Stettner

PERSPECTIVES OF MODERN COMPLEX ANALYSIS 21

July, 2014–25 July, 2014, Będlewo

The main topics of the conference reflected the impact of Prof. Alexandre Eremenko (Purdue University) on modern complex analysis. During the conference we celebrated his 60th birthday anniversary (http://bcc.impan.pl/14Perspectives/).

THE PRINCIPAL THEMES INCLUDED:

- Classical complex analysis and its associated potential theory
- Iteration of real, rational and entire mappings
- Real algebraic geometry
- Spectral theory and mathematical physics
- Diverse subjects centered on analysis

← Alex Eremenko with Walter Hayman and Misha Sodin

ORGANIZING AND SCIENTIFIC COMMITTEE:
Krzysztof Barański (University of Warsaw), David Drasin (Purdue University), Andrei Gabrielov (Purdue University), Tadeusz Iwaniec (Syracuse University), Feliks Przytycki (Polish Academy of Sciences), Dierk Schleicher (Jacobs University Bremen), Boris Shapiro (Stockholm University), Mitsuhiro Shishikura (Kyoto University).

INVITED 1-HOUR PLENARY SPEAKERS:
- Carl Bender (Washington University in St. Louis)
- Walter Bergweiler (Christian-Albrechts-Universität zu Kiel)
- Mario Bonk (University of California, Los Angeles)
- Walter Hayman (Imperial College)
- Mikhail Lyubich (Stony Brook University)
- Mikhail Sodin (Tel Aviv University)
- Frank Sottile (Texas A&M University)
- Alexander Volberg (Michigan State University)
- Katsutoshi Yamanoi (Tokyo Institute of Technology)
- Anna Zdunik (University of Warsaw)

Funded mainly by IMPAN and University of Warsaw (within WCMCS) and USA National Sciences Foundation, about 100 participants.

Except for Wednesday afternoon, when excursions were organized to the Wielkopolski Forest and Poznań, lectures (about 50 altogether – part of them in parallel sessions) lasted from the mornings till evenings. Open air grill and banquet were organized (including roasted pigs and boars and birthday cake).

Feliks Przytycki

NEW FACULTY – AUTUMN 2014

3–7 YEARS POSITIONS
- Mateusz Michałek, 7-years adiunkt position, algebra and algebraic geometry
- Damian Osajda, 7-years adiunkt position, topology
- Michał Lasoń, 3-years adiunkt position, topology
- Bernard Nowakowski, 3-years adiunkt position, differential equations
- Tatiana Shulman, 5-years, adiunkt position, mathematical physics and differential geometry

1–2 YEARS POSITIONS
- Agnieszka Kałamajska, associate professor position, differential equations
- Tomasz Klimsiak, adiunkt position, probability theory and mathematics of finance
- Tomasz Piasecki, adiunkt position, differential equations
- Rafał Pierzchała, adiunkt position, differential equations
- Stanisław Lech Woronowicz, part time professor position, noncommutative geometry
- Adrian Langer, professor position, algebra and algebraic geometry
- Sylwia Antoniuk, assistant position, topology
- Hector Gabriel Salazar Pedroza, adiunkt position, foundation of mathematics
- Michał Farnik, adiunkt position, topology
- Karen Strung, adiunkt position, noncommutative geometry
- Sylwester Zając assistant position, functional analysis
- Colin Mrozinski, adiunkt position, noncommutative geometry
- Ewelina Zatorska, adiunkt position, differentia equations, WCNM
- Olli Toivanen, postdoc position, differential equations, WCNM
- Van Luong Nguyen, IMPACT program, mathematical analysis, control theory
- Merhrdad Kalantar, Iuventus Plus program, quantum groups

EXCHANGE
- Paweł Goldstein (MIM UW), adiunkt position, differential equations
- Oskar Kędzierski (MIM UW), adiunkt position, algebra and algebraic geometry
- Daria Michalik (UKSW), adiunkt position, topology

PERMANENT POSITION
- Yuriy Tomilov, professor position, functional analysis

*Abbreviations:
WCMCS = Warsaw Center of Mathematical and Computer Science, created jointly by IMPAN and MIMUW;
MIMUW = Faculty of Mathematics, Informatics and Mechanics of the University of Warsaw;
UKSW = Cardinal Stefan Wyszyński University

IMPAN PRIZES

IMPAN Scientific Prize is awarded by IMPAN Director yearly since 2009, for outstanding achievements in mathematics. This prize in 2014 was awarded to Rafał Latała (see Newsletter of IMPAN nr 5)

The Kazimierz Kuratowski Award is awarded yearly by IMPAN and Polish Mathematical Society for young mathematicians under 30 years old for outstanding results. Dr Kamil Kaleta from Technical University of Wrocław and Warsaw University is Kuratowski Award winner in 2014 for outstanding results in potential theory for Lévy processes.

Ph.D. thesis Prize is awarded by IMPAN Director for an outstanding doctoral thesis in IMPAN once a year. The main award is named Marek Wacławek award. In 2014 this prize was awarded to Radosław Bogucki for the thesis related to the convergence of semigroups of operators associated with deterministic Markov processes.

AWARDS TO EMPLOYEES OF IMPAN

KURT GÖDEL RESEARCH PRIZE FELLOWSHIP 2014

Marcin Sabok from IMPAN received 2014 the Kurt Gödel research prize fellowship, in the category: Logical Foundations of Mathematics for his project "Classification: in search of groups".

The Kurt Gödel Research Prize Fellowships Program is organized by the Kurt Gödel Society with support from the John Templeton Foundation. The awards are based on a categorized world-wide open competition. The program offers one fellowship award in each of the following categories: Logical Foundations of Mathematics, Logical Foundations of Computer Science and Logical Foundations of Artificial Intelligence. Marcin Sabok, Matteo Mio and Gianluigi Greco were awarded Kurt Goedel Fellowships gold medals designed by the Austrian Mint at the special Vienna Summer of Logic Award Ceremony on July 17, 2014.

PRIME MINISTER'S AWARDS

In 2014, Jerzy Zabczyk from IMPAN received the Prime Minister of Poland Award for Scientific Achievements. In this category six prizes was awarded.

Professor Jerzy Zabczyk is the author of fundamental works in the field of stochastic equations with Lévy and Wiener noise, partial differential equations in Hilbert spaces, stochastic and deterministic control theory and financial mathematics. They have numerous applications in the automatics, optimization and mathematical economics. Zabczyk has 106 works in prestigious journals, and is co-author of 4 monographs published by Cambridge University Press, in particular: G. Da Prato, J. Zabczyk, Stochastic equations in infinite dimensions, 1992. He is one of the most cited Polish mathematicians.

3-YEAR SCHOLARSHIPS OF THE MINISTRY OF SCIENCE AND HIGHER EDUCATION

for outstanding young scientists under the age of 35. In the ninth edition of the competition the Ministry received more than 727 applications. Of these, 202 winners were selected. In 2014 one of the winners was Jarosław Buczyński employed on the common position at IMPAN & MIMUW. In previous years Tomasz Cieślak and Adam Skalski have received such scholarships.

WACŁAW SIERPIŃSKI PRIZE

is the scientific award in mathematics awarded yearly by Division III of Sciences and Earth Sciences of the Polish Academy of Sciences. In 2014, Adam Skalski was awarded the Wacław Sierpiński Prize for a series of works related to the three areas of the theory of operators:

- study of topological entropy in the sense of Voiculescu;
- quantum symmetry group;
- harmonic analysis and geometric group theory for locally compact quantum groups.

Special events

IEEE Milestone for 3 Polish Mathematicians

On August 5th, 2014, on a square in front of the Institute of Mathematics, Polish Academy of Sciences, took place the ceremony of IEEE Milestone Plaque Dedication to three Polish mathematicians – Marian Rejewski, Jerzy Różycki and Henryk Zygalski, Enigma code breakers.

IEEE (Institute of Electrical and Electronics Engineers) is the world's largest professional association for the advancement of technology. The IEEE Milestones program honours significant technical achievements in all areas associated with IEEE. Milestones recognize the technological innovation and excellence for the benefit of humanity found in unique products, services, seminal papers and patents.

Many representatives of IEEE participated in the ceremony, including IEEE President J. Roberto de Marca, IEEE Vice President – Technical Activities, Jacek Żurada, Director of Division IV Józef Modelski, and IEEE members of the Poland Section with its Chair Ryszard Jachowicz. The ceremony was attended by nearly 250 people, inter alia Vice-President of Warsaw City Włodzimierz Paszyński, President of Polish Academy of Sciences Michał Kleiber, Vice-President of PAS, prof. Marek Chmielewski, President of Polish Federation of Engineering Associations – Ewa Mankiewicz-Cudny, President of Association of Polish Electrical Engineering (SEP) – Piotr Szymczak, Director of IM PAN prof. Feliks Przytycki, as well as a significant number of high rank Polish army officers, family representatives of the awarded mathematicians (including Rejewski's daughter Janina Sylwestrzak) and many others.

ENIGMA AND THE POLISH CIPHER BUREAU

The Enigma machines produced a polyalphabetic substitution cipher. During World War I, inventors in several countries realized that a purely random key sequence, containing no repetitive pattern, would, in principle, make a polyalphabetic substitution cipher unbreakable. This led to the development of rotor cipher machines which alter each character in the plaintext to produce the ciphertext, by means of a scrambler comprising a set of rotors that alter the electrical path from character to character, between the input device and the output device. This constant altering of the electrical pathway produces a very long period before the pattern (the key sequence or substitution alphabet) repeats.

Marian Rejewski, Henryk Zygalski and Jerzy Różycki, mathematics graduates of Poznań University, joined the Polish Cipher Bureau in September 1932 and their first task was to solve the logical structure of the military Enigma. They achieved "one of the most important breakthroughs in cryptologic history" by using the theory of permutations and groups to work out the Enigma scrambler wiring, instead of using linguistics.

According to Rejewski's specifications, the Polish Cipher Bureau commissioned the AVA Radio Company to build replicas of the Enigma. In order to catalog the cycle structure of Enigma permutations, Marian Rejewski devised a machine called a cyclometer and characteristics cards. Henryk Zygalski created the decryption method based on perforated sheets and called the Zygalski sheet method. Jerzy Różycki, on the other hand, developed the ''clock method''. After Rejewski's characteristics method became useless, he invented an electro-mechanical device that was dubbed the ' ' or cryptologic bomb.

As the likelihood of war increased in 1939, the Polish General Staff, realizing what was likely to happen, decided to share their work on Enigma decryption with their western allies. At a conference near Warsaw on 26 and 27 July 1939, the Poles revealed to the French and British that they had broken Enigma and pledged to give each a Polish-reconstructed Enigma, along with details of their Enigma-solving techniques and equipment, including Zygalski's perforated sheets and Rejewski's cryptologic bomb. During the war, Allied cryptologists decrypted a vast number of messages enciphered on Enigma. The intelligence gleaned from this source, codenamed "Ultra" by the British, was a substantial aid to the Allied war effort.

The Fifth Congress of Young Polish Mathematicians 18–21 September, 2014, Zielona Góra

Fifth, in turn, Congress took place at the Faculty of Mathematics, Computer Science and Econometrics (MIiE) of the University of Zielona Góra, under the patronage of the President's wife, Mrs. Anna Komorowska. The main organizers were the MIiE Department and IMPAN.

The aim of the Congress was to bring together highly gifted pupils, including winners of the Mathematical Olympiads, sharing an interest in mathematics, the pupils for which mathematics is their passion. For most of the young participants, it was their first scientific meeting.

The Congress gathered about 450 pupils 16–19 years old from all of the country (including 150 from Lubusz Voivodeship) and 9 from Ukraine. The program included 6 plenary lectures delivered by Krzysztof Ciesielski (UJ), Marek Kordos (UW), Tadeusz Nadzieja (UO), Zdzisław Pogoda (UJ), Krzysztof Przesławski (UZ) and Paweł Strzelecki (UW), and 20 pupils' talks selected by a competition. Feliks Przytycki presented and commented the Simons Foundation short films on the recent winners of the Fields Medal. Moreover, a marathon of games, tournaments, workshops and competitions specially prepared for the Congress participants, was organized.

Congresses of Young Polish Mathematicians have been organized since 2004. The main organizers of the First Congress (2004) were IMPAN and the Polish Mathematical Society. Starting from the second Congress, they have been co-organized by 13 top mathematics institutes / faculties in Poland. The main organizers are IMPAN and the department of University, where the Congress takes place.

Previous Congresses: Warsaw, 17–19 September 2004; Poznań, 2 6–28 September 2008; Kraków, 17–19 September 2010; Gdańsk, 20–23 September 2012.

43rd National Conference on Applications of Mathematics September 2th–9th, 2014, Zakopane Kościelisko.

The Conference gathered 99 participants. The opening lecture was delivered by prof. Tadeusz Trzaskalik and was entitled *The participants commemorated doc. Eugeniusz Fidelis*, the founder and long time organizer of the conference and prof. Witold Kosiński, long time active member of the program committee, who died in 2014.

The traditional prize for the best presentations in the category of young researches has been awarded since the 30th Conference. Since the 43rd Conference it is called Fidelis prize.

In 2014 Fidelis prize was given to Przemysław Rola (Jagiellonian University) and Michał Wroński (Military University of Technology).

Passed away

Eugeniusz Fidelis (1927–2014)

Doc. dr Eugeniusz Fidelis was an applied probabilist. He worked at IMPAN since 1956 until his retirement in 2009. His special field was queueing and renewal theory, statistical quality control and applications of mathematics in medical sciences. He translated to Polish major books in the above fields written by B.V. Gnedenko and I.N. Kovalenko, G.P. Klimov and G. Marczuk. In 1972 he originated annual National Conferences on Applications of Mathematics. For almost 40 years he was its main organizer. Doc. Fidelis was a teacher of several generations of engineers and military officers. He co-organized Courses on Applications of Mathematics at IMPAN. Since 1970 till 1989 doc. Fidelis was a deputy director of IMPAN (in charge of general affairs). He actively participated in major events at IMPAN: creation of the Banach Center, organization of the International Congress of Mathematicians in 1983 and establishing the editorial department at IMPAN. His organizational achievements were acknowledged by Golden Cross of Merit, Knight's Cross and Oficer's Cross of Order of Polonia Restituta from the Polish President. He was also nominated to honorary membership of the Polish Mathematical Society.

↑ Eugeniusz Fidelis, 2009.

Banach Center Upcoming Events 2014–2015

For more information, please check out: http://www.impan.pl/BC/Program/2014.html

	TITLE	DATE	PLACE	ORGANIZERS
1	V Hurwicz Workshop on Mechanism Design Theory	14–15.11.2014	Warszawa	Ł. Stettner, J. Werner, Ł. Woźny
2	XL Conference on Mathematical Statistics	30.11–05.12.2014	Będlewo	B. Ćmiel, A. Dudek, P. Majerski, K. Nosek, Z. Szkutnik
3	BIOFIZMAT 1 (research group)	11–13.12.2014	Warszawa	J. Miękisz, R. Rudnicki
4	The 15th Katowice-Debrecen Winter Seminar on Functional Equations and Inequalities	28–31.01.2015	Będlewo	R. Ger, M. Sablik
5	TFML 2015 – Theoretical Foundations of Machine Learning (conference)	16–21.02.2015	Będlewo	J. Tabor, M. Śmieja, W. Czarnecki, P. Spurek, M. Wiercioch
6	Quantum Probability, Groups and Geometry (research group)	07–11.04.2015	Warszawa	G. Dales, M. Daws, P. Koszmider, A. Skalski
7	IMPANGA 2015 (conference)	12–18.04.2015	Będlewo	J. Buczyński, M. Donten-Bury, G. Kapustka, O. Kędzierski, M. Michałek, E. Postinghel, J. Szpond
8	Information-Based Complexity (conference)	26.04–02.05.2015	Będlewo	F. Kuo, T. Mueller-Gronbach, E. Novak, L. Plaskota, J. F. Traub, H. Woźniakowski
9	Probability and Analysis (conference)	04–09.05.2015	Będlewo	K. Kaleta, T. Kulczycki, M. Kwaśnicki, J. Małecki, G. Serafin, P. Sztonyk
10	Geometry of Jets and Fields (conference)	10–16.05.2015	Będlewo	K. Grabowska, M. Jóźwikowski, M. Rotkiewicz, J. de Lucas
11	16th International Conference on Functional Equations and Inequalities (16th ICFEI)	17–23.05.2015	Będlewo	J. Brzdęk, K. Ciepliński, Z. Leśniak, A. Bahyrycz, M. Piszczek, J. Olko, P. Solarz, J. Wiercioch
12	Micro and Macro Systems in Life Sciences (MMSLS 2015) (conference)	08–13.06.2015	Będlewo	M. Lachowicz, U. Ledzewicz, Z. Szymańska, M. Zaborowski
13	Dynamics, Topology and Computations (conference)	14–20.06.2015	Będlewo	T. Kapela, K. Mischaikow, M. Mrozek, P. Zgliczyński
14	Groups and Their Actions (conference)	21–27.06.2015	Będlewo	A. Bier, W. Hołubowski, W. Tomaszewski
15	Conference on Geometric Group Theory	28.06–03.07.2015	Wrocław	T. Elsner, J. Dymara, Ś. Gal, P. Nowak, J. Świątkowski
16	Topological Quantum Groups – Graduate School	28.06.–11.07.2015	Będlewo	U. Franz, A. Skalski, P. Sołtan
17	3-rd Conference on Finite Dimensional Integrable Systems in Geometry and Mathematical Physics 2015 (FDIS2015)	12–17.07.2015	Będlewo	A. J. Maciejewski, V. Matveev, M. Przybylska, S. Tabachnikov
18	Nonlinear Control and Geometry (conference)	23–29.08.2014	Będlewo	M. Grochowski, B. Jakubczyk, W. Kryński, G. Pietrzkowski, W. Respondek
19	Mathematical Fluid Mechanics: Old Problems, New Trends - a week for Wojciech Zajączkowski (conference)	30.08–05.09.2015	Będlewo	T. Kobayashi, M. Pokorny, P. B. Mucha, J. Rencławowicz
20	Geometric Singularity Theory (conference)	06–11.09.2015	Warszawa	W. Domitrz, G. Ishikawa, S. Izumiya
21	Analytic, Algebraic and Geometric Aspects of Differential Equations (conference)	06–19.09.2015	Będlewo	G. Filipuk, Y. Haraoka, G. Łysik, S. Michalik
22	Workshop on Almost Hermitian and Contact Geometry	18–24.10.2015	Będlewo	I. Agricola, T. Friedrich, A. Tralle

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