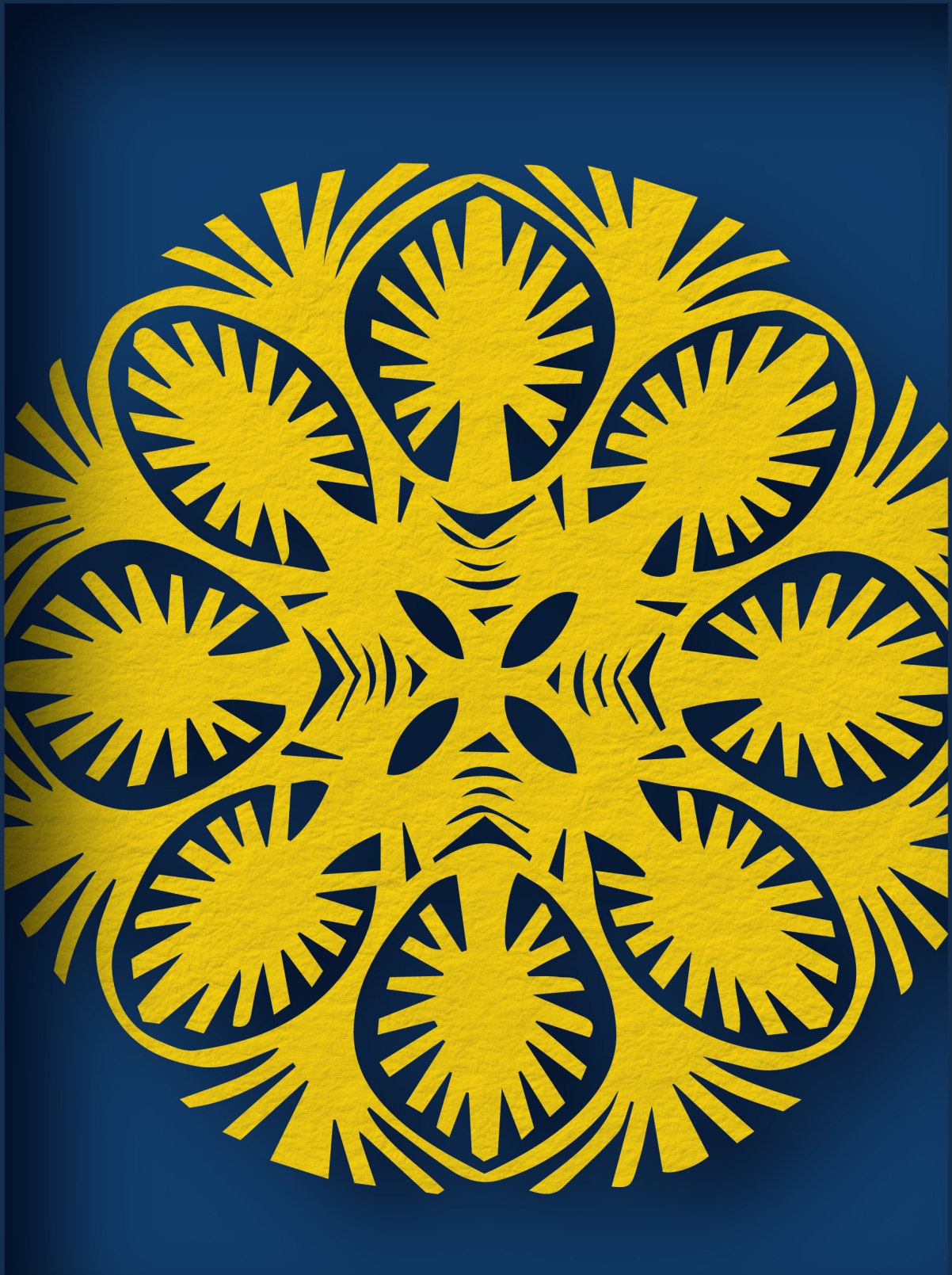


ISSUE 15, WINTER 2022/2023

NEWSLETTER

OF THE INSTITUTE OF MATHEMATICS OF THE POLISH ACADEMY OF SCIENCES



BANACH CENTER UPCOMING EVENTS IN 2023

Title	Date	Place
Workshop: Networking in Applied Network Theory	19-25.02.2023	Będlewo
Some Problems of Applied & Computational Topology	05-11.03.2023	Będlewo
Complex Dynamics and Related Fields. From Introductory Minicourses to Advanced Topics (Simons: Dynamical Systems)	12-25.03.2023	Warsaw
Nonlocal Operators and Markov Processes 3	19-24.03.2023	Będlewo
Smooth and Topological Dynamics (Simons: Dynamical Systems)	10-22.04.2023	Warsaw
Introduction Conference to XXII Andrzej Jankowski Memorial Lecture	21-23.04.2023	Warsaw
Beyond Uniform Hyperbolicity (Simons: Dynamical Systems)	23.04-5.05.2023	Będlewo
XXXIV Conference on History of Mathematics	7-12.05.2023	Będlewo
Dynamic and Fractals (Simons: Dynamical Systems)	7-13.05.2023	Warsaw
Stochastic Modeling and Control (Simons: Stochastic Modeling)	8-13.05.2023	Będlewo
Thermodynamic Formalism: Non-additive Aspects and Related Topics (Simons: Dynamical Systems)	14-19.05.2023	Będlewo
International Banach Prize PTM Conference	18-19.05.2023	Warsaw
Ergodic Theory and Parabolic Dynamics (Simons: Dynamical Systems)	22.05-3.06.2023	Warsaw
Stochastic Models VII	28.05-2.06.2023	Będlewo
Workshop on Modeling with Hawkes Processes: Theory, Statistics and Applications	29.05-2.06.2023	Warsaw
Nilpotent Structures in Topological Dynamics, Ergodic Theory and Combinatorics (Simons: Dynamical Systems)	4-10.06.2023	Będlewo
High Dimensional Probability	11-16.06.2023	Będlewo
Nonsmooth Problems with Applications in Mechanics	17-22.06.2023	Będlewo
LOOPS'23	25.06-2.07.2023	Będlewo
Graph Algebras in Będlewo (Simons: Operator Algebras)	2-8.07.2023	Będlewo
Workshop on Differential Equations and Their Applications	2-8.07.2023	Będlewo
60LB Geometry and Singularities - 60th Anniversary of Lev Birbrair	16-22.07.2023	Będlewo

List continues on p.19

IM PAN has a new Director

The interview with Karol Palka was conducted by Yonatan Gutman.

On the 19th of May 2022 the President of the Polish Academy of Sciences nominated Prof. Karol Palka to the post of Director of the Institute of Mathematics of the Polish Academy of Sciences (IM PAN).

Yonatan Gutman: Congratulations!

Karol Palka: Thank you.

Y.G.: We are very curious about your plans for IM PAN but first we would like to hear about your scientific itinerary. Please tell us about your education and research.

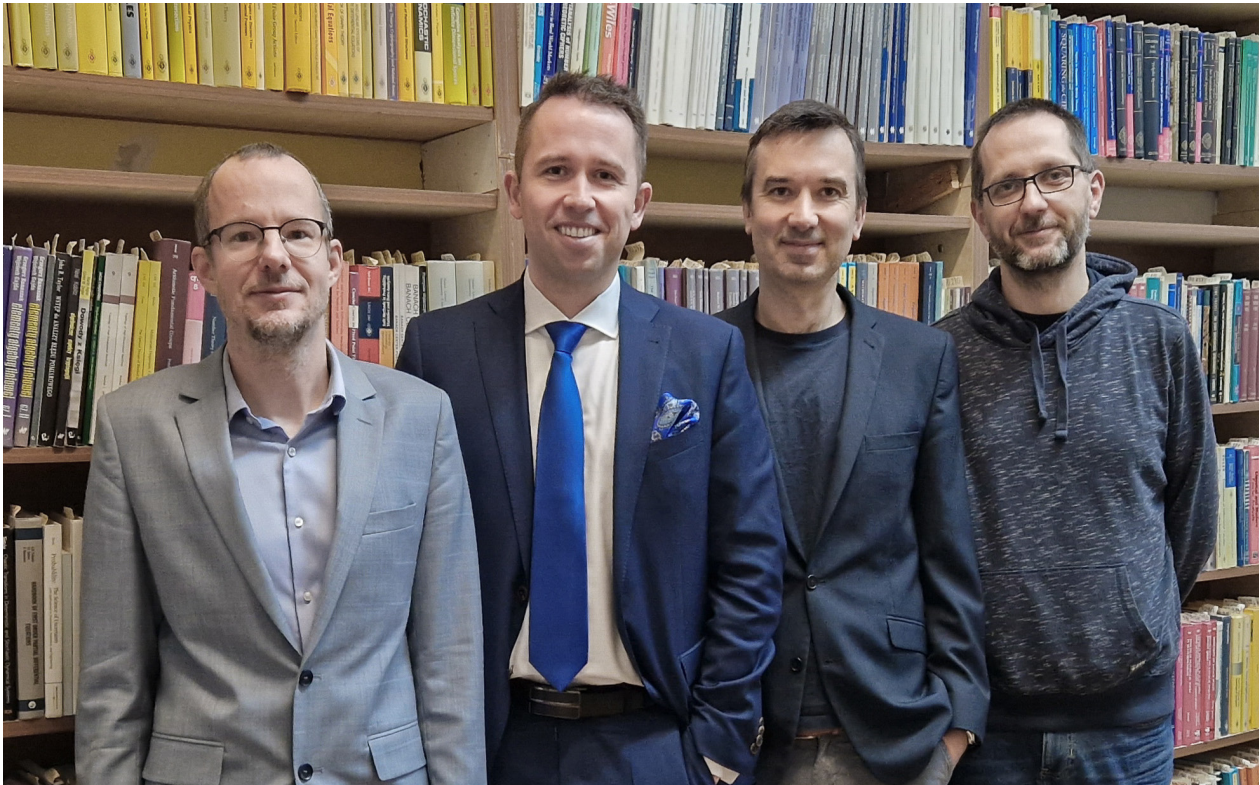
K.P.: I studied mathematics at the University of Wrocław for two years. At that time I was still attending high school and playing cello, too. But mathematics consumed me already, so I gave up cello and went to Warsaw, where I studied mathematics and physics at the University of Warsaw. I did my Ph.D in algebraic geometry and MSc in string theory. After my Ph.D. I moved to Montreal for three beautiful years. Then I came back to Warsaw and I have worked at IM PAN since then. I did my habilitation in 2018. My research concentrates on the theory of open algebraic varieties, singularities, embeddings. There are many open problems of fundamental nature here and somehow they attract me - easy to state, very difficult to solve, like the Jacobian Conjecture. Part of my research is devoted to complex affine surfaces and, more generally, to varieties topologically close to affine spaces, where the exotic algebraic phenomena and subtleties are more clearly visible.

Y.G.: In 2017 you were awarded the Waclaw Sierpiński Prize for establishing the Coolidge-Nagata conjecture. Please tell us about the conjecture and its solution.

K.P.: The first part of the story is that in algebraic geometry besides usual automorphisms of varieties we have birational automorphisms, not everywhere defined, creating the so-called *Cremona group* of a variety. For instance, the Cremona group of the projective plane is generated by linear automorphisms and the involution $[x:y:z] \rightarrow [1/x: 1/y: 1/z]$. The Cremona group of the plane is large and very interesting. The second part of the story are algebraic curves, possibly singular, which are topologically identical to the projective line. There are numerous infinite exotic families of such curves constructed over the last few decades by various authors. The Coolidge-Nagata conjecture is the first deeper geometric insight into their geometry - it says that they are all in the same orbit of the action of the Cremona group. In other terms - if we have a complex planar curve homeomorphic to the projective line then it can be rectified onto an honest line using some Cremona-



Prof. Karol Palka, Director of IM PAN. Photograph by Marcin Gregorczyk, Luxurity.org



The Executive Board of IM PAN (from left to right): Scientific Director Prof. Maciej Borodzik, Director Prof. Karol Palka, Scientific Director Prof. Piotr Nowak, Scientific Director Prof. Adam Skalski. Photograph courtesy of Prof. Palka.

na transformation. This claim about the existence of some transformation could not be checked case by case, because the classification of such curves is unknown. The solution was to develop a theory of *almost minimal models* - a variant of the well-known theory of minimal models for pairs (surface, boundary curves), initiated by S. Mori. I generalized the classical version of the theory, developed mainly by Japanese mathematicians, by adding some new degrees of freedom. This allowed for attacking the problem in terms of this theory. Together with Mariusz Koras we then solved the difficult cases of the conjecture. This was quite a journey. But in fact I am more happy with the theory than with the solution of the conjecture itself, as it led to some other deep insights and classificational results, coauthored with my PhD student, Tomasz Pełka.

Y.G.: As you mentioned, some of the work on the Coolidge-Nagata conjecture was joint with the late Mariusz Koras who was also your PhD advisor. Please tell us about this remarkable person and mathematician.

K.P.: Mariusz Koras was my PhD supervisor but quickly became a friend. Very direct, honest, optimi-

stic person. And a great climber. His mathematics was kind of climbing too. Once he found a problem he was interested in, he did not give up. Together with his friend Peter Russell they solved the linearization conjecture for C^* actions on C^3 , which took more than ten years. He helped me to find my way in mathematics.

Y.G.: During 2019 – 2021 you served as the Chairman of the Polish Young Academy of the Polish Academy of Sciences. Please tell us about the Polish Young Academy and your term as Chairman.

K.P.: The Polish Young Academy is a group of young scientists chosen by the members of the Polish Academy of Sciences for a 5-year term. A major advantage is that it is an independent voice of young scientists, a group of experts from various disciplines working together. They comment on legislative drafts related to science and its funding and take stands on the situation of young scientists. They have quite a lot of freedom in choosing the goals of their actions. For instance, at the time when the new Higher Education Act was proposed, there was a growing discussion on the role and future of the Institutes of the Polish Academy of Sciences. We or-

ganized surveys, debates and produced reports concerning problems in the Institutes. Then I became a member of an advisory committee for the reform of the Academy. Being involved more and more in this type of activity I decided to become a Chairman. A very interesting experience which led to some long-term friendships. And I learned a lot about the Polish Academy of Sciences, too.

Y.G.: Let us now return to the present. How do you see the current position of IM PAN and what are your plans for the coming years?

K.P.: The position of IM PAN in the Polish scientific landscape is strong and the basic plan is to keep it and to improve it, at the same time taking care of our collaboration with the universities. The advantage of working here is that there is no teaching, so one can, and one should, concentrate on research, choosing ambitious goals. In the current funding system for science, the places where one can work on long term projects are very important, especially for mathematicians, and IM PAN is surely one of them. IM PAN plays an important role for the Polish mathematical community, too, it has branches in several cities. As for other plans - there are problems related to the budget, to the infrastructure and the organizational structure. There is a need for a digital transformation, too.

Y.G.: What role does/should IM PAN as well as its Mathematical Research and Conference Center at Będlewo play in the mathematical landscape of Poland, Europe and the world?

K.P.: The basic role for IM PAN is to stay a leading mathematical research center in Poland and to fight for its better place in the European landscape, that's clear. Another role is to promote high scientific standards. The Banach Center, which is part of the Institute, co-finances good conferences, workshops and meetings of smaller research groups. It develops cooperation with other mathematical research centers. Many events take place in our Research and Conference Center in Będlewo, near Poznań. The Banach Center is well-known in the world and is our showcase. Unfortunately, so far it has not received separate funding from the Ministry, which is a headache for subsequent directors. Nevertheless, this way IM PAN plays an important role for the mathematical

community and this role should be maintained.

Y.G.: There has been a lot of discussion about the financial situation of IM PAN. Could you please explain where IM PAN stands financially and what should be done in this respect?

K.P.: The main financial problem is the current funding algorithm that determines the subsidy from the Ministry of Education and Science. It does not take into account the specifics and multiple roles of entities such as IM PAN and proposes to reduce the subsidy. Not to mention inflation. This may hamper the functioning of the Institute and requires more management effort, as our budget is less stable than university budgets. Very good science depends on very good funding. Let's hope our government will understand this. But my predecessors dealt with harder problems, so I'm optimistic.

Y. G.: Where do you see IM PAN in 10 years?

K.P.: I see it as the best place for doing outstanding mathematics in Poland, attracting people from abroad.

Y.G.: Finally, what would be your advice for a young PhD student?

K.P.: Maybe... don't be afraid to climb higher mountains.



Prof. Karol Palka, Director of IM PAN. Photograph by Marcin Gregorczyk, Luxury.org

Evaluation results for IM PAN

Piotr Nowak

The evaluation of scientific institutions in Poland takes place every four years and is supervised by the Ministry of Education and Science. The most recent edition was scheduled for 2021, however, it was delayed by one year due to the COVID-19 pandemic and eventually covered the years 2017 to 2021. Generally speaking, during this process scientific institutions are evaluated on three metrics: publications, grants and broader impact.

The most important category is the first one, namely the quality of the publication output. This is done by assigning to each article or monograph a certain number of points on a fixed scale. In the case of research articles published in peer-reviewed international journals, which constitute the majority of the research output in mathematics, it is the journal in which an article is published that determines its score.

The new legislation Constitution for Science, passed in 2018, introduced new rules on scoring journals. Previously scores were based on the Impact Factor and were assigned on the scale of 0-50 points, with 5 point increments between the different tiers of journals. This linear scale did not properly reflect the differences in the quality of journals. The new scale has several point values: 200, 140, 100, 70, 40, 20, and for each discipline the scores for the journals were proposed by a group of scientists appointed by the ministry and finalized by the Committee for the Evaluation of Scientific Institution (the articles published before the new scale was introduced were scored on the old scale in the evaluation). In addition, a new important regulation limited the number of articles that can be submitted by a single researcher to 4, shifting the focus of the evaluation to the quality instead of the volume of the published output.

The data necessary for the evaluation was submitted by IM PAN in February of 2021 and consisted of almost 250 publications. The latter were se-



lected from the set of all articles and books published by researchers employed at IM PAN during the period 2017-2021. A list of 64 funded research projects and two cases of broader impact were prepared by Paweł Dłotko, the leader of the Dioscuri Center in Topological Data Analysis, as well as Piotr Miłoś and Łukasz Kuciński from the Machine Learning Group.

The results of the evaluation were announced in the summer: IM PAN has been evaluated as the top institution in mathematics in Poland and received the highest A+ category. Only two other institutions managed to reach the same category, one of them being the Department of Mathematics, Informatics and Mechanics at the University of Warsaw.

This excellent result is the effect of the joint effort of all the researchers employed at IM PAN in the last 5 years and we can all be proud of contributing to making the Institute of Mathematics of the Polish Academy of Sciences the leading research institution in mathematics in Poland. At the same time there is still work ahead of us, in building a stronger European and international profile for IM PAN.

50th Anniversary of the Banach Center

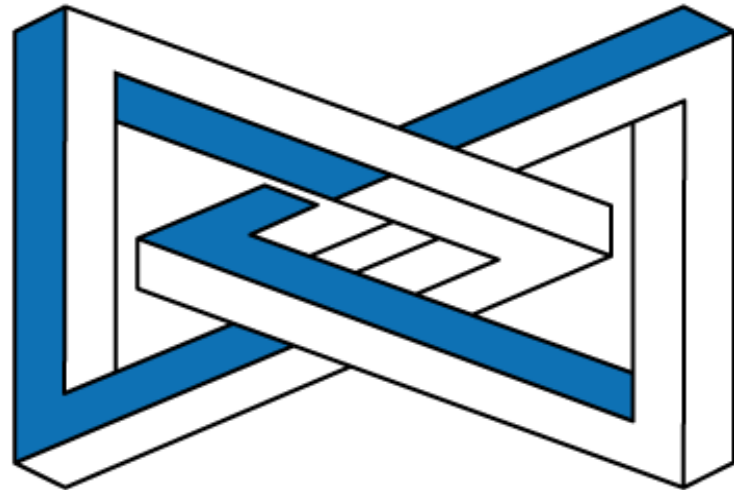
Adam Skalski

The International Banach Center is the conference arm of the Institute of Mathematics of the Polish Academy of Sciences (IM PAN). This year it celebrated its 50th anniversary.

The Banach Center was established on January 13, 1972, following the initiative of Professor Czesław Olech, who was then the Director of IM PAN. It was originally based on an agreement signed in Warsaw by the Academies of Sciences of Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania and the USSR. The aim of the Center has been the promotion and stimulation of international co-operation in mathematics, especially between the East and West. Poland, with its geographic location, cultural and mathematical traditions, has always served as a natural meeting place. Since 1993 the Banach Center has worked under the auspices of the new agreement with the European Mathematical Society. It is one of the founding members of ERCOM (European Research Centers on Mathematics), an organisation gathering top research institutes in Europe, described on page 9 of this Newsletter.

As specified in the agreement with the EMS, the Banach Center is headed by the Director of IM PAN or one of its Scientific Directors, and is supervised by the International Council of the Banach Center. The Council consists of three members representing Poland, three members nominated by the European Mathematical Society, and three members representing the founding countries of the Banach Center (nominated by IM PAN). The following mathematicians have held the post of the Chairman of the Council: Lubomir Iliev (Bulgaria) 1972-1976, Ákos Császár (Hungary) 1977-1980, Klaus Matthes (East Germany) 1981-1982, Kazimierz Urbanik (Poland) 1983-1986, Romulus Cristescu (Romania) 1987-1989, Sergeĭ M. Nikol'skiĭ (USSR) 1990-1992, Friedrich Hirzebruch (Germany) 1993-2001, Rolf Jeltsch (Switzerland) - 2002-2005, Ari Laptev (Sweden) - 2006-2013, Marta Sanz-Solé (Spain) - 2013 - 2014, Pavel Exner (Czech Republic) - 2014 - 2021, Gert-Martin Greuel (Germany) - 2022.

Since 2015 the Banach Center has been collaborating with the Simons Foundation, whose support via the Targeted Grants for Institutes scheme made it possible to organise Simons Semesters at the Banach Center, a years research and training programmes. The grant was renewed in 2020, and IM PAN is currently hosting a program called *Simons Semesters at Banach Center: 2020s vision*.



Banach Center

The anniversary celebration on the 26th of May 2022 gathered the current Scientific Council, the deans of the mathematical departments of the Warsaw University and the Warsaw University of Technology, the Dean of the Third Section of the Polish Academy of Sciences, and several invited guests who played an important role in the history of the Center. After a presentation of the history of the Center by Adam Skalski and an introduction of the Simons Semesters programme by Piotr Gwiazda, we heard a scientific lecture entitled “Linear PDE with Constant Coefficients” delivered by Bernd Sturmfels, the Director of the Max Planck Institute for Mathematics in the Sciences in Leipzig (Germany) and a Professor of Mathematics, Statistics and Computer Science at the University of California at Berkeley.

Zemánek Prize

Yuri Tomilov

The 2022 Jaroslav and Barbara Zemánek Prize in functional analysis with emphasis on operator theory has been awarded to Amine Marrakchi (École Normale Supérieure de Lyon, France). The Jury emphasized „Marrakchi’s groundbreaking achievements in the theory of operator algebras, ergodic theory and geometric group theory, and especially his contributions to the study of Connes’s bicentralizer problem for type III von Neumann algebras.”

Marrakchi received his PhD in 2018 from Université Paris-Sud under the supervision of Cyril Houdayer. He held a postdoctoral position at Kyoto University from 2018 to 2019 and is a CNRS Junior Researcher at ENS Lyon.

The Jaroslav and Barbara Zemánek Prize was founded in 2018 by the Institute of Mathematics of the Polish Academy of Sciences (IM PAN) to encourage research in functional analysis, operator theory and related topics. The Prize is awarded to mathematicians under thirty-five years of age who have made important contributions to the field.

The Prize Jury for 2022 consisted of R. Latała (Warsaw University), F. Gesztesy (Baylor University), V. Müller (Institute of Mathematics of the Czech Academy of Sciences), N. Nikolski (University of Bordeaux), G. Pisier (Texas A&M), A. Skalski (IM PAN) and Y. Tomilov (IM PAN). The awarding ce-

remony took place at the IM PAN, Warsaw, on November 4th, 2022. It featured an introductory lecture „An introduction to von Neumann algebras and Marrakchi’s work on the structure of type III factors” by Stefaan Vaes (KU Leuven) and the lecture „On Connes’s bicentralizer problem” given by the recipient of the prize, Amine Marrakchi.

More detailed information about the Prize can be found on the webpage <https://www.impan.pl/en/events/awards/b-and-j-zemane-k-prize>.



Amine Marrakchi. Credit: private archive

Kuratowski Prize

Kamil Kaleta

The Kuratowski prize is awarded annually by the Polish Mathematical Society and the Institute of Mathematics of the Polish Academy of Sciences. It is awarded to an outstanding young mathematician, that is, under the age of 30, who is working in Poland. The laureate for 2022 is Jakub Skrzeczkowski from the Warsaw Doctoral School of Mathematics and Computer Science. The prize recognizes his results on partial differential equations describing fast reaction in reaction-diffusion systems.



Jakub Skrzeczkowski. Photograph by Maria Marouschek.

ERCOM – European Research Centers on Mathematics

Adam Skalski

ERCOM is a committee of the European Mathematical Society (EMS), consisting of the scientific directors and administrators of the European Research Centres in the Mathematical Sciences, or their chosen representatives. It was established in 1997, with the idea of gathering research oriented institutions, with an international scientific board and a large international visiting programme, covering a broad area of the Mathematical Sciences. ERCOM gathers now around 30 geographically-diverse European institutions, from Portugal to Poland and from Israel to United Kingdom. The Banach Center has been one of the founding members, together for example with MFO (Oberwolfach), the Isaac Newton Institute (Cambridge) and CIRM (Luminy). The full list of the members can be found on the website www.ercom.org.

The purposes of ERCOM, as listed in the official mission statement, are the following:

- to constitute a forum for communication and exchange of information and to foster collaboration and coordination among the centres themselves and between the centres and the EMS;
- to promote advanced research training on a European level;
- to advise the Executive Committee of the EMS on matters related to activities of the centres;
- to contribute to make the EMS more visible;
- to cultivate contacts with similar research centres within and outside Europe.

A key event for ERCOM is the annual spring meeting in one of the centres, which for example in 2022 took place in BCAM (Bilbao), and in March 2023 is planned at IMCAS (Prague). During the meetings the representatives discuss a variety of topics of interest for our institutions. In recent years these included for example the future of mathematical publishing, the position of women in research communities, the role of hybrid activities or the impact of the war in Ukraine and the assistance that is and should be provided to refugee scientists. General discussions are often followed by concrete projects. For example the programme of the joint MFO-Banach Center Graduate Seminars was born during one of the ERCOM meetings.

ERCOM is traditionally led by a Chairman, elected by the representatives of the member institutions. Below is the list of people who have held this post since the beginning of ERCOM:

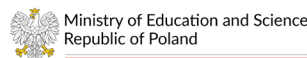
- Ole Barndorff-Nielsen (MaPhySto, Denmark), 1997-2002;
- Manuel Castellet (CRM, Spain), 2002-2005;
- Jan Karel Lenstra (CWI, The Netherlands), 2006-2009;
- Gert-Martin Greuel (MFO, Germany), 2010-2013;
- Keith Ball (ICMS, UK), 2013-2015 ;
- Ari Laptev (Mittag Leffler, Sweden), 2015-2018;
- David Abrahams (INI, UK), 2018-2021;
- Adam Skalski (BC, Poland), 2021-2024.



**EUROPEAN
RESEARCH CENTRES
ON MATHEMATICS**
AN EMS COMMITTEE



Jointly sponsored by



DioscURI Centre in 2022

Paweł Dłotko

It has been more than two years since the DioscURI Centre in Topological Data Analysis was established at the Institute of Mathematics. The times when we start operating were not easy – the Centre was started in the middle of the global Covid pandemic and long periods of work from home were necessary. Subsequently, the war situation in the region did not make the recruitment of new members any easier. Despite this, the Centre has grown and is getting recognition within the Polish, European and Global landscape of Applied Mathematics.

Since the beginning of our operations, we have hosted a total of 5 postdocs. One of them, Anastasios Stefanou, currently holds a tenure track position at the University of Bremen. Justyna Sigmarska-Rynkowska, Michał Lipiński and Rafał Topolnicki are currently working at the Centre (in the Gdańsk, Kraków and Wrocław branches of IM PAN). Another postdoctoral researcher, Bartosz Naskręcki (currently at the Adam Mickiewicz University) joining in December 2022. In addition, we hosted a number of interns, including Mathis Hailler (Sorbone) and Aldi Hoxha (Udine) and one (online) visiting professor on sabbatical Radmila Sazdanovic (NCSU). Additional interns and visiting sabbatical professors are scheduled to join us in the upcoming years. Four PhD students are currently involved in the Centre: Davide Gurnari and Niklas Hellmer (as a part of the joint Doctoral School with MIMUW) and Ahmad Farhad and Jan Senge (external). We are also co-supervising a group of PhD students from the Queen's University in Belfast.

The DioscURI Centre is actively searching for new collaborations. In collaboration with the IMDEA Materials Institute in Madrid and Haifa University we have successfully applied for the M-Era-Net grant. The aim of this project is to construct

new geometries of nanoporous materials enjoying desired mechanical properties. The workflow starts from models of geometry going through its 3-dimensional meshes for numerical tests concluding with mechanical tests on 3-dimensional printed models. We were also close to obtaining a Marie-Curie Doctoral Training Centre grant jointly with a group of universities promoting work related to explainable mathematical methods in medical sciences. We hope that this initiative will be successful in the next call.

Our Centre is working towards building a Polish community in Applications of Mathematics. During the last two years a number of initiatives towards this aim have taken place, including a joint workshop with Gdańsk University of Technology, the PL-MATHS-IN community meeting in Będlewo as well as special session of the latter as part of the 50th Conference on Applications of Mathematics co-organized by the Centre in Zakopane Kościelisko.

The Centre is also active internationally in the area of applied and computational topology. At the beginning of July 2022 we hosted the 3rd edition of the Applied Topology in Będlewo conference, an open and globally recognized forum for research in applied topology as well as one of the largest conferences in this topic worldwide.

One of our goals is to bring the idea of computational and application-targeted research to Polish mathematicians, with a strong emphasis on PhD students. To achieve this aim we organized a number of initiatives, including a workshop for PhD students and young researchers hosted at the Adam Mickiewicz University prior to the Applied Topology in Będlewo conference. It featured lectures with a strong emphasis on computational components given by six plenary speakers representing different areas

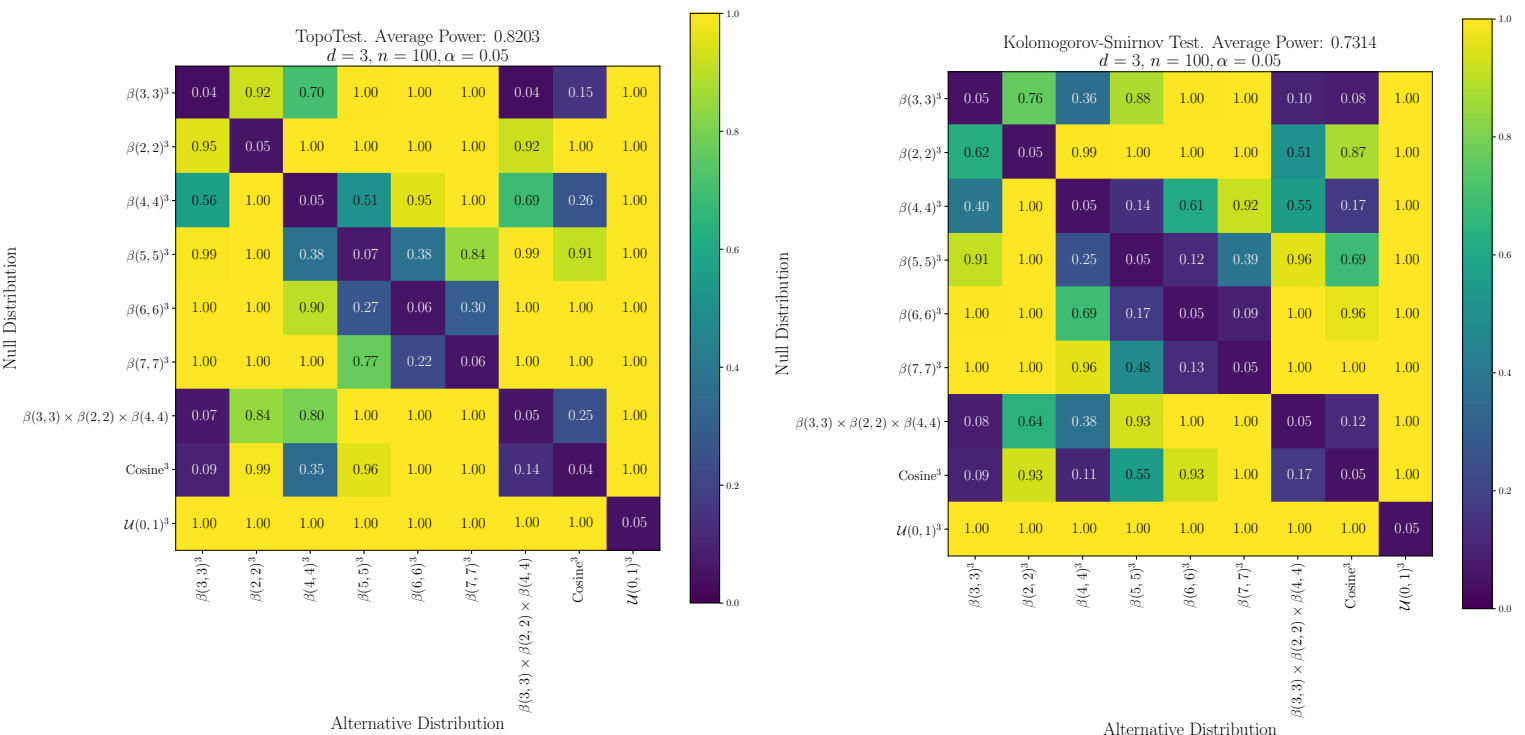
of mathematics. In addition, a number of speakers from strong global R&D industrial partners (like IBM and Lawrence Berkeley National Laboratory) discussed the prospects of applied mathematics in the intersection of academia and the industry. It can be also noted that Paweł Dłotko's presentation was considered the best lecture in the 2021 edition of the Baby Steps Beyond the Horizon conference.

At the Centre we are actively working on scientific outreach. The Warsaw Science Festival in 2020 and 2021 is one aspect of it, but perhaps the long-standing one is the collaboration with the Copernicus Science Museum. At present, we prepared and showcased a number of mathematical lectures that can be presented as part of the Museum's curriculum. However, our ambitions go much further - our intention is to create, in addition to the already existing Museum of Chemistry, Physics and Biology, a Laboratory of Mathematics at the Copernicus Centre. If successful, it will be a hub for ideas of mathematicians who want to share their enthusiasm with Society, especially focusing on its young members. In addition to collaboration with the Copernicus Museum, a number of popular science interviews and articles in Nauka w Polsce, radio RDC as well as an upcoming article in Akademia have described, in terms understandable by the general public, the Center's research work. Some of the work done at the Centre, related to vectorizing of finite graphs,

has a spin off as an educational game teaching the basics of graph theory (soon available on Android and iPhone platforms).

Most importantly, the Centre is performing a wide range of research activities including research in applied statistics (new goodness of fit tests, explainable and provably correct regression methods), methods to reconstruct and analyze dynamics from data (equation-free paradigm), mathematical methods to visualize high dimensional data, analysis of industrial process and materials, analysis of cell types and micro-array type data and more.

As an illustration of our research activity let us concentrate on one example in which topological methods help in a standard task of a Goodness of Fit (GoF) test in statistics. Specifically, in this problem we ask if a given collection of points X in R^n is likely to be sampled from a given probability distribution F . The classical GoF tests used in statistics are restricted to arbitrary one-dimensional distributions or normal distributions in higher dimensions. In joint work with mathematicians from the Institute, we have proposed a new GoF method, called TopoTest, in which topological invariants are used to characterize various high dimensional probability distributions and their samples. Our work, currently under review, shows that topological methods have a strong advantage with respect to our only competitor: the Kolmogorov-Smirnov test (KS).



The picture above shows an average power of TopoTest (left) compared to KS (right) in recognizing various three dimensional distributions from their samples. As one can observe, the average power of TopoTest is considerably higher than the one of KS. A state-of-the-art public domain implementation of TopoTest is made available to the community via the Centre's github account.

Maestro Grant at IM PAN

Piotr Nowak

August was the starting month of the project entitled *Analysis on Groups*, funded by the National Science Center within the Maestro 13 competition. The project is led by Piotr Nowak, who over the period 5 years will build a team of 4 postdocs and 2 PhD students. The project is focused on analytic properties of groups, in particular spectral properties of certain classical operators in the setting of group cohomology, and algebraic methods that can be used to establish phenomena such as the existence of a spectral gap.

For operators such as the Laplacian on a discrete group certain spectral properties carry crucial information about the group itself. In particular, if there is a gap in the spectrum of the Laplace operator around zero, then the group has Kazhdan's property (T), a powerful rigidity property that has strong implications for actions and algebras associated to the group, or for graphs constructed from its finite quotients.

In recent years, a new approach to proving such spectral properties has emerged. It is algebraic in nature and involves showing that certain elements in the group ring are positive, by which it is meant that they are finite sums of squares. Such a condition is finite-dimensional and can be attacked by numerical methods.

The PI, jointly with M. Kaluba, D. Kielak and N. Ozawa, have used such an approach successfully to prove that $\text{Aut}(F_n)$, the group of automorphisms of the free group F_n on $n > 5$ generators, has Kazhdan's property (T), answering in the affirmative a long-standing open problem [KNO, KKN].

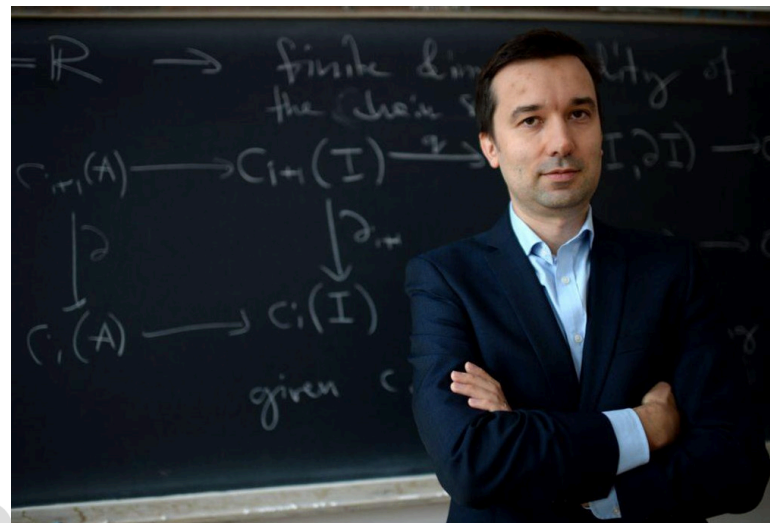
This new approach to proving spectral phenomena by means of algebraic and numerical methods lends itself naturally to generalizations to higher cohomology of groups, a classical theory of algebraic invariants of groups and spaces [BN]. The project focuses on studying such generalizations. The main goal of the project is to use this novel approach to prove new spectral phenomena for the cohomological Laplacian and other related operators.

The results are expected to have interesting applications, including new vanishing theorems for higher cohomology and new rigidity results for groups together with their applications to approximability of groups; constructions of higher-dimensional expanders, which are families of simplicial complexes with exotic geometric properties; and finally, constructions of new types of counterexamples to certain versions of the Baum-Connes conjecture, which is a well-known problem in higher index theory with roots in the classical Atiyah-Singer index theorem.

[BN] U. Bader and P. W. Nowak, Group algebra criteria for vanishing of cohomology, *J. Funct. Anal.* 11 (2020).

[KKN] M. Kaluba, D. Kielak, and P. W. Nowak, On property (T) for $\text{Aut}(F_n)$, and $SL_n(\mathbb{Z})$, *Annals of Mathematics* 193 (2021), no. 2, 539–562.

[KNO] M. Kaluba, P. W. Nowak, and N. Ozawa, $\text{Aut}(F_n)$ has property (T), *Math. Ann.* 375 (2019), no. 3-4, 1169–1191.



Prof. Piotr Nowak. Credit: PAP.

Banach Medal to Professor Michel Talagrand

Feliks Przytycki

Laudation of Professor Michel Talagrand on the occasion of being awarded the Banach Medal by the Polish Academy of Sciences:

Professor Michel Talagrand was awarded in 2022 the Stefan Banach Medal by the Polish Academy of Sciences for groundbreaking results in functional analysis, the theory of Banach spaces, probability theory and in statistical mechanics: the theory of „spin glasses”. His results inspired the research of outstanding Polish mathematicians.

Michel Talagrand is a full member of the French Academy of Sciences and a recipient of prestigious international awards: the Loeve prize in 1995, the Fermat prize in 1997 and the Shaw prize in 2019. He was a plenary speaker at the ICM in Berlin in 1998.

Some of his pivotal results are:

- concentration of measure and isoperimetric inequalities for product measures, having many applications and generalisations,
- characterisation of Gaussian processes with continuous trajectories, related to almost sure convergence of random series in Banach spaces,
- estimates of suprema of stochastic processes, chaining methods.
- proof of the Parisi formula computing „free energy” in any temperature (Annals of Mathematics 2006). F. Germinate in his review in Math. Rev. wrote “it was the most celebrated longstanding open problem in the area of spin glasses”.

He is the author of several fundamental books. One should mention:

- „What is Quantum Field Theory” Cambridge 2022;
- „Upper and Lower Bounds for Stochastic Processes, Modern methods and classical problems”, Springer-Verlag 2014, where results of Witold Bednorz and Rafał Łatała from the University of Warsaw and Adam Paszkiewicz from the University of Łódź are discussed;
- „The generic chaining. Upper and lower bounds of stochastic processes”, Springer-Verlag 2005.
- „Probability in Banach spaces. Isoperimetry and

processes” joint with Michel Ledoux, Springer-Verlag 1991, cited 1138 times according to MathSciNet; – „Spin glasses: a challenge for mathematicians. Cavity and mean field models”, Springer-Verlag 2003.

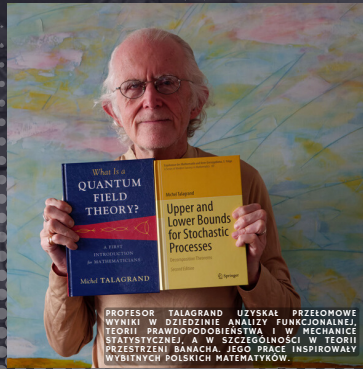
The mathematicians who nominated Michel Talagrand for the Banach Medal wrote: „Astounding is the richness and value of his achieved results. None of them is „easy”. They demand a lot of perseverance and extraordinary deep insight. Many of them are solutions of famous old problems.”

With admiration,
Congratulations,
Feliks Przytycki
Chairman of the Jury

ODCZYT LAUREATA MEDALU BANACHA (2022)
8 WRZEŚNIA 2022, GODZ. 15:00

MIĘDZYNARODOWE CENTRUM MATEMATYCZNE IM. STEFANA BANACHA
SALA 321, INSTYTUT MATEMATYCZNY PAN
UL. ŚNIADECKICH 8, WARSZAWA

PROFESOR MICHEL TALAGRAND



PROFESOR TALAGRAND UZYSKAŁ PRZEŁOMOWE WYNIKI W DZIEDZINIE ANALIZY FUNKCYJALNEJ, TEORII PRAWDOPODOBIEŃSTWA, W MECHANICE STATYSTYCZNEJ, A W SZCZEGÓLNOŚCI W TEORII PRZESTRZENI BANACHA, JEGO PRACE INSPIROWAŁY WYBITNYCH POLSKICH MATEMATYKÓW.

Chaining: a long story

ABSTRACT: CHAINING WAS INVENTED BY KOLMOGOROV AS A TOOL TO PRODUCE BOUNDS FOR STOCHASTIC PROCESSES. IT TURNS OUT THAT IN MANY SITUATIONS, AN APPROPRIATE USE OF CHAINING YIELDS BASICALLY OPTIMAL BOUNDS.

KAPITUŁA MEDALU:
JERZY KACZOROWSKI
STANISŁAW KWAPIEN
TOMASZ ŁUCZAK
WIESŁAW PLEŚNIAK
FELIKS PRZYTYCKI
(PRZEWODNICZĄCY)

PAN
POLSKA AKADEMIA NAUK

Banach Center
INSTITUTE OF MATHEMATICS

Poster design: Jakub Paulus.

IM PAN Prize for Outstanding Scientific Achievements in Mathematics

Feliks Przytycki

In 2022 the Prize was awarded to dr hab. Tomasz Grzywny from the Wrocław University of Technology, for groundbreaking results in probabilistic potential theory, in particular about Lévy type processes with variable jump measure. The results have been published in a cycle of papers in the years 2007-2021.

The IM PAN Prize for Outstanding Scientific Achievements in Mathematics has been awarded yearly since 2009 to a Polish mathematician under the age of 45. The 7 member jury is appointed by the Director of IM PAN after consultation with the Scientific Council of IM PAN.

Tomasz Grzywny wrote his PhD dissertation under the supervision of prof. dr hab. Michał Ryznar and defended it in 2007 at the Wrocław University of Technology. He obtained his habilitation in 2017, also at the Wrocław University of Technology. He has been a recipient of a number of NCN grants, presently he holds an OPUS grant on geometric qu-

antities related to non-local partial differential equations. In the year 2021 Tomasz Grzywny was awarded the Sierpiński Prize of the Third Section of the Polish Academy of Sciences, for papers published in the years 2018-2021.

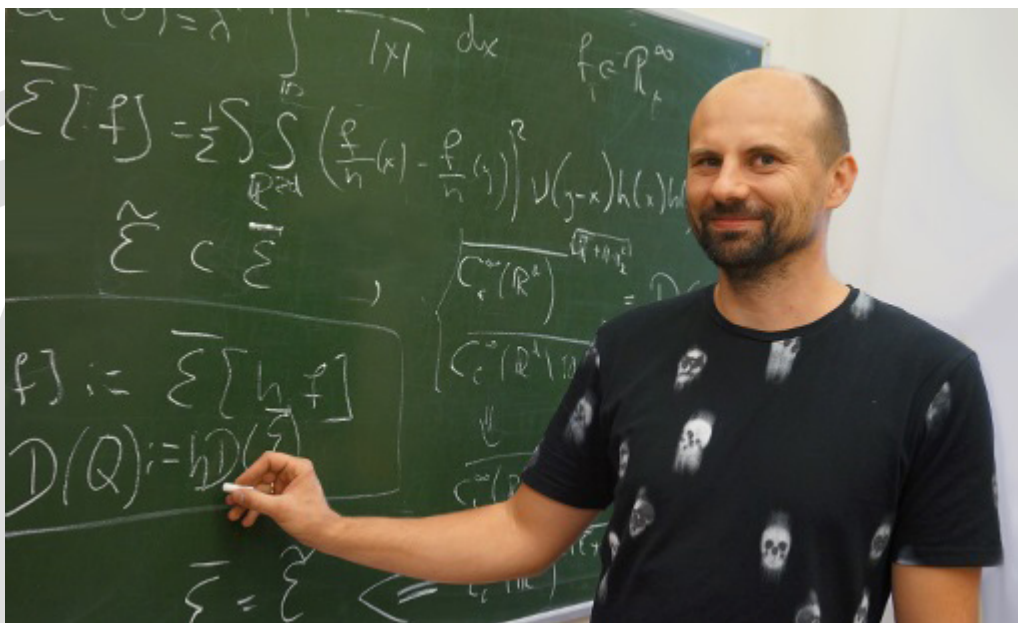
His outstanding fundamental papers include:

-Bogdan, Krzysztof; Grzywny, Tomasz; Ryznar, Michał, Heat kernel estimates for the fractional Laplacian with Dirichlet conditions. *Ann. Probab.* 38.5 (2010).

-Bogdan, Krzysztof; Grzywny, Tomasz; Ryznar, Michał, Density and tails of unimodal convolution semigroups. *J. Funct. Anal.* 266.6 (2014).

-Bogdan, Krzysztof; Grzywny, Tomasz; Pietruska-Pałuba, Katarzyna; Rutkowski, Artur, Extension and trace for nonlocal operators. *J. Math. Pures Appl.* 137 (9) (2020).

-Grzywny, Tomasz; Kim, Kyung-Youn; Kim, Panki, Estimates of Dirichlet heat kernel for symmetric Markov processes. *Stochastic Process. Appl.* 130.1 (2020).



Dr hab. Tomasz Grzywny. Credit: Wrocław University of Technology.

IM PAN assistance for Ukrainian refugees

Jakub Paulus

After the war broke out in Ukraine, the Institute of Mathematics of the Polish Academy of Sciences (IM PAN) offered the infrastructure necessary to accommodate 23 refugees from Ukraine free of charge. Most of them were mathematicians or their families. The last guests to stay did so during mid-August.

The Institute provided the guests from Ukraine with the opportunity to use the entire hotel infrastructure, including the kitchen and laundry room. In addition, during their entire stay at IM PAN, they had free access to the Internet, and the library. To help the refugees find employment, competitions for research positions were announced, as a result of which two scientists were offered positions at IM PAN.

The IM PAN Research and Conference Center in Będlewo hosted free of charge a family of 5 from Ukraine in the period from April 20 to August 31, 2022. Two members of the family worked at the Research and Conference Center in Będlewo (in the kitchen and in the restaurant).

Thanks to the determination of IM PAN's employees, the Institute was additionally able to

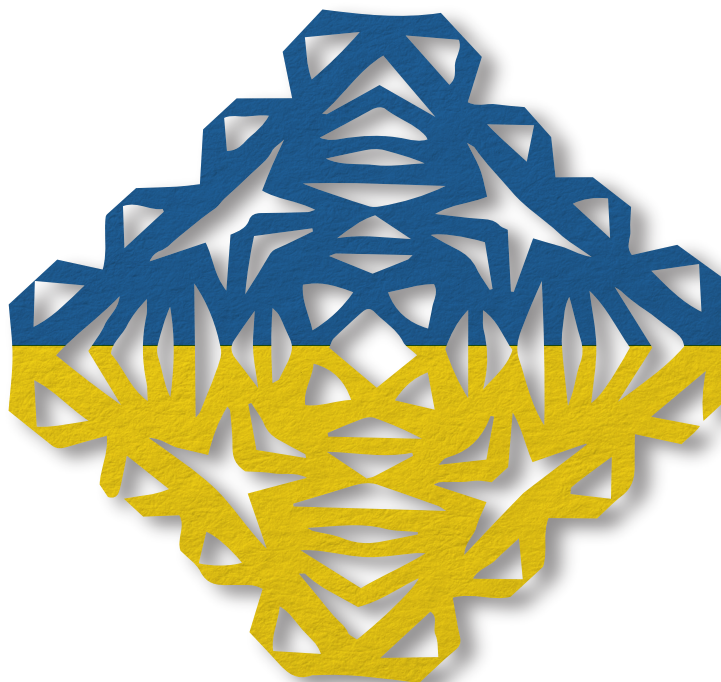
temporarily provide free meals for the guests from Ukraine:

We collaborated with various catering companies that have provided meals during past events held at the Institute as well as the Warszawski Wikt catering company and Groole restaurant.

By using its own funds, fundraising by employees, as well as help from Lara Gessler's Culinary Studio, the Institute provided the refugees with permanent access to hygiene products, food with long shelf life, toys and other basic necessities (especially for women and children).

The Executive Board of the Institute also appointed me as a temporary Coordinator for Refugees Affairs: I dealt with the allocation of hotel rooms, distribution of necessary hygiene and food products, and provided the guests with all the information they needed.

I also submitted in the name of IM PAN several requests to the Polish Academy of Sciences (PAN) for various types of funding or grants for scientists from Ukraine, thanks to which PAN and NAS (American National Academy of Sciences) granted funding to the Institute for three people.



List of new grants at IM PAN in 2022

Mariola Iżycka & Adam Skalski

New Grants of IM PAN employees starting in 2022

European grants:

1. Graph Algebras (Marie Skłodowska-Curie Research and Innovation Staff Exchange)

prof. dr hab. Piotr Hajac
2022-2026

2. PORMETALOMICS: Porous Metal Genomics for Tailoring Mechanical Properties of Light-weight 3D-Printed Architectures (M-Era-Net)

dr hab. Paweł Tadeusz Dłotko
2022 - 2025

NCN Grants:

1. Analysis on Groups (MAESTRO)

dr hab. Piotr Wojciech Nowak
2022-2027

2. One-parameter deformations in the theory of symmetric functions (SONATA BIS)

dr hab. Maciej Dołęga
2022- 2026

3. Applications of graph algebras and higher rank graphs to noncommutative geometry (OPUS)

prof. dr hab. Piotr Mieczysław Hajac
2022- 2026

4. Effective methods in birational and affine geometry (OPUS)

dr hab. Karol Palka
2022- 2026

5. Holomorphic dynamics, fractals and thermodynamical formalism (OPUS)

prof. dr hab. Feliks Marian Przytycki
2022-2025

6. Function spaces for local smoothing (SONATA)
dr hab. Jan Rozendaal
2022- 2025

7. Classifying derived models of the Axiom of Determinacy (WEAVE-UNISONO)
dr Grigor Sargsyan
2022-2025

8. Uniformity and genericity of metric structures: groups, dynamical systems, Banach spaces and C^* -algebras (WEAVE-UNISONO)
dr hab. Maciej Malicki
2022-2025

9. De-Rham cohomology for p-group coverings (SONATINA)
dr Jędrzej Garnek
2022-2023

10. Artinian Rings and Calabi-Yau Manifolds (PRELUDIUM BIS)
dr hab. Michał Kapustka
2022- 2026

11. Approximation techniques for PDEs and variational calculus (PRELUDIUM BIS)
prof. dr hab. Piotr Andrzej Gwiazda
2022- 2026

12. Some applications of set theory to functional analysis (PRELUDIUM)
mgr Damian Głodkowski
2022-2025



NARODOWE CENTRUM NAUKI

Simons Semesters in 2022

Piotr Gwiazda

The year 2022 brought both negative and positive news for the Simons Semesters held at the Banach Center. One initial cause for concern was that the Ministry of Education and Science of the Republic of Poland did not provide additional funding. Such a decision resulted from an unfavorable for us formal change in the program “Co-funding of International Projects”.

Fortunately, a cause for optimism is the possibility for funding from various external sources, such as the NCBiR program “Excellent science. Support for scientific conferences, and the Thematic Research Programmes of IDUB at the University of Warsaw. Another piece of good news for 2022 was the end of Covid-19 pandemic. That allowed for international mobility activation.

I would like to express my gratitude to the organizers of past and currently running semesters for their significant effort and commitment stated below:

- Around transport and diffusion phenomena organized by A. Świerczewska-Gwiazda, E. Titi
- Algorithms for massive parallel computation model organized by P. Sankowski, K. Onak, A. Czumaj
- Computational Mathematics for the 21st Century

organized by K. Kropielnicka, A. Iserles
-AGATES (Algebraic Geometry with Applications to Tensors and Secants) organized by J. Buczyński, W. Buczyńska, F. Galuppi, J. Jelisiejew

We encourage the reader to actively participate in one of the following forthcoming programs:

-Topological, smooth and holomorphic dynamics, ergodic theory, fractals 01.03. - 30.06.2023 organized by K. Barański, J. Boroński, A. Dudko, N. Fagella, K. Frączek, Y. Gutman, B. Karpińska, D. Kwietniak, M. Pollicott, F. Przytycki, M. Rams, A. Zdunik

-Stochastic modeling and control 01.05. - 30.06.2023 organized by Ł. Stettner, J. Jakubowski, M. Pitera

-Operator algebras that one can see 01.06. - 31.08.2023 organized by S. Eilers, P. M. Hajac, T. Maszczyk

-Set theory, model theory, logic and computer science 01.08. - 31.12.2023 organized by P. Kowalski, A. Kwiatkowska, M. Malicki, M. Sabok, G. Sargsyan, M. Bojańczyk



A workshop on Recent Advances in Kinetic Theory and Fluid Dynamics Models in honour of Claude Bardos recognizing his significant contribution to the field of nonlinear partial differential equations. The workshop was organised by the University of Warsaw and the Institute of Mathematics of Polish Academy of Sciences and was held on August, 8–12, 2022 in Warsaw. Photograph by Banach Center.

New Faculty Autumn 2022

Mariola Iżycka & Adam Skalski

The following new employees were hired at IM PAN in 2022

1. dr hab. Maciej Borodzik,
Topology (4 years)
2. dr Mateusz Wasilewski,
Functional Analysis (5 years)
3. dr hab. Błażej Wróbel,
Functional Analysis (7 years)
4. dr Laura Baldelli,
Partial Differential Equations (1.5 years)
5. dr Konstantin Bogdanov,
Dynamical Systems (2 years)
6. dr hab. Stephen Coughlan,
Algebra and Algebraic Geometry (2 years)
7. dr Maria Donten Bury,
Algebra and Algebraic Geometry (1 year)
8. dr Jędrzej Garnek,
Algebra and Algebraic Geometry (2 years)
9. dr Karol Hajduk,
Partial Differential Equations (2 years)
10. dr Damian Jelito,
Probability (1 year)
11. Mateusz Kobak,
Algebra and Algebraic Geometry (1,5 years)
12. Jakub Koncki,
Algebra and Algebraic Geometry (2 years)
13. dr Michał Kowalczyk,
Partial Differential Equations (1 year)
14. dr Manish Kumar,
Functional Analysis (2 years)
15. dr Bartosz Naskręcki,
Dioscuri Centre in Topological Data Analysis
(2 years)
16. dr Łukasz Pawelec,
Dynamical Systems (2 years)
17. dr Matthias Schötz,
Noncommutative Geometry (2 years)
18. dr Zdenek Silber,
Functional Analysis (2 years)
19. dr Grzegorz Świdorski,
Functional Analysis (2 years)
20. dr Hua Wang,
Functional Analysis (2 years)
21. dr Iryna Yehorchenko,
Functional Analysis (1 year)



BANACH CENTER UPCOMING EVENTS IN 2023

(continued from page 1)

Title	Date	Place
Summer School in Algebraic Combinatorics	30.07- 4.08.2023	Będlewo
Workshop: Descriptive Set Theory & Dynamics (Simons: Set Theory)	14-18.08.2023	Warsaw
Conference: Descriptive Set Theory & Dynamics (Simons: Set Theory)	21-25.08.2023	Warsaw
Complex Differential and Difference Equations II	27.08-2.09.2023	Będlewo
Convergence in Topology and Optimization	2-8.09.2023	Będlewo
Marvellous Event on Geometric Analysis	8-13.10.2023	Będlewo
Conference on Generic Structures	23-28.10.2023	Będlewo
Recent Developments in Set Theory	12-18.10.2023	Będlewo
Banach Center - Oberwolfach Graduate Seminar: Model Reduction and Approximation: Projection-, Tensor- and Data-based Methods	13-17.11.2023	Będlewo
Banach Center - Oberwolfach Graduate Seminar: Optimal Transport Theory and Hydrodynamics (from Euler to Monge and vice versa)	13-17.11.2023	Będlewo
SIMONS SEMESTERS 2023		
Dynamical Systems: Topological, Smooth and Holomorphic Dynamics, Ergodic Theory, Fractals (In cooperation with UW and UMK)	01.03-30.06.2023	
Stochastic Modeling and Control	01.05-30.06.2023	
Operator Algebras That One Can See	01.06-31.08.2023	
Set Theory, Model Theory, Logic and Computer Science	01.08.2023 -31.12.2023	

For more information, please see: <https://www.impan.pl/en/activities/banach-center/conferences>.

Editorial Board: Yonatan Gutman, Maciej Dołęga.

Graphic Design: Agnieszka Kaliszewska.

Contact: newsletter@impan.pl

IM PAN
ul. Śniadeckich 8
00-656 Warsaw, Poland
www.impam.pl

Stefan Banach International
Mathematical Center
ul. Śniadeckich 8
00-656 Warsaw, Poland

Będlewo Research
and Conference Center
Będlewo, ul. Parkowa 1
62-060 Stęszew, Poland