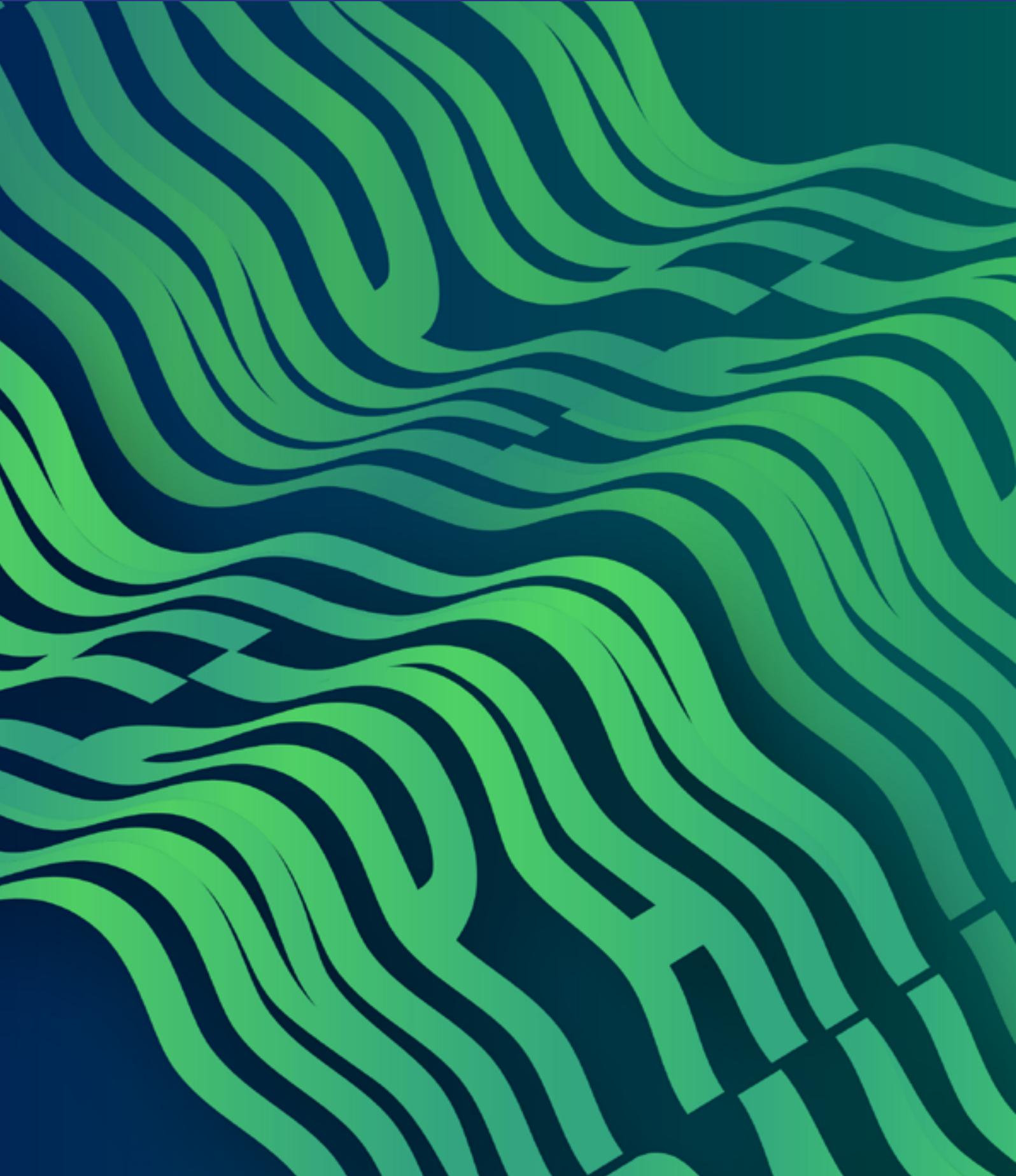


ISSUE 14 AUTUMN 2021

# NEWSLETTER

INSTITUTE OF MATHEMATICS OF THE POLISH ACADEMY OF SCIENCES



# BANACH CENTER UPCOMING EVENTS 2022

Karolina Leśnik

Title	Date	Organizers	Place
Cohomology of Varieties	27.03.2022 - 01.04.2022	P. Achinger, W. Nizioł	Warsaw
Inspirations in Real Analysis	03-08.04.2022	F. Strobilin, E. Jabłońska, W. Fechner, et al.	Będlewo
Self-similar random processes	19-22.04.2022	D. Buraczewski, P. Dyszewski	Będlewo
Parameterized Algorithms. Retreat of the University of Warsaw (3rd edition)	24-29.04.2022	M. Pilipczuk, P. Rzażewski	Będlewo
Recent trends in nonlinear and dispersive equations: equilibria, stability, dynamics	01-07.05.2022	P. Bizoń, J. Jendrej, M. Kowalczyk, et al.	Będlewo
Dynamical Systems and Applications in Life and Social Sciences	08-14.05.2022	J. Banasiak, A. Błoch, M. Lachowicz, et al.	Będlewo
XXXIV Konferencja z Historii Matematyki	08-13.05.2022	W. Więśław, L. Maligranda, R. Murawski, et al.	Będlewo
Stochastic Models VII	29.05.- 03.06.2022	K. Dębicki, P. Lorek, T. Rolski, et al.	Będlewo
9th Euro-Japanese Workshop on Blow-up	05-11.06.2022	M. Fila, G. Karch, M. Sierżęga	Będlewo
Operators, Functions, Systems: Classical and Modern	12-18.06.2022	E. Abakumov, A. Borichev, S. Kislyakov, et al.	Będlewo
Dynamics, Topology and Computations	19-25.06.2022	T. Kapela, K. Mischaikow, M. Mrozek, et al.	Będlewo
Computational mathematics for the 21st Century: 30 years of Acta Numerica	26.06.- 02.07.2022	P. Gwiazda, I. Ipsen, A. Iselres, et al.	Będlewo
Applied Topology in Będlewo 2022	03-08.06.2022	P. Dłotko, W. Marzantowicz, J. Signerska-Rynkowska	Będlewo
The algebra of the Yang-Baxter equation	10-16.07.2022	I. Colazzo, Ł. Kubat V. Lebed, et al.	Wrocław
Independence and Conditional Aspects of Probability	17-23.07.2022	P. Józiać, B. Kołodziejek, W. Matysiak, et al.	Będlewo

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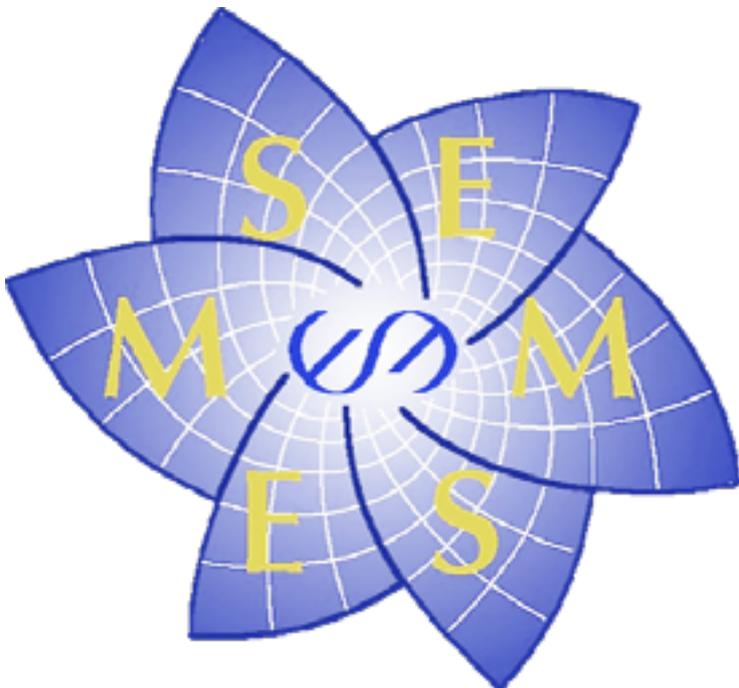
# ERCOM – European Research Institutes in Mathematics

Adam Skalski

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European Research Institutes in Mathematics (ERCOM) is a committee of the European Mathematical Society established in 1997. In practice, it is to a large extent an independent organization gathering European mathematical research institutes and conference centres, primarily serving as an arena of exchange of information, sharing good practice and developing closer scientific and administrative contacts between the members. This is primarily achieved via an annual spring meeting (the last two took place online, but prior to that, ERCOM representatives met in Cambridge, Bonn, Linz and Saint Petersburg).

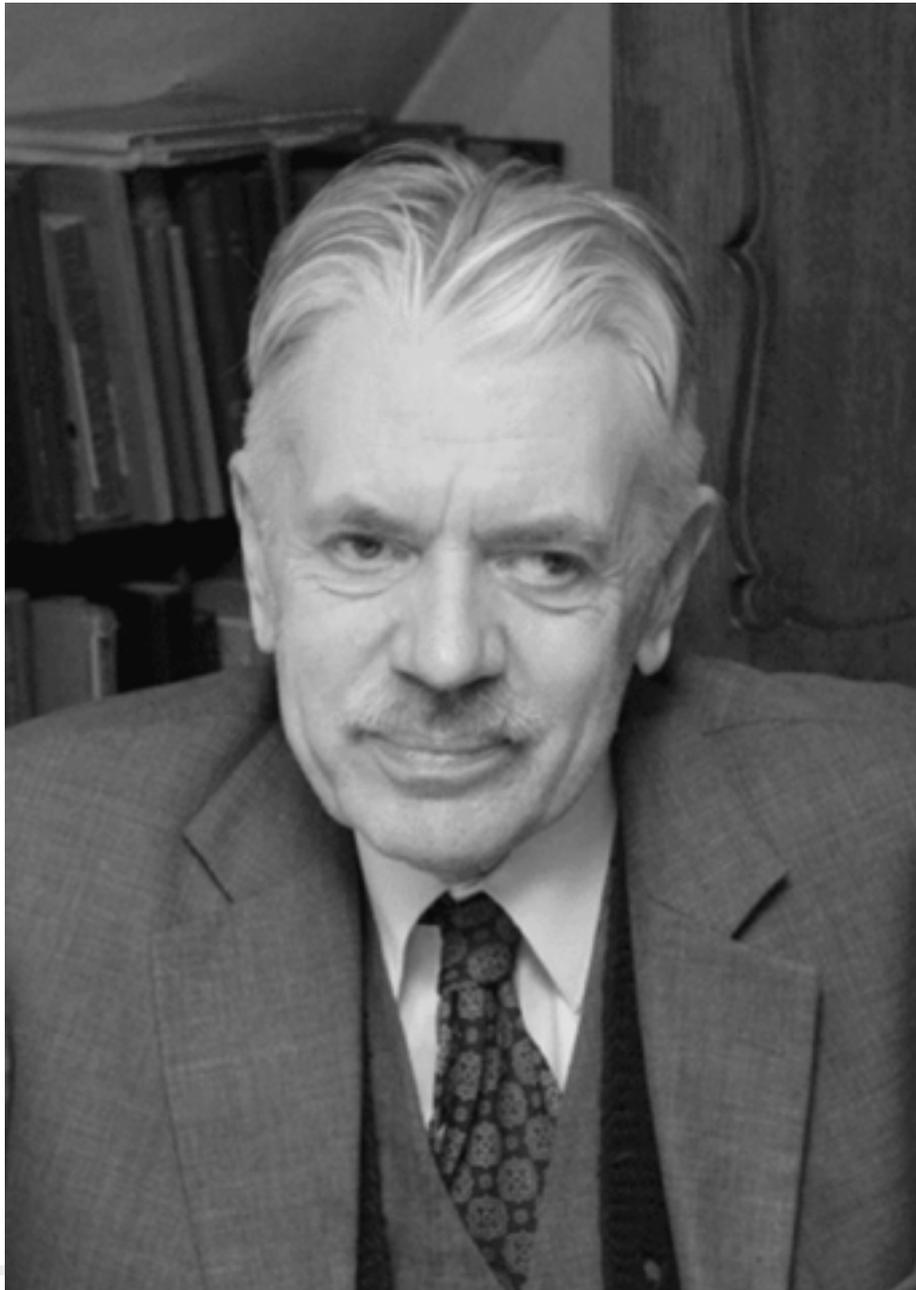
## ERCOM



ERCOM currently gathers 30 member institutions, from the Isaac Newton Institute in Cambridge and Centro Internacional de Matemática in Lisbon on the western shores of Europe, to the Steklov Institute in Moscow and the Emmy Noether Institute in Ramat-Gan in the East. The Banach Center is one of the founding members of ERCOM, and has always played an important role in its discussions, usually represented by the vice director of IM PAN responsible for the Banach Center. The Chairperson of ERCOM is elected by the representatives of the member institutions; the term normally lasts four years. So far the following mathematicians were ERCOM Chairpersons:

1. Ole Barndorff-Nielsen 1997-2001 (MAPHYSTO, Aarhus)
2. Manuel Castellet 2002-2005 (CRM Barcelona)
3. Jan Karel Lenstra 2006-2009 (CWI, Amsterdam)
4. Gert-Martin Greuel 2010-2013 (MFO Oberwolfach)
5. Keith Ball 2013-2015 (ICMS, Edinburgh)
6. Ari Laptev 2015-2018 (Institut Mittag-Leffler, Stockholm)
7. David Abrahams 2018-2021 (Isaac Newton Institute)

Following the spring call for nominations and elections which took place over the summer, since October 1st, 2021 the function of the ERCOM Chairman will be fulfilled by Adam Skalski from IM PAN. The Deputy Chairman of ERCOM is Christophe Ritzenthaler from CIMPA (Nice).



## Obituary: Andrzej Schinzel (1937-2021)

Łukasz Stettner

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**A**ndrzej Schinzel was born at Sandomierz, Poland in 1937. He studied mathematics at the University of Warsaw in the years 1953–1958 and in 1960 obtained a doctorate in mathematics at the Mathematical Institute of the Polish Academy of Sciences (denoted in the sequel as the Institute) as a student of Professor W. Sierpiński. He studied further at Cambridge and Uppsala as a Rockefeller Foundation fellow and in 1962 obtained at the Institute a habilitation in mathematics. Subsequently he worked in the Institute as a research associate, an

assistant professor, an associate professor, since 1968 as the head of the number theory section and since 1974 as a full professor. In the years 1986–1989 he was the scientific director of the Institute.

In 1964 he was a visiting assistant professor at Ohio State University, in 1967 a visiting professor at the University of Paris (still undivided), in 1975 at the Scuola Normale Superiore di Pisa, in 1977 at the University of Michigan, in 1980 at the University of California Irvine, in 1981 at the University of Limoges, in 1984 at the University of Pisa and again at the University of Limoges, in 1994 at the University

of Architecture in Venice, in 2000 at the University of South Carolina.

In 1969-2007 he was the editor of *Acta Arithmetica*.

In 1976 he was elected a member of the Deutsche Akademie der Naturforscher Leopoldina, in 1979 a corresponding member of the Polish Academy of Sciences, in 1982 a full member of the Warsaw Scientific Society, in 1994 a full member of the Polish Academy of Sciences, in 1997 a corresponding member of the Austrian Academy of Sciences, in 2001 an honorary member of the Hungarian Academy of Sciences, in 2002 a corresponding member of the Polish Academy of Arts and Sciences and in 2004 a full member of this academy. In 1998 he received an honorary degree from the University of Caen. He was the vice-president of the Polish Mathematical Society during 1981–83, the chairman of the Division of Mathematical and Physical Sciences of the Warsaw Scientific Society during 1982–1987 and one of the founders of the Sandomierz Scientific Society in 1993. He was named a honorary citizen of the city of Sandomierz in 2016. In 2011 he received a honorary doctorate from the Adam Mickiewicz University

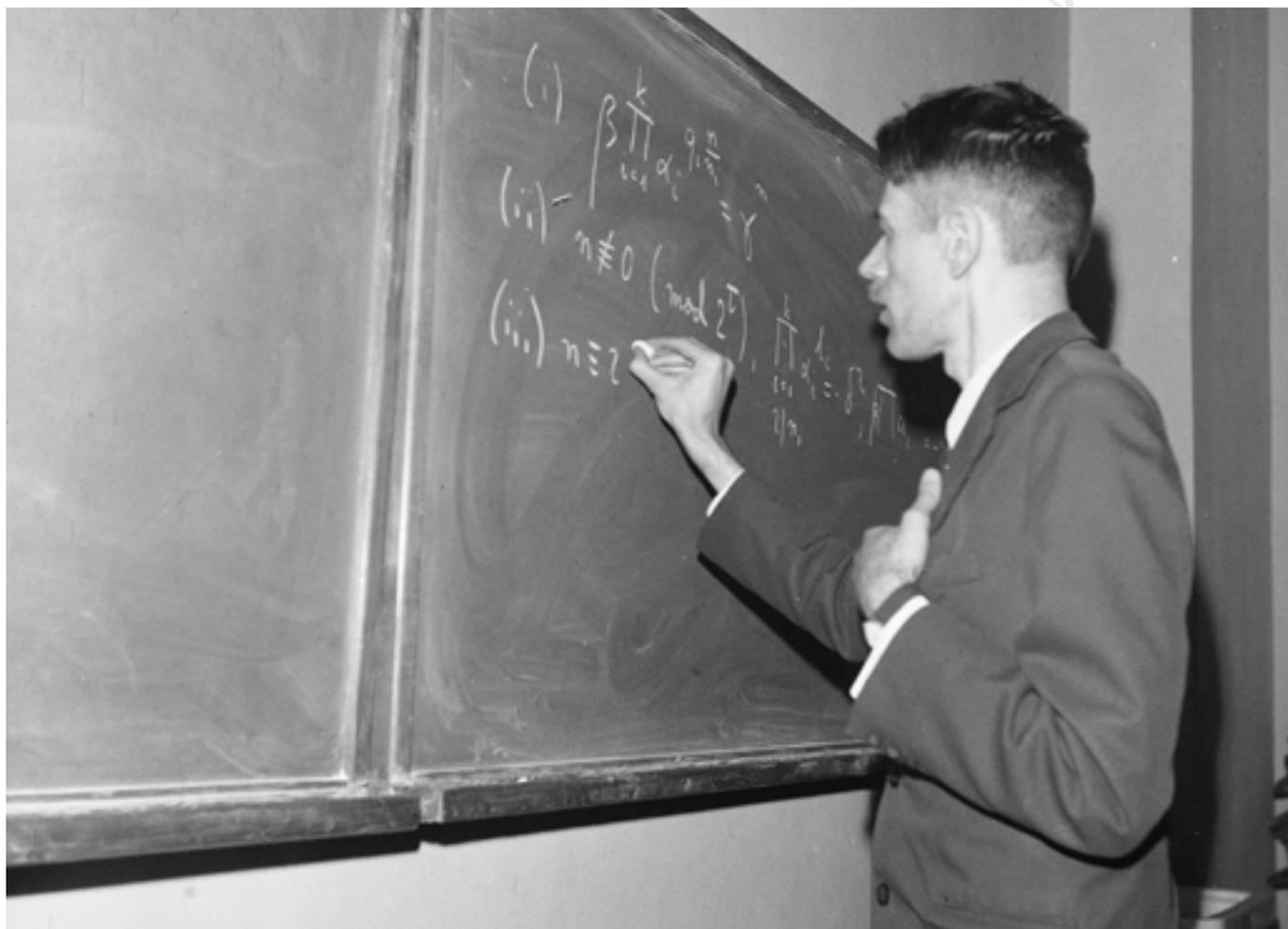
and in 2012 from the Cardinal Stefan Wyszyński University. Prof. Schinzel chaired the Scientific Council of IM PAN in 2007-2018 and afterwards he was named a honorary chair of the Council.

Prof. Schinzel was awarded with three classes of the Order of Polonia Restituta; Commander's Cross, Officer's Cross and Knight's Cross and the Cross Pro Ecclesia et Pontifice.

Prof. Schinzel was a deeply religious person. He was a member of the Literary Archconfraternity of the Blessed Virgin Mary in St. John's Archcathedral in Warsaw. He participated in the summer seminars in Castel Gandolfo in 1993, 2001, 2003 as a guest of Pope St. John Paul II.

Prof. Schinzel was the author of over 349 research articles in various branches of number theory, including elementary, analytic and algebraic number theory, diophantine equations, geometry of numbers in particular algebraic and arithmetic aspects of polynomials.

Prof. Schinzel died on August 21st, 2021 in the Senior's House of PAN in Konstancin Jeziorna. He was buried in the Cathedral cemetery of Sandomierz.



Profesor Andrzej Schinzel circa 1970. Photograph by Grażyna Rutowska, source: National Digital Archives.



## Obituary: Profesor Andrzej Białynicki-Birula (1935-2021)

Feliks Przytycki

Andrzej Szczepan Białynicki-Birula has passed away on 19 April, 2021. He was a world class expert in algebra and algebraic geometry, one of the pioneers of differential algebra. His most cited and influential article is: *Some theorems on actions of algebraic groups*. *Annals of Mathematics* (2) 98 (1973), on existence of invariant decompositions.

He brought up generations of Polish mathematicians and wrote several university textbooks. He was a supervisor of 22 Ph.D. students. Most of them have become outstanding mathematicians and brought up his further mathematical descendants. Some notable names include Juliusz Brzeziński, Maciej Bryński, Jerzy Jurkiewicz, Maksymilian Boratyński, Stefan Jackowski, Michał Szurek, Joanna Świącicka, Agnieszka Bojanowska, Mariusz Koras, Jerzy Konarski, Krzysztof Dąbrowski, Krzysztof Pawałowski, Krzysztof Nowiński, Paweł Traczyk, Andrzej Szczepański and Jan Samsonowicz.

He was born in Nowogródek (now in Belarus) on 26 December 1935. He studied and received a master degree in 1956 at the University of Warsaw and received his Ph.D. from the University of California, Berkeley in 1960. His thesis was written under the direction of Gerhard Paul Hochschild. After a few years spent in Berkeley, he returned to Poland. His return marked the introduction of modern algebraic geometry to Poland.

In the years 1964-1970 he worked as a docent at IM PAN. Since 1970, he was a professor at the University of Warsaw, until very recently.

He was an ordinary member of the Polish Academy of Sciences, the Polish Academy of

Learning, the Warsaw Scientific Society, and Academia Europaea. In 2015 he was distinguished by the University of Warsaw with a doctorate honoris causa. He was a laureate of the Sierpiński medal (1999) and the Orlicz medal (2009).

He was fully devoted to the university, educating thousands of students, creating and discussing with numerous collaborators, during half of century at the University of Warsaw. In the years 1977-1981 he was dean of its Department of Mathematics, Informatics and Mechanics, in the period 1987-1990 he was vice-rector of the University and for many years a member of its Senate.

But his role went far beyond the University; he belonged to the leaders of Polish Science. In the years 1999-2002 he was a member of the Presidium of PAN, in 1991-1997 he was the chairman of the Committee of Mathematics of PAN, and since 2019 its honorary chairman.

At IM PAN he was a long-term member of the Scientific Council and of editorial boards of IM PAN journals, in particular *Fundamenta Mathematicae*.



Professor Białynicki-Birula, both photographs are from his family archive.

# Remembering Professor Edward Flatau

Feliks Przytycki

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On Thursday 16th September, 2021, on the facade of the Institute of Mathematics of the Polish Academy of Sciences (IM PAN) building in Warsaw at 8 Śniadeckich street, an unveiling of a commemorative plaque dedicated to Professor Edward Flatau was held. Professor Edward Flatau, who had his laboratory in this building, was a co-founder of modern neurology. The plaque says:

*In this building acted in the years 1911 – 1939 the laboratory of neurobiology of the Warsaw Scientific Society and of Marcei Nencki Institute of Experimental Biology, whose founder and head was EDWARD FLATAU (1868 – 1932), co-founder of Polish and world neurology, author of a modern human brain atlas, researcher of migraine, an outstanding physician.*

*Polish Neurology Society  
Warsaw Scientific Society  
2021*

The unveiling was preceded by a scientific session at IM PAN, where the achievements of Professor Edward Flatau were detailed. It included short talks and presentations, in particular by Prof. Teofan Domżał (a scientific grandson of Prof. Flatau) and Prof Dariusz Kozirowski (Medical University of Warsaw). Professor Piotr Flatau, the benefactor of the plaque, the grandson of E. Flatau, a researcher at the University of California San Diego, a physicist and foreign member of PAN, gave a moving talk through videophone. Notable was a presentation by Mrs Krystyna Grochowska-Iwańska, a curator of the State Museum in Płock, the native city of Edward Flatau.

Several prominent scientists participated in the event, in particular: Prof. Pawel Rowiński (Vice-president of PAN), Teofan Domżał (Honorary Chairman of PTN – Polish Neurology Society), Jarosław Sławek (Chairman of PTN), Jerzy M. Langer (President of TNW - Warsaw Scientific Society),



Photograph of Edward Flatau (1928) A. Gurtler. From family archive. Source: Wikipedia



From the left: Piotr Goldstein, Dagmara Mirowska-Guzel, Dorota Czarnocka-Cieciura, Krystyna Grochowska-Iwańska, Łukasz Stettner, Teofan Domżał, Paweł Rowiński, Małgorzata Skup, Jerzy Langer, Wojciech Iwańczak, Dariusz Koziarowski, Feliks Przytycki, Jarosław Sławek, Andrzej Friedman. Photograph by Karolina Leśnik.

Wojciech Iwańczak (Secretary General of TNW), Dagmara Mirowska-Guzel (Chair of the 5th Dept. of TNW – Medical Sciences), Andrzej Friedman (Medical University of Warsaw), Małgorzata Skup (Chair of the Committee on Neurobiology of PAN and Head of the Dept. of Neurophysiology at the Nencki Institute).

The event was hosted by Prof. Łukasz Stettner, director of IM PAN, and Prof. Feliks Przytycki, chairman of the Scientific Council of IM PAN.

(After Wikipedia) Edward Flatau (27 December 1868, Płock – 7 June 1932, Warsaw) was a co-founder of the modern Polish neurology, an authority on the physiology and pathology of meningitis, co-founder of the medical journals *Neurologia Polska*

and *Warszawskie Czasopismo Lekarskie*, and member of the Polish Academy of Learning (Polska Akademia Umiejętności). His name in medicine is linked to the Redlich-Flatau syndrome, the Flatau-Sterling torsion dystonia (type 1), Flatau-Schilder disease, and Flatau's law. His publications greatly influenced the developing of the field of neurology. He published a human brain atlas (1894), wrote a fundamental book on migraine (1912), established the localization principle of long fibers in the spinal cord (1893), and with Sterling published an early paper (1911) on progressive torsion spasm in children and suggested that the disease has a genetic component.

Flatau played an important role in the development of the Nencki Institute of Experimental Biology in Warsaw, and created the first experimental neurobiological laboratory in Poland. He was a member and contributor to the development of the Warsaw Scientific Society (TNW).

In October 1911, Flatau donated to TNW his neurological laboratory. In that time, the TNW received as a gift from Józef Mikołaj Potocki, a house on Śniadeckich 8, to which the laboratory was moved. Here he collaborated with an assistant of Maria Skłodowska-Curie, Ludwik Wertenstein, on experimental oncology (use of radioactivity).

In addition to his scientific work, he had a private practice in Warsaw. In 1904, he became head of the Department of Neurology at the Jewish Hospital in Czyste (now included in the Wola Hospital of Warsaw), which he led for 28 years.



The commemorative plaque dedicated to Professor Edward Flatau on the facade of IM PAN building in Warsaw at 8 Śniadeckich street. Photograph by Karolina Leśnik.

## New OPUS grants at IM PAN

The very competitive OPUS grants are offered by the National Science Centre (Poland) usually twice a year. Unlike, other programs of the NCN, no restriction is set on the year of obtaining the PhD for the Principal Investigator.

ARITHMETIC OF DIFFERENTIAL EQUATIONS  
(OPUS 20 UMO-2020/39/B/STI/00940)



Masha Vlasenko

Recently the research project “Arithmetic of differential equations” led by Masha Vlasenko won an OPUS grant from the National Science Centre of Poland. This project focuses at number theoretical properties of differential systems associated to families of algebraic varieties. There is a small study group at IM PAN aimed to involve postdocs and students in research on this fascinating subject. In the XIX century the German mathematician Gotthold Eisenstein observed that expansion coefficients of algebraic functions can be made integral after a simple rescaling of the variable. Somewhat similarly, expansion coefficients of solutions of differential equations arising in algebraic geometry possess various integrality and congruence properties. Their study was initiated by Bernard Dwork in 1960s in his work on deformation theory of local zeta functions. Integrality and congruences for expansion coefficients of period functions were also observed by physicists in the last decade of the XX century. In algebraic ge-

ometry and theoretical physics, mirror symmetry is a relationship between geometric objects called Calabi–Yau manifolds. Two such manifolds may look very different geometrically but are nevertheless equivalent when employed as ‘extra dimensions’ to describe interaction of particles in string theory. Physicists predicted that the number of curves of a given degree on a Calabi–Yau manifold can be computed using solutions to a differential equation on its mirror. This is why differential equations associated to Calabi–Yau manifolds are especially interesting for number theorists.

One of the goals of “Arithmetic of differential equations” is to reach a better understanding of several arithmetic phenomena occurring in mirror symmetry.

Let us now say a few words about the number theory group at IM PAN. There is a seminar which continues the tradition of number theory seminars held for many years by professor Schinzel. Nowadays it gathers researchers from Warsaw and other Polish cities, and its ultimate goal is to consolidate the number theory community in the country. This year it is organized by Bidisha Roy and Masha Vlasenko from IM PAN, Bartosz Naskęcki from the Adam Mickiewicz University in Poznań and Jakub Byszewski from the Jagellonian University in Kraków. During the pandemic the seminar was running on Zoom, the talks were advertised internationally and there were participants and speakers from many universities and research centres worldwide. At present the seminar has returned to the classical style with board talks and local speakers.

ANALYSIS OF ASYMPTOTICAL AND NON  
CONVEX STOCHASTIC CONTROL PROBLEMS  
WITH APPLICATIONS  
(OPUS 19 UMO-2020/ 37/ B/ ST1/ 00463)



Łukasz Stettner

In this project we are interested in two kinds of stochastic control problems: asymptotics (limit behavior) of long run functionals and non convex stochastic control problems. Long run functionals appear in a form of discounted functionals, average cost per unit time functionals and risk sensitive functionals. The last class of functionals is very important since due to their form they measure not only the expected value of an average cost but also its other moments, in particular variance, which is frequently considered as a measure of risk. The state process is modeled using controlled Markov processes in discrete or continuous time, that is processes for which the future behavior depends on the actual state but does not depend on the former states. In the case of continuous time we prefer impulse control, which in practice is an important class of feasible controls. It consists of a sequence of random times and controls chosen at these random times. In this project we are studying approximations of average cost per unit time functionals using discounted functionals, discrete time approximations of continuous time functionals, approximations of average cost per unit time functionals using risk sensitive long run functionals. We would like not only to approximate functionals but also to do the same with value functions i.e. optimal values of the cost functionals. Such approximations are important to form optimal or nearly optimal controls. Namely, frequently optimal control of the limit problem (a function of the state process) is nearly optimal for the real problem. The state process may be either fully observed or only partially observed and this data is used in order to determine the control. Since we are studying long time horizons the problems with partial observations (degenerated or non degenerated) are hard to study.

Non convex problems appear in many situations in stochastic control. In this project we shall concentrate on a family of problems coming from the mathematics of finance. We are thinking about

markets with concave transaction costs. It is quite usual that when we buy or sell larger number of assets or currency or more expensive commodity then we pay a transaction fee which depends on the transaction volume and is smaller in percent when the transaction is large. While the case of proportional transactions has been studied intensively this case seems to require investigation. When we consider the so called solvency set i.e. the set of all non-negative positions of our portfolio, then it appears to be non convex set. We are interested in the characterization of the conditional of absence of arbitrage, which is an absence of the possibility of obtaining nonnegative gain, which is positive with positive probability, without risk. We would also like to characterize optimal portfolio maximizing expected utility from terminal wealth. Solving such problem, we notice that although the utility function is concave the value function appears to be non concave.

ANALYSIS OF TRAVELLING WAVES  
IN SEMILINEAR ELLIPTIC PROBLEMS  
(OPUS UMO-2020/37/B/STI/02742)



Jarosław Mederski

The research project is devoted to the study of travelling waves solutions to some elliptic problems arising in Bose-Einstein condensates in nonlinear optics. The physical models are described by the Gross-Pitaevskii equation, the Schrödinger equation as well as by the electromagnetic wave equation. These models are widely investigated in physics and engineering, however there is a need for an analytical study from the mathematical point of view. Some long-standing open problems have been answered recently, however new questions and mathematical challenges have appeared.

Our first aim is to find a large class of nonlinear effects (e.g. Kerr-effect, a cubic-quinticeffect arising in nonlinear optics), for which we obtain travelling waves solving the Gross-Pitaevskii equation. Moreover we want to investigate the existence of travelling waves in the presence of an external potential, which is used to confine the condensate in the Bose-Einstein model. We intend to study the multiplicity of the travelling waves as well, that is the existence of finitely or infinitely many solutions with

possibly different energy.

Secondly, we are developing a new concept of multidimensional black and dark solitons (a special type of solitary waves in nonlinear optics) in  $\mathbb{R}^N$ . Next, we also look for two dimensional profiles of the electromagnetic travelling wave fields in nonlinear media described by the Maxwell equations and the constitutive material laws. In particular, we want to find profiles taking into account nonlinear effects, possibly sign-changing (modeling both focusing and defocusing effects) and involving a quintic nonlinearity.

The project lies at the intersection of the following fields: variational methods, spectral theory, partial differential equations, functional analysis and mathematical physics. The potential applications of the expected results is a better understanding of the physical models. As a potential output, we expect that new nonlinear phenomena in the context of travelling waves will yield to analytical tools, a novel concept of dark/black solitons will be developed with analytical justification; the existence of solutions to our problems and their symmetry properties will be obtained. We plan to develop a functional and variational setting, which allows to study travelling waves by means of PDE methods, where some new mathematical techniques have to be worked out. We are convinced that these new methods will allow to study problems with nonzero conditions at infinity, including strongly indefinite nonlinear partial differential equations like nonlinear wave equations or Schrödinger equations, and will be of interest for specialists in all the above fields.

We expect that the results of the project will give rise to further studies of the dynamics of the time-dependent Gross-Pitaevskii equation or the nonlinear electromagnetic wave equation.

## OPTIMAL REPRESENTATION OF DYNAMICAL SYSTEMS

(OPUS 20 UMO 2020/39/B/ST1/02329)



Yonatan Gutman

The basic object in the field of dynamical systems is a pair  $(\mathbf{X}, \mathbf{T})$  consisting of a phase space  $X$  and a time evaluation map  $\mathbf{T} : \mathbf{X} \rightarrow \mathbf{X}$ . In different subfields of dynamics  $\mathbf{X}$  and  $\mathbf{T}$  are subject to different regular-

ity stipulations. For example in ergodic theory  $\mathbf{X} = (X, B, \mu)$  is a (standard Lebesgue) probability space and  $\mathbf{T} : \mathbf{X} \rightarrow \mathbf{X}$  is a measurable measure-preserving map, whereas in topological dynamics  $\mathbf{X} = (X, \mathbf{T})$  is a compact (usually metric) topological space and  $\mathbf{T} : \mathbf{X} \rightarrow \mathbf{X}$  is a continuous map. These and other appropriate abstractions within the theory of dynamical systems allow for analyzing long-term properties of systems naturally occurring in different branches of science.

Successful modeling and analysis of dynamical systems within the natural sciences depend, as a first step, on a process of acquiring data from observations, tailored to the attributes in which one is interested. This process necessarily results with a representation of the system. It is therefore natural to ask how to acquire/represent a given system optimally from the point of view of simplicity, precision, efficiency, reconstructability, storage constraints or other parameters depending on the exact circumstances. In this Project we investigate several problems arising in connection with these considerations.

Let us illustrate one of the problems we study. A renowned approach to the problem of optimal acquiring and reconstruction of a sparse (=few non zero entries) data vector  $x \in \mathbb{R}^N$  is the technique of compressed sensing developed by Candes, Donoho, Romberg and Tao. Assuming the vector  $x$  is *s-sparse*, it is shown that applying a random matrix  $A \in \mathbb{R}^{m \times N}$  with  $m \approx s \ln(N/s) \ll N$ , one is able to reconstruct  $x$  from  $y = Ax$  efficiently with high probability. We are concerned with extending the compressed sensing framework to the realistic scenario where the data is given by an analog signal represented (as the result of sampling) by a continuous-alphabet discrete-time stochastic process  $\dots x_{-1}, x_0, x_1, \dots$ . This subject has recently gained popularity. The main problem is finding *universal* algorithms in various classes of stochastic processes. A universal algorithm is an algorithm which performs *optimally* despite not having prior knowledge of the exact statistics of the process being compressed.

The research team of the Project consist of Yonatan Gutman, the Principal Investigator, a Co-Investigator, Tomasz Downarowicz (Wrocław University of Science and Technology), and a two-year Postdoc. The Postdoc is expected to start her or his appointment around the end of 2022. The recruitment ad will appear soon at the websites of IM PAN, NCN, EURAXESS, European Women in Mathematics and MathJobs. Suitable candidates are encouraged to contact the Principal Investigator.

# A new International Scientific Council of the Banach Center.

Adam Skalski

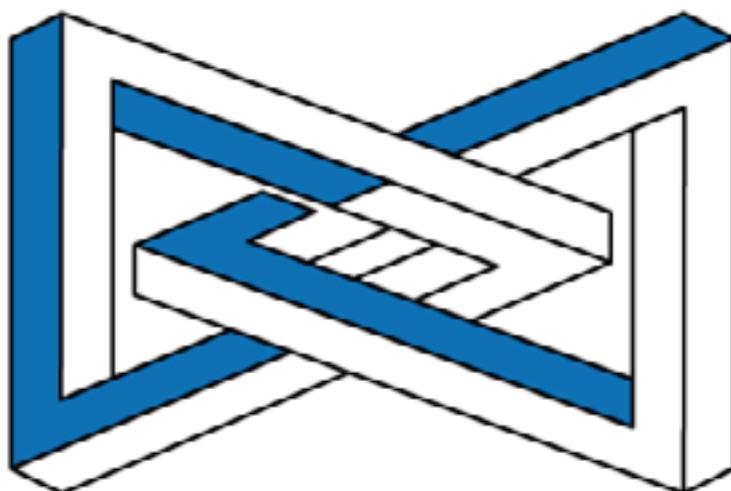
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According to an agreement with the European Mathematical Society signed in 1993 the activities of the Banach Center are supervised by an International Scientific Council of the Banach Center. The Council meets every year in the spring to assess the conference applications; apart from that it serves as an advisory body to the Director of IM PAN in all matters regarding the Banach Center.

The Council consists of nine members, three of which are nominated by the European Mathematical Society, three represent Poland and three come from other founding countries of the Banach Center. The Chairman of the Council is traditionally one of the EMS-nominated members; in the past this role was filled by for example by Friederich Hirzebruch, Rolf Jeltsch, Ari Laptev, Marta Sanz-Sole and Pavel Exner.

The term of membership lasts four years, and can be renewed once. The new council has just been formed (for 2022-2025). Its members are:

- Gert-Martin Greuel (University of Kaiserslautern, Germany) – Chairman, EMS-nominated, second term
- Miklos Abert (Alfréd Rényi Institute, Hungary)
- Lucian Beznea (Simion Stoilow Institute, Romania)
- Mikołaj Bojańczyk (University of Warsaw, Poland)
- Alexey Davydov (National University of Science and Technology “MISIS”, Russia)
- Hélène Esnault (Freie Universität Berlin, Germany), EMS-nominated
- Sławomir Kołodziej (Jagiellonian University, Poland), second term
- Mariusz Lemańczyk (Nicolaus Copernicus University, Poland)
- Sárka Nečasová (Institute of Mathematics of the Czech Academy of Sciences, Czech Republic), EMS-nominated



**Banach Center**  
INSTITUTE OF MATHEMATICS PAS

We thank all the distinguished mathematicians listed above for their agreement to serve on the Council. We also thank the members who are leaving the Council in 2021: Pavel Exner (Doppler Institute for Mathematical Physics and Applied Mathematics, Czech Republic), Alice Fialowski (Eötvös Loránd University, University of Pécs, Hungary), Grzegorz Karch (University of Wrocław, Poland), Domokos Szász (Budapest University of Technology and Economics, Hungary), Henryk Woźniakowski (University of Warsaw, Poland), Sjoerd Verduyn Lunel (Universiteit Utrecht, The Netherlands).

# New Faculty Autumn 2021

Renata Podgórska-Zajac

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## OPEN CALLS FOR TEMPORARY RESEARCH POSITIONS

### 3—7 years positions:

- Mateusz Wasilewski, adiunkt position, Functional Analysis
- Aneta Wróblewska-Kamińska, professor of IMPAN, Differential Equations

### 2- 4 years positions:

- Damian Osajda, adiunkt position, Topology
- Marco Capolli, adiunkt position, Differential Equations

### ½ - 2 years positions:

- Bartosz Bieganski, adiunkt position, Differential Equations
- Genadi Levin, professor of IM PAN position, Dynamical Systems
- Jakub Siemianowski, adiunkt position, Differential Equations
- Justyna Szpond, adiunkt position, Algebra and Algebraic Geometry
- Zohreh Ravanpak, adiunkt position, Mathematical Physics and Differential Geometry
- Lorenzo Marino, adiunkt position, Probability Theory

### 1-2 years positions for young mathematicians

- Rodion Deev, adiunkt position, Algebra and Algebraic Geometry
- Loris Arnold, adiunkt position, Functional Analysis
- Andreas Kraft, assistant position, Noncommutative Geometry
- Konstantin Bogdanow, adiunkt position, Dynamical Systems

- Sugato Mukhopadhyay, assistant position, Functional Analysis
- Karol Hajduk, adiunkt position, Differential Equations
- Daniel Vargas-Montoya, assistant position, Number Theory
- Mohamed Marzougue, adiunkt position, Probability Theory
- Paweł Plewa, adiunkt position, Functional Analysis

### POSITIONS FUNDED BY NCN GRANTS

- Aleksandra Borówka, adiunkt position, Algebra and Algebraic Geometry, Sonata Bis7
- Francesco Galuppi, adiunkt position, Sonata Bis 7
- Mariia Boritchev, adiunkt position, OPUS19
- Justyna Signerska-Rynkowska, adiunkt position, Topology, Dioscuro
- Michał Lipiński, assistant position, Topology, Dioscuro
- Rafał Topolnicki, adiunkt position, Topology, Dioscuro
- Rafał Meller, adiunkt position, Probability Theory, Sonatina

### POSITIONS FUNDED BY ERC GRANTS

- Loris Arnold, adiunkt position, Functional Analysis



# Prizes awarded by IM PAN in 2021

Renata Podgórska-Zajac

- **The IM PAN Scientific Prize**

The IM PAN Scientific Prize is awarded annually for exceptional accomplishments in the field of Mathematics. The laureate is chosen by a Jury, whose 7 members are appointed by the Director of IM PAN after consulting the Scientific Council of IM PAN.

The 2021 IM PAN Prize was awarded to profesor Krzysztof Krupiński from the University of Wrocław for development of a deep theory and achieving breakthrough results, linking model theory with descriptive set theory and topological dynamics, in a cycle of papers published in the years 2010-2020.

- **The Kuratowski Award**

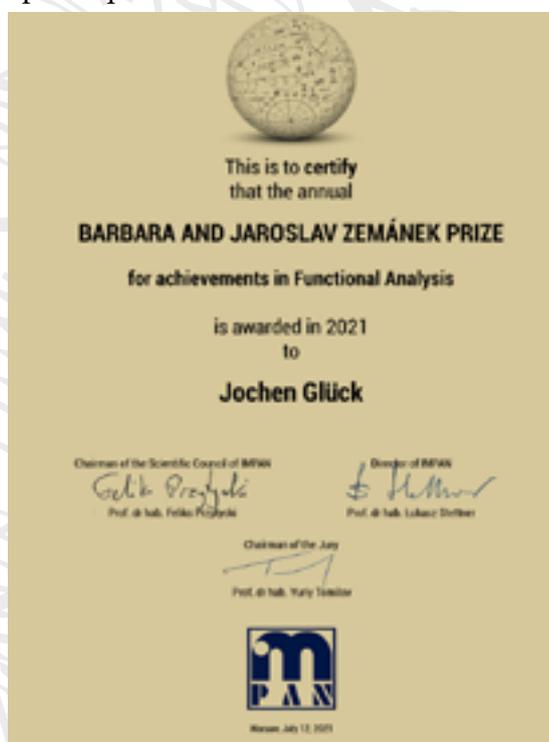
The Kuratowski Prize is awarded annually by IM PAN and Polish Mathematical Society to a young Polish mathematician (age limit: 30). The winners of the award in 2021 are: Dr. Wojciech Górny from the University of Warsaw and the University of Vienna, for results on partial differential equations regarding the least gradient problem, and Marcin Sroka from the Jagiellonian University for results in geometric analysis concerning the existence and regularity of solutions of the quaternionic Monge-Ampère equation.



Photographs of the Zemánek and IM PAN prizes by Anna Karolak.



Recipients of the Kuratowski Award: Dr Wojciech Górny (left), and Marcin Sroka (right)



- **The Barbara and Jaroslav Zemánek prize**

The prize was established thanks to the funds transferred by Prof. Zemánek and his wife to IM PAN, the institution in which Prof. Zemánek worked for many years. The Prize is awarded annually for achievements in functional analysis, with special emphasis on operators' theory. The Laureate is chosen by a Jury appointed by the Director of IM PAN. In 2021 the Prize was awarded to Dr Jochen Glück from the University of Passau.

•For more information see:

<https://www.IMPAN.pl/en/events/awards>

# Prizes awarded to IMPAN employees in 2021

Adam Skalski

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On October 6th, 2021 Yonatan Gutman received the National Science Center Award in exact and technical sciences (the award, established by the Council of the National Science Center in 2013, honours significant discoveries in basic research conducted at Polish host institutions by researchers under 40 years of age).

Yonatan Gutman works on the theory of dynamical systems, and more specifically on topological dynamics and ergodic theory. He won the award for six long papers published in 2019-2021 concerning problems lying at the intersection of dynamical systems, ergodic theory and classical topology. The results of his investigations, notably these concerning the optimal dimension estimates for embedding abstract dynamical systems into Hilbert cubes and these regarding the structure of nilspaces, are considered to be genuine breakthroughs in the field. More information can be found at the address: <https://www.ncn.gov.pl/aktualnosci/2021-10-06-nagroda-ncn-w-rekach-mlodych-naukowcow>



Winners of the National Science Centre Award for 2021. From left: Yonatan Gutman (Physical Sciences and Engineering), Sebastian Glatt (Life Sciences) and Paweł L. Polkowski (Arts, Humanities, Social and Sciences). Photograph by Michał Łepecki.



Professor Feliks Przytycki, Laureate of the Waclaw Sierpiński Medal. Photograph by Emilia Konopka.

Professor Feliks Przytycki is the 2020 Laureate of the Waclaw Sierpiński Medal. The award ceremony took place at the University of Warsaw on October 14, 2021.

The title of the Lecture by Professor Przytycki was “From dynamics to geometry, or from the butterfly effect via equilibrium states to fractal dimensions”.

The Waclaw Sierpiński Medal is awarded to outstanding mathematicians associated with Poland. The Waclaw Sierpiński Medal and Lecture is a joint venture of the University of Warsaw and the Polish Mathematical Society. The Medal is awarded since 1974.

On the day of receiving the Medal, the laureate delivers a lecture called the Waclaw Sierpiński Lecture.

For many years the Chairman of the Committee was Professor Andrzej Schinzel, who recently passed away.

## A new professor at the Institute: Adam Nowak



The interview with Adam Nowak was conducted by Yonatan Gutman.

On January 4th, 2021 the President of Poland conferred upon Adam Nowak the title of Professor.

**Y.G.:** Congratulation!

**A.N.:** Thank you.

**Y.G.:** Please describe roughly your mathematical life. What were the milestones leading to the position you hold now?

**A.N.:** Well, it seems my adventure with mathematics began implicitly already at school. It was the subject which I liked the most and which I could learn fast and without much effort. That somehow motivated the choice of mathematical studies, though I considered also physics and computer science. Initially my plan during undergraduate studies was to specialize in some branch of applied mathematics, like e.g. financial mathematics that was quite fashionable that time, and then get a good job in some company. However, gradually I discovered the beauty of pure mathematics and finally, in 2000, decided to start PhD studies. My advisor was Prof. Krzysztof Stempak. Actually, the way we met was a very fortunate coincidence. From the perspective of time I can tell that I owe him a lot. His high quality supervision and then our joint collaboration to large extent determined my further scientific development.

After receiving a PhD degree in 2004 I continued intensive research work, always having more questions and topics than being able to deal with. A crucial aspect was traveling, meeting new collaborators and going into new topics. Perhaps the biggest sentiment I have to my numerous visits to Gothenburg University and Chalmers University of Technology, where I had the pleasure to collaborate with Prof. Peter Sjögren. He should be named, after Prof. Stempak, as a person from whom I learned a lot and certainly to whom I owe a lot.

Probably the biggest milestone in my career

was choosing to work at IM PAN, in 2009. Here I found perfect conditions for scientific work and development.

I should also mention, as a kind of milestone, serving as the PhD advisor of T.Z. Szarek and B. Langowski (theses defended in 2015 and 2016). That was an important (and demanding, to be honest) experience. I tried to keep up to the quality of supervision which I myself had earlier received. Now they are both active and I think successful mathematicians, at the moment continuing post-docs at Rutgers University/BCAM Bilbao and Indiana University, respectively. Another significant career experience is editorial work. In 2016 I joined the editorial boards of *Studia* and *Colloquium*. Since 2018, together with G. Karch, I am the managing editor of *Colloquium*.

To conclude, let me stress that the scientific output, thus also the position I have now, are the result of the coincidence of several influential factors including meeting the right people (no doubt I had a lot of good luck in this aspect!), working hard, being stubborn in attacking difficult problems and also, last but not least, always having understanding and support from my family: initially parents, then my wife (who, by the way, also went through a mathematical education and concluded with a PhD degree) and finally my children.

**Y.G.:** Your narrative is very inspiring. These are important lessons for young mathematicians. Let us now move to mathematics itself. Could you please tell us about your research?

**A.N.:** In general, I am interested in what is widely understood as analysis, but my research focuses mainly around modern harmonic analysis. Perhaps the main part of research I have undertaken so far concerns harmonic analysis related to the so-called classical orthogonal expansions, both discrete and continuous. Here I investigated diverse objects and notions, like Riesz transforms, conjugacy, singular integrals, maximal operators, fractional integrals,

transplantation, multipliers, Sobolev spaces and others. Apart from that, I have been active in various areas of real harmonic analysis, dealing with problems involving the Fourier transform, the spherical Radon transform, harmonic functions, Calderón-Zygmund operators and potential operators, among others. Often special functions play an important role in my research. Usually, I use them as tools, nevertheless I also have some results in special functions theory as such.

There are a few lines of achievements that I am particularly happy with and proud about. To mention just one, let me describe briefly our recent joint result with P. Sjögren and T.Z. Szarek (published in 2019 in *J. Math. Pures Appl.*). Namely, we found genuinely sharp estimates of the heat kernel on a Euclidean sphere of arbitrary dimension. Heat kernel bounds of this type are rare in the literature and much more subtle than commonly appearing only qualitatively sharp bounds. The difference is that the latter allow different constants in exponential factors in the lower and upper estimate, which roughly speaking can consume e.g. various polynomial factors. In the genuinely sharp bounds all the factors must precisely be determined. The problem for the sphere was long standing open, and remarkably our result is new even in case of the ordinary sphere of dimension 2! More recently, we extended the genuinely sharp spherical heat kernel estimates to all compact rank one Riemannian symmetric spaces, i.e. to all real, complex and quaternionic projective spaces and the exceptional Cayley's projective plane over octonions (the paper has been published this year in *Math. Ann.*). Nonetheless, it should be remarked that all these results have roots in my and P. Sjögren's study of the heat kernel associated with expansions in Jacobi polynomials. It all began around 2005 and it took us years to obtain the first reasonable description of that kernel, but this is another story...

**Y.G.:** You serve as the head of the Wrocław Branch of IM PAN. Please tell us about the history and future

plans for this branch.

**A.N.:** True, I have been serving as the head since late 2014. Concerning the Branch history, unfortunately I do not have a complete picture of it. Actually, I tried to answer similar questions in the past, but there seems to be no satisfactory written report available. Anyway, let me say that many recognized mathematicians worked, at least in some periods, at the Wrocław Branch, including Steinhaus, Marczewski, Hartman, Ryll-Nardzewski, and Hulanicki. After the political crisis in March 1968 the Branch offered a "shelter" for those mathematicians who for political reasons were not allowed to work at the Wrocław universities, particularly not to have contacts with students.

Nowadays, the Branch is rather small in terms of mathematicians employed, at the moment the number is 6. In the recent five years our building and the area surrounding it underwent an extensive renovation. This together with the location in Wrocław's beautiful historical Szczytnicki Park create excellent conditions for scientific work. Thus the natural plan for the future should be scientific revitalization and strengthening of the Branch.

**Y.G.:** What role does the Wrocław branch play in the mathematical landscape of Wrocław?

**A.N.:** In the mathematical landscape of Wrocław there are three pivotal institutions: The University of Wrocław, Wrocław University of Science and Technology and IM PAN represented by the Wrocław Branch. The last one integrates, in some sense, the mathematical community of Wrocław. People from the two universities regularly spend here their scientific leaves. Also, there have been common seminars involving the three institutions, like e.g. "Harmonic analysis and orthogonal expansions" I have been co-leading. Moreover, for several years the Branch co-organizes and hosts annual mathematical picnics for the whole Wrocław mathematical community which, by the way, are quite successful events.

**Y.G.:** Finally, are there any open problems or directions you would like to mention/advertise?

**A.N.:** Sure, I would like to advertise working at IMPAN, especially in the Wrocław Branch. In my case choosing IMPAN turned out to be a very good decision!



Photographs from Adam Nowak's personal archive.

# 20 years of IMPANGA —on the occasion of Prof. Piotr Pragacz's retirement

Christophe Eyrat



Prof. Piotr Pragacz (Będlewo 2021). Photograph by Letterio Gatto.

Founded in 2000 and conducted for more than 20 years by Professor Piotr Pragacz, **IMPANGA** — the acronym for Instytut Matematyczny Polskiej Akademii Nauk - Geometria Algebraiczna — is a research environment in algebraic geometry (in the broad sense of the word) associated with the Department of Algebra and Algebraic Geometry of the Institute of Mathematics of the Polish Academy of Sciences. Mathematicians working at **IMPANGA** are primarily, but not exclusively, interested in complex algebraic geometry - a classical domain of Mathematics where fundamental questions in geometry and related problems in algebra and combinatorics are studied. Growing steadily over the years, the spectrum of the research interests of the **IMPANGA** group now includes classical projective and affine complex algebraic geometry, vector bundles, moduli spaces, intersection theory, enumerative geometry, algebraic combinatorics, Schubert calculus, secant varieties and ranks of tensors, local and global theories of singularities, analytic geometry and local algebra, geometry and topology of hypersurfaces, Calabi-Yau varieties, arithmetic algebraic geometry, Hilbert schemes, algebraic geometry in positive characteristic, representation theory and number theory.

The heart of **IMPANGA** is the *IMPANGA Seminar*, a bi-monthly seminar held at the Institute of Mathematics of the Polish Academy of Sciences in Warsaw. Organized by Professor Pragacz with the help of a team of collaborators including P. Achinger, W. Buczyńska, J. Buczyński, S. Cynk, C. Eyrat, M. Kapustka and A. Langer (in alphabetical order), this seminar attracts a large number of participants from all over Poland and hosts speakers from around the world. Mathematicians who gave lectures at this seminar include J.-P. Brasselet, S. Capell, H. Duan, O. Debarre, H. Esnault, L. Gatto, L. Gruson, H. Hamm, F. Hirzebruch, L. Katzarkov, V. Kiritchenko, J. Kollár, W. Kucharz, A. Lascoux, V. Lazić, L. Manivel, V. Mehta, T. Mostowski, A. Némethi, K. O'Grady, M. Oka, A. Parusiński, T. Peternell, K. Ranestad, R.

Rimányi, S. Schröer, J. Schürmann, V. Srinivas, B. Totaro, J. Włodarczyk (in alphabetical order) among many others. On January 31st, 2020, the seminar celebrated its 400th meeting. For that special event, we had lectures by F. Catanese and Lê Dũng Tráng.

Besides its regular seminar, **IMPANGA** also organized many schools such as *Characteristic classes* (2002), *Stratifications of moduli spaces* (2002), *Schubert varieties* (2003), *Symplectic topology* (2004), *Moduli spaces* (2005), *Holomorphic symplectic singularities* (2006). It also run research groups including *Classical algebra, combinatorics and Hoene-Wroński* (2008), *Thom polynomials and the Green-Griffith conjecture* (2011), *The ubiquity of Wrońskians* (2011), *Okounkov bodies and Nagata type conjectures* (2013), *The geometry of homogeneous varieties* (2013), and *Abelian varieties* (2014). **IMPANGA** organized special sessions as well: *Hommage à Grothendieck* (2004), *Algebraic cycles and motives - IMPANGA 100* (2005), *In honor of Hoene-Wroński* (2007), and *Zeta functions* (2007).

In 2003, **IMPANGA** organized, jointly with the Institutes of Mathematics of the Bulgarian and Romanian Academies of Sciences, a conference entitled *Algebraic geometry, algebra and applications* which was held in Borovetz, Bulgaria. Since 2010, **IMPANGA** also organizes major international

meetings every five years at the Banach Center in Będlewo. The first one in 2010 was the *IMPANGA summer school on algebraic geometry*. It was a school devoted to Prym varieties and their moduli, moduli spaces of curves and abelian varieties, differential forms and applications to moduli,  $K3$  and Enriques surfaces, invariants of singularities in birational geometry, minimal model program, toric varieties and equivariant cohomology. The second meeting of the series which took place in 2015 was the *Conference on algebraic geometry IMPANGA 15*. Topics discussed there include Chern class formulas for degeneracy loci, equivariant cohomology of flag varieties, moduli spaces of abelian varieties and surfaces, characteristic classes of singular varieties, Thom polynomials, tropical algebraic geometry and its applications, geometry in positive characteristic and filtrations of  $B$ -modules. The latest large event organized by **IMPANGA** was the *Conference IMPANGA 20 on Schubert varieties*. Due to the COVID-19 pandemic, this meeting which was initially scheduled for June 2020 was held in July 2021 in a hybrid form allowing the participants to attend the event either in person or online. The goal of this conference was to discuss recent progress on Schubert varieties, their appearances in algebraic geometry, representation theory, combinatorics and mathematical physics.

Speakers who contributed to **IMPANGA** schools and conferences (apart from speakers at the seminar already mentioned above) include K. Altmann, P. Aluffi, D. Anderson, G. Bérczi, M. Brion, A. Buch, P. Cascini, C. Ciliberto, I. Coskun, J.-M. Drezet, L. Escobar, G. Farkas, G. van der Geer, T. Gómez, B. Harbourne, J. Huh, J. M. Hwang, S. Kato, M. Kazarian, S. Kebekus, J. Keum, A. Knutson,

T. Lam, M. Lehn, L. Mihalcea, R. Miranda, S. Mukai, J. P. Murre, M. Mustață, T. Ngô Dac, K. Ono, L. Patimo, N. Perrin, F. Russo, A. H. W. Schmitt, F. O. Schreyer, M. Shimozono, H. Tamvakis, J. Tymoczko, M. Vlasenko, P. Zinn-Justin (in alphabetical order) among many others.

Another aspect of the activities by **IMPANGA** is editing the *IMPANGA Lecture Notes* arising from the seminars, schools and conferences organized by the group. Currently, the following four volumes are available: *Topics in cohomological studies of algebraic varieties* (P. Pragacz, ed., Birkhäuser 2005), a volume dedicated to A. Grothendieck; *Algebraic cycles, sheaves, shtukas, and moduli* (P. Pragacz, ed., Birkhäuser 2007), dedicated to J. Hoene-Wroński; *Contributions to algebraic geometry* (P. Pragacz, ed., EMS Publishing House 2012), dedicated to O. Zariski; and *Schubert varieties, equivariant cohomology and characteristic classes* (J. Buczyński, M. Michałek and E. Postingshel, eds., EMS Publishing House 2018), a volume dedicated to F. Hirzebruch. **IMPANGA** also edited a special volume about J. Hoene-Wroński: *Hoene-Wroński: life, mathematics, and philosophy* (P. Pragacz, ed., IMPAN 2008).

On October 8th 2021, the *IMPANGA Seminar* organized a special session in honor of Professor Pragacz on the occasion of his retirement. For that special event, we had lectures by L. Darondeau and M. Kapustka.

*All members of the group are grateful to you, Professor Pragacz, for 20 years of your remarkable work at IMPANGA. We wish you all the best and look forward to your many new mathematical discoveries in the future!*

*May IMPANGA continue for another 20 years and beyond!*



Conference IMPANGA 15 (Będlewo 2015). Photograph by Sławomir Malecha

# BANACH CENTER UPCOMING EVENTS 2022

(continued from page 2)

Title	Date	Organizers	Place
Topics in variational problems arising from models in physics	24-30.07.2022	M. Clapp, J. Mederski, A. Szulkin, et al.	Będlewo
19th WORKSHOP: Noncommutative probability, noncommutative harmonic analysis and related topics, with applications	31.07.-06.08.2022	M. Bożejko, B. Das, W. Ejsmont, et al.	Będlewo
Galois representations and automorphic forms	07-13.08.2022	G. Banaszak, S. Barańczuk, T. Berger	Będlewo
Projection Algorithms: Stefan Kaczmarz 125th Birthday Anniversary	14-20.08.2022	A. Cegielski, R. Zalas	Będlewo
Conference on elementary and analytic number theory (ELAZ 2022)	22-26.08.2022	J. Kaczorowski, Ł. Pańkowski, M. Radziejewski	Poznań
Number-Theoretic Methods in Cryptology (NutMiC 2022)	29-31.08.2022	M. Grześkowiak, K. Gierszewski	Poznań
Convergence in Topology and Optimization	02-08.09.2022	F. Mynard, M. Denkowski, A. Starosolski	Będlewo
Noncommutative harmonic analysis and quantum groups	11-16.09.2022	K. De Commer, A. Skalski, J. Krajczok, et al.	Będlewo
9th Polish Combinatorial Conference	18-24.09.2022	S. Antoniuk, J. Grytczuk, J. Jaworski, et al.	Będlewo
Numerical analysis and applications of SDEs	25.09.-01.10.2022	M. Hefter, P. Przybyłowicz, M. Szölgvényi, et al.	Będlewo
Approximation and geometry in high dimensions	09-15.10.2022	L. Plaskota, J. Prochno, S. Szarek, et al.	Będlewo
Gdańsk-Kraków-Łódź-Warszawa Workshop in Singularity Theory - a special session dedicated to the memory of Stanisław Łojasiewicz	11-17.10.2022	M. Denkowski, C. Eyral, T. Krasieński, et al.	Warsaw

For more information, please see: <https://www.impan.pl/en/activities/banach-center/conferences?y=2022>

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