Newsletter
of IMPAN

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PAN

MAESTRO

MAESTRO is the most prestigious competition organized by the Polish National Science Centre (Narodowe Centrum Nauki – NCN), an agency of the Polish Ministry of Science and Higher Education. The announcement says: "*this is the competition for experienced researchers aimed at realization of pioneering scientific research, including interdisciplinary research, substantial for the development of science, reaching beyond the actual state of knowledge, which can result with scientific discoveries".* Some rules and procedures are similar to those of the European Research Council (ERC) Advanced Grants which *"allow exceptional established research leaders of any nationality and any age to pursue ground-breaking, high-risk projects that open new directions in their respective research fields or other domains.*"

There have been already 5 such competitions, till recently organized every half a year, since 2013 once a year. Each competition had about 20-50 laureates in 3 categories: science and technology, life science, humanities.

There are 3 such programs at IMPAN:

1. "Geometric Group Theory" by Prof. Tadeusz Januszkiewicz, 2013–2016,
2. "Geometry of Jets and Field theories" by Prof. Janusz Grabowski, 2013–2018,
3. "Invariant measures, entropy and other parameters of growth in classical and nonclassical dynamical systems", by Prof. Tomasz Downarowicz, 2013–2018.

Geometry of jets and field theories
Professor Janusz Grabowski

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This is an interdisciplinary project on the borderlines of mathematics and physics. It aims to combine resources of the traditional differential geometry of gauge and jet bundles with graded differential geometry and recently developed methods from category theory, homological and homotopical algebra, and geometric theory of PDE's, in order to develop a new framework for field theories of various types. Among them are generalizations of BRST and AKSZ formalisms and formalisms based on higher or homotopy structures. The goal is to achieve a substantial progress in understanding and constructing covariant field theories, both classical and quantum, with the emphasis on algebraic

and geometrical ideas new in this context. The stress is put on developing concepts and formalisms, combined with checking their usefulness for applications, rather than proving particular theorems. This should confirm the opinion of V. I. Arnold that "mathematics is the part of physics where experiments are cheap".

The current team working on the project consists of six reserchers, one PhD student, and one associated postdoc. One place of the team activities is the IMPAN seminar *Geometric Methods of Physics*. The research is conducted in close cooperation with leading centers of geometry and mathematical physics in Europe. Besides small Working Groups, a larger conference on the subject is planned in 2015. There is still place for PhD students (also graduate students intending to start their PhD soon) and postdocs willing to join the project.

Geometric Group Theory

Polish National Center for Science (NCN) grant Maestro "Geometric Group Theory" is located at IMPAN and headed by professor Tadeusz Januszkiewicz.

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Members of the group working on the grant are Professors Tadeusz Januszkiewicz and Jacek Swiatkowski; dr hab. Jan Dymara; doctors Tomasz Elsner, Swiatoslaw Gal, Piotr Przytycki, Damian Osajda; MSc Kamil Duszenko, Lukasz Garncarek and Michal Marcinkowski.

Members of the group, over the period of many years, were working both in IMPAN and University of Wrocław.

The general direction of research is, needless to say, geometric group theory: study of infinite groups by geometric methods. This is a subject started in the 80' by Misha Gromov.

Main research themes are continuation and extensions of those addressed by core members of the group in research funded previously by Polish (and NSF) grants over a long period of time. The common thread is the study of spaces which admit metrics of nonpositive curvature, or their mutants: metrics resulting in similar properties.

Nonpositive curvature implies several properties of spaces (and groups) which are often hard to establish by other methods.

Nonpositively curved spaces arise in many places in mathematics: statistical mechanics (billiard models of gas), topological robotics (configuration spaces of robots in a factory), Lie and Kac-Moody theories (symmetric spaces and buildings), algebraic geometry (ramified covers), and combinatorics (mainly via combinatorics of Coxeter groups).

Showing that a metric is nonpositively curved is usually hard, that's why combinatorial, finite check, conditions sufficient for nonpositive curvature (or its mutations) are so valuable.

This direction, is best developed (with spectacular successes) for cubical complexes in the works of (among others) Dani Wise, and Frederic Haglund. Both of them are co-authors of members of the present project. But it is clear that this direction still holds a lot of promise.

Clearly one not only wants to prove that the space of interest carries a nonpositively curved metric, but one also wants to study other robust features of the space, such as properties of its Gromov boundary or cohomological properties. Such questions are well represented in the project.

NCN grants

The National Science Centre (NCN) supports basic research by funding research projects. Recently, the projects of the following mathematicians from IM PAN have been qualified for funding:

→ In the competition "**OPUS 5**: general grants" published on March 15 – prof. dr hab. Szymon Peszat, prof. dr hab. Zbigniew Tadeusz Jelonek, dr hab. inż. Adam Nowak, prof. dr hab. Jan Janas;

→ In the competition "**SONATA 5**: PhD holder grants" published on March 15 – dr Tomasz Cieślak, dr Aneta Wróblewska-Kamińska, dr Tomasz Adamowicz.

Invariant measures, entropy and other parameters of growth in classical and nonclassical dynamical systems
Professor Tomasz Downarowicz
(Wrocław University of Technology and IMPAN)

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A topological dynamical system in the classical sense has usually many invariant measures, collection of which has specific compact topology and convex structure. What types of compact convex sets are possible, what is the possible distribution of entropy, or other measure-theoretic parameters, over this set? What happens if we restrict to some class of dynamical systems, or if we consider dynamical systems in a wider, generalized sense? These and similar questions have puzzled mathematicians since nearly a century and many results and theories have grown around this subject matter. The progress can be measured by the number and level of difficulty of unsolved old problems. One of the most popular in this area is Furtsenberg's "*times 2 times 3*" *conjecture*, which asks about invariant measures of the semigroup generated by two commuting maps on the circle: multiplication by 2 and multiplication by 3 (both modulo 1). In 1990 D. J. Rudolph proved that except the Lebesgue measure, all other have entropy zero (for both maps). But are there any, except the obvious atomic measures, remains an unsolved mystery.

This spring I applied for MAESTRO project entitled "*Invariant measures, entropy and other parameters of growth in classical and nonclassical dynamical systems*".

The scope includes, except the direct investigation of the simplex of invariant measures and entropy, some related topics, correspondingly to the research interests of my colleagues co-investigators. The members of the team are: prof. Janusz Mierczyński (PWr)/(Wrocław University of Technology) – principal Lyapunov exponent in dynamical systems arising from some types of differential equations; dr Bartosz Frej (PWr)/(Wrocław University of Technology) – entropy theory for doubly stochastic and Markov operators; dr hab. Andrzej Biś (UŁ)/ (University of Lodz) – entropy theory for foliations; dr hab. Jacek Serafin (PWr)/ (Wrocław University of Technology) – symbolic extensions; dr Dawid Huczek (PWr)/ (Wrocław University of Technology) – zero-dimensional extensions; Yonatan Gutman (IMPAN) – theory of mean dimension; and dr Dominik Kwietniak (Jagiellonian University) – generalizations of the specification property and their impact on the simplex of invariant measures.

The application was successful, the grant is running since October 2013. We are planning to organize a small conference in 2014 and a larger one in 2016. We will be soon opening additional two-year research positions financed from the grant: a post-doc and a PhD student.
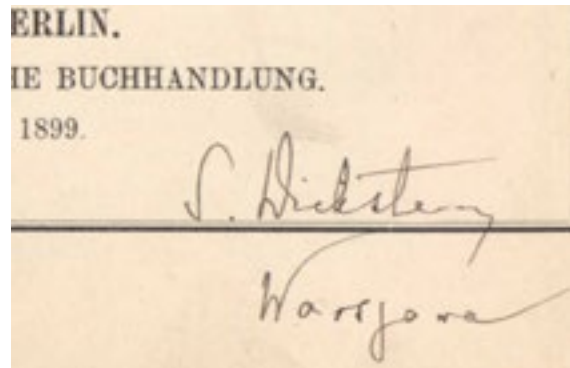

→ On the top of Aconcagua 6962m, January 2013 (photo by Daniel Pons)

The Library

The Library of the Institute of Mathematics of the Polish Academy of Science was founded in 1947. The first books, saved from the ruins of Warsaw, came from the collection of the Warsaw Scientific Society collected by Professor Samuel Dickstein, great popularizer of mathematics. He had started collecting books in the second half of the XIX century. He knew personally almost all great mathematicians of his time. Many of our old books and journals have his signature.

The Library collects scientific publications concerning mathematics and its applications. These include publications of well-known publishers as well as unique and rare publications of small publishers from all over the world.

↑ Signature of Samuel Dickstein in the book: *Logarithmisch-trigonometrische Tafeln mit fünf Decimalstellen by Karl Bremiker.*

↓ The oldest books in the library date back to 1800 (older ones were transferred to the Polish Academy of Sciences Library in Kórnik). These books are now being prepared for digitalization (they are being cleaned and restored).

↑ The photo represents Zygmunt Janiszewski's curriculum vitae, Andrzej Mostowski's letter, Wacław Sierpiński's manuscript "Wstęp do algebry", and two photographs of mathematicians: in Vilnius, 1931 and in Lviv, 1930.

The Library has 80 000 book volumes and 600 titles of current paper journals (over 84.000 volumes), among them 550 foreign ones.

The Library owns "Polish Mathematical Archives", a collection of photographs, documents, letters, manuscripts, and notes, legacy of famous Polish mathematicians, donated by their family and friends. Selected documents from this collection are now being digitalized.

The Library endeavours to move with the times.

The readers have access to the bibliographical databases of "Mathematical Reviews" and "Zentralblatt fur Mathematik". The Library computers provide access to full texts of more than 3 500 mathematical books, 2 000 titles of mathematical journals, as well as to scientific journal databases of Springer, Elsevier, Wiley, Cambridge University Press, Oxford University Press, Taylor & Francis and other publishers.

The Library is part of a Consortium which catalogues collections (over 1 300 000 volumes) of 24 Polish research institutes. The Institute of Mathematics has been leading the Consortium since its beginning (1995). Thanks to placing our books' metadata in nukat (the overall catalogue of Polish research libraries), information about books from our collection is available online as well as via Google and WorldCat. The Library's online book catalogue is still being updated.

The Library is now creating a Digital Repository (RCIN) in collaboration with 16 institutes.

The aim of the project is to make electronic versions of paper publications that are Polish scientific achievements, and of research documentation and scientific resources of the institutes. Highly professional digitalization tools are being used in this project (including archiving the master files).

Hard 3-year work within the RCIN project has given almost 36 000 online documents (including more than

1 200 IMPAN publications); these were read more than 4 350 000 times (IMPAN documents: 140 000 times). The publications were prepared in 5 big scanning labs and 11 smaller ones. More than 100 graphic editors have prepared the versions of the files to be placed on the internet.

↓ Consortium RCIN bought 2 automatic book scanners (ScanRobots, the first of this kind in Poland), which turn pages automatically.

↑ Mathematicians from all over the world praise the IMPAN Library. The Library has faithful readers who come to Warsaw regularly, just to visit the Library.

NEW FACULTY

→ **3–7 years positions:**
1. Tomasz Adamowicz: 5-years adiunkt position; differential equations
2. Yonatan Gutman: 7-years adiunkt position; dynamical systems
3. Michał Jóźwikowski: 5-years adiunkt position; mathematical physics and differential geometry
4. Tomasz Kochanek: 7 – years adiunkt position (joint with University of Warsaw); functional analysis
5. Marcin Sabok: 7 – years adiunkt position; foundations of mathematics
6. Aneta Wróblewska – Kamińska: 3-years adiunkt position; differential equations

→ **1–2 years positions:**
1. Janusz Adamus, 1-year adiunkt position; differential equations
2. Tomasz Byczkowski, 2-years part time professor position; probability theory
3. Tomasz Downarowicz: 2-years professor position; dynamical systems
4. Christophe Eyral: 2-years associate professor position; algebra and algebraic geometry
5. Bartosz Kwaśniewski: 1-year adiunkt position; noncommutative geometry
6. Andrzej Sitarz: 2-years part time associate professor position; noncommutative geometry

→ **POSTDOC positions:**
1. Jan Burczak: 2-years assistant position; differential equations
2. Marcin Krzywkowski: 6-months adiunkt position; foundations of mathematics
3. Joanna Kułaga-Przymus: 2-years adiunkt position; dynamical systems
4. Poj Lerthoosakul: 1-year assistant position; dynamical systems
5. Justyna Signerska: 1-year adiunkt position; dynamical systems
6. Sanjay Singh: 1-year adiunkt position; algebra and algebraic geometry
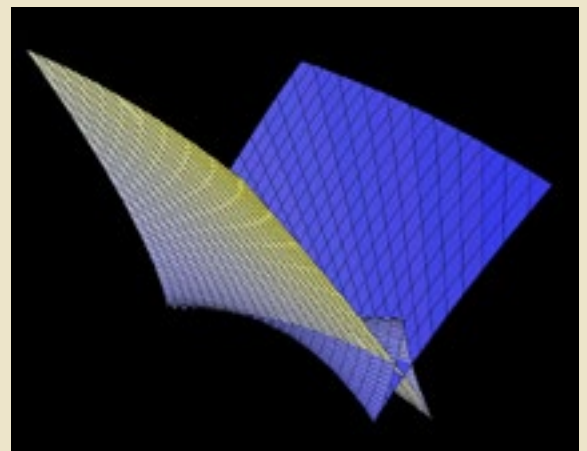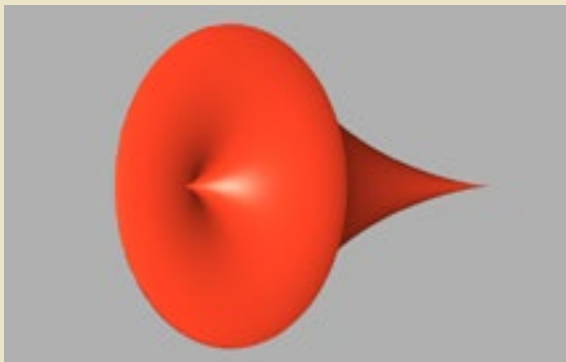7. Saurabh Trivedi: 1-year adiunkt position; algebra and algebraic geometry

Scientific Events

Polish-Japanese successful collaboration in singularities

Singularity theory, despite being a relatively recent branch of mathematics, has already played an important role in connecting various disciplines of science. Its deep and intriguing results have promoted fundamental progress in optics, image recognition and processing, control theory, mechanics, relativity theory, quantum physics, and numerous other fields of study including those pertaining to biological, medical, and social sciences. Japanese singularity theorists hold a prominent place in this field, so it was a natural consequence that they were recognized in the 21st Century COE (Centers of Excellence) program *Mathematics of Nonlinear Structure via Singularity*.

Aiming to promote international connections between research institutions and educate young mathematicians, Professors Keizo Yamaguchi (President of the Hokkaido University), Goo Ishikawa and Shyuichi Izumiya from the Center of Research Interactions in Mathematics of Hokkaido University, together with their Polish counterpart Professor Stanislaw Janeczko decided in 2001 to establish a series of open international conferences named "Polish-Japanese Geometric Singularity Theory Working Days". First three workshops were organized each year at the Mathematical

↑ Butterfly symmetric singularity proved to be structurally stable in three space, J. London Math. Soc. 48(1993),178-192.

Research and Conference Center in Będlewo; four others took place in picturesque Polish neighborhoods, including the mountains and the seaside (Institute's conference facilities in Sopot). Several Polish researchers took part in the singularity theory conference held in Sapporo in September 2003. The recent workshop of the series was organized in August 2013, together with substantial participation of researchers from Brasil, Spain and Israel.

Each meeting was comprised of over thirty high quality research and survey lectures, while a friendly atmosphere helped to maintain close contact between the participants. The conferences were attended by the world's leading mathematicians, including Heisuke Hironaka, who won the Fields Medal in 1970, Takuo Fukuda, Stanisław Łojasiewicz, Peter Slodowy, Tadeusz Mostowski, Zbigniew Szafraniec and Kenji Fukaya, as well as specialists from several countries other than Japan and Poland. Moreover, there has always been a substantial attendance of master and doctoral students.

The next workshop will be held in Poland in 2015, and due to the growing number of researchers who

↓ Caustic as an envelope of reflected beam of rays sent from the point source inside the sphere.

have taken part in them, and the significant volume of joint research papers originating from the conferences, we hope that the future Polish-Japanese Singularity Theory meetings will further contribute in recognizing the universal role of mathematics in a general sense and singularity theory in particular.

Stanisław Janeczko

International Conference Beyond Uniform Hyperbolicity
27.05.2013 – 07.06.2013 | IMPAN Research and Conference Center in Będlewo

Local organizers: Krzysztof Barański (University of Warsaw), Piotr Gałązka (Warsaw University of Technology), Feliks Przytycki (IMPAN Warsaw), Julia Romanowska (University of Warsaw)

Foreign organizers:

Christian Bonatti (Université de Bourgogne, France)
Keith Burns (Northwestern University, USA)
Sylvain Crovisier (Université Paris-Sud 11, France),
Maria José Pacifico (Universidade Federal do Rio de Janeiro, Brazil)
Marcelo Viana (Instituto Nacional de Matemática Pura e Aplicada, Rio de Janeiro, Brazil),
Amie Wilkinson (Chicago University, USA)
Lan Wen (Peking University, China)

The focus of this 2-weeks conference was to put on the global qualitative study (topological and ergodic) of differentiable dynamical systems, especially diffeomorphisms and vector fields, that are not uniformly hyperbolic.

There were about 100 participants, in particular many PhD students.

There were several 4-6 hours minicourses:
1. Shaobo Gan: Partially hyperbolic singular flows
2. Katrin Gelfert, Michal Rams: Dimension and Lyapunov exponents in conformal non-hyperbolic dynamics

3. Andy Hammerlindl, Rafael Potrie: Classification of partially hyperbolic diffeomorphisms in certain 3-dimensional manifolds
4. Jairo Bochi, Christian Bonatti: Some perturbative techniques in C1 dynamics
5. Anatole Katok: Measure rigidity beyond uniform hyperbolicity: an introduction

There were also several plenary talks delivered in particular by S. Croivisier, R. Ures, D. Turaev, J. Rivera-Letelier, A. Navas, P. Walczak, V. Baladi, S. Hurder, A. Wilkinson, D. Coronel, S. Newhouse, M. Viana, C.G. Moreira.

There were excursions to Gniezno and Poznań (ancient capitals of Poland), and to the forest (The National Park of Wielkopolska).

More information and the conference photos can be found at http://bcc.impan.pl/13Uniform/

Advances in Mathematics of Finance
6th General AMaMeF and Banach Center Conference
10.06.2013-15.06.2013 | Warsaw

The conference was organized by the Committee of Mathematics of the Polish Academy of Sciences, the Faculty of Mathematics, Informatics and Mechanics of the University of Warsaw and the Stefan Banach International Mathematical Center, under the honorary patronage of the Rector of the University of Warsaw.

The conference took place in the building of the Old Library (Stary BUW) on the main campus of the University of Warsaw. The organizers were prof. Andrzej Palczewski and prof. Łukasz Stettner. The Conference was the 6th General Conference of the network Advanced Mathematical Methods for Finance (AMaMeF). Former conferences were: in April 2006 in Side (Turkey), in May 2007 in Będlewo (Poland), in May 2008 in Pitesti (Romania), in May 2009 in Alesund (Norway) and in May 2010 in Bled (Slovenia) and were sponsored by ESF. The network organized also the Mid-Term AMaMeF Conference in Vienna in September 2007 and the final AMaMeF Workshop in Berlin in September 2010.

Sponsors of the 6th General AMaMeF and Banach Center Conference were: Warsaw Center of Mathematics and Computer Science and BRE Bank SA.

The Conference gathered 145 participants including 82 from abroad. There were 10 plenary lectures (60 minutes) delivered by: H. Follmer (Berlin), F. Benth (Oslo), R. Cont (London), D. Filipovic (Lausanne), M. Jeanblanc (Evry), D. Brigo (London), P. Salminen (Turku), R. Stelzer (Ulm), W. Runggaldier (Padova), Yu. Mishura (Kiev); and 53 shorter presentations (30 minutes). Main topics of the conference included: theory of pricing of financial derivatives, illiquid markets, markets with transaction costs, portfolio analysis, term structure models, power energy markets, insurance mathematics and credit risk.

During the conference there was a meeting of the Steering Committee of the network. New Acting Board, which is supposed to control activities of the network between the meetings of the Steering Committee, was chosen. Next general AMaMeF Conference is planned in Lausanne in October 2015.

Errata

42nd *Polish Conference on Applications of Mathematics*
27.08.2013-03.09.2013 | Zakopane-Koscielisko

The conference gathered 105 specialists of applications of mathematics. The opening lecture was delivered by prof. Wojciech Niemiro and concerned Markov chain Monte Carlo algorithms. There was an open meeting of the Section of Applied Mathematics of the Committee of Mathematics during the conference. A special piano concert performed by prof. T. Trzaskalik and Ayaka Meiwa was organized in Karol Szymanowski Museum in villa Atma in Zakopane , at the foot of Tatra Mountains.

→ View from Rysy, the highest in Polish Tatra Mountains, photo by F. Przytycki, August 2013.

Evaluation of Scientific Units:
IMPAN has got the top rank: A+

The results have been announced at the end of September 2013 and will be valid for the next 4 years. The evaluation has been done by the Committee for Evaluation of Scientific Units (Komitet Ewaluacji Jednostek Naukowych — KEJN), which was appointed on 30th December 2010 as a consultative and advisory body to the Polish Minister of Science and Higher Education.

From the Ministry web page, http://www.nauka. gov.pl/en/committee-for-evaluation-of-scientific-units/: "The main task of the Committee is to draw up the project of parameters and criteria for comprehensive evaluation of scientific units and to perform such evaluation not less frequently than every four years. The Committee indicates to the Minister the leading scientific units taking into account the quality of their scientific activity in order to determine the level of financial support granted to fund their research potential"

The evaluation has been done in four groups of sciences:
1. Humanities and Social Sciences
2. Sciences and Engineering
3. Life Sciences
4. Art Sciences and Artistic Production

Each was split into subgroups, so called Groups of Common Evaluation (Grupy Wspólnej Oceny — GWO) depending on the area (such as: mathematical sciences, physics, etc.) and on the type of the unit (so called basic units of the universities, institutes of the Polish Academy of Sciences, research institutes).

Out of 963 classified units 37 have got A+, 2 in mathematics: IMPAN and Department of Mathematics, Informatics and Mechanics of the University of Warsaw (MIMUW). Other granted categories have been: A (308 units), B (541 units), C (77 units).

The evaluation took in account four criteria: scientific achievements, scientific potential, material effects, other (10 most spectacular achievements), with weights depending on GWO. A+ has been awarded by a comparison method, in pairs within all units in each GWO.

Minister Barbara Kudrycka said "Research units with the prestigious A+ category, together with the National Leading Research Centres, are the elite of the Polish science" (http://www.nauka.gov.pl/en/polish-science-news/ministry-of-science-and-higher-education-the-potential-of-research-units-evaluated.html).

Banach Center Selected Upcoming Events 2014

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

	TITLE	DATE	ORGANIZERS	PLACE
1.	Probabilistic Aspects of Harmonic Analysis (conference)	26.04–03.05.2014	M. Preisner, K. Bekała, W. Cygan, G. Kępa, K. Kolesko, M. Mirek, G. Świderski, B. Wróbel	Będlewo
2.	7th Young Set Theory Workshop	11–17.05.2014	M. Sabok, P. Borodulin-Nadzieja, H. Michalewski	Będlewo
3.	Ergodic Theory and Dynamical Systems (conference, the main organizer: Nicolaus Copernicus University in Toruń))	11–17.05.2014	M. Lemańczyk, K. Frączek, J. Kułaga-Przymus	Toruń
4.	Stochastic Networks and Risk Analysis IV (conference)	27.05–01.06.2014	C. Constantinescu, K. Dębicki, E. Hashorva, Z. Palmowski, T. Rolski, R. Szekli	Będlewo
5.	11th International Conference on Ordered Statistical Data	01–06.06.2014	A. Dembińska, A. Goroncy, K. Jasiński, P. Miziuła, T. Rychlik - chair	Będlewo
6.	3rd Conference on Algebra, Logic and Number Theory ALANT	08–13.06.2014	A. Blaszczok, A. Czogała, P. Gładki, P. Koprowski, K. Kuhlmann, B. Rothkegel, A. Sładek	Będlewo
7.	XXVIII Konferencja z Historii Matematyki: Historia Matematyki Polskiej XIX i XX wieku	09–13.06.2014	W. Więsław	Będlewo
8.	Integration, Vector Measures and Related Topics VI (conference)	15–21.06.2014	M. Balcerzak, M. Cichoń, K. Musiał, G. Plebanek	Będlewo
9.	AAA 88 – Workshop on General Algebra	19–22.06.2014	G. Bińczak, T. Brengos, A. Mućka, A. Pilitowska, A. Romanowska, M. Stronkowski, A. Zamojska-Dzienio, M. Ziembowski	Warszawa
10.	Constructive Approximation of Functions (conference)	30.06–05.07.2014	M. Baran, L. Białas-Cież, M. Kosek, G. Lewicki, A. Skiba, J. Szczepański, P. Ozorka	Będlewo
11.	16th Workshop: Non-commutative Harmonic Analysis and Probability with Applications	06–12.07.2014	M. Bożejko, R. Lenczewski, R. Sałapata, P. Śniady, W. Młotkowski, A. Krystek, W. Ejsmont, Ł. Wojakowski, J. Wysoczański, A. Kula, M. Marciniak	Będlewo
12.	Aleksander Pełczyński Memorial Conference	13–19.07.2014	T. Figiel, S. Kwapień, K. Oleszkiewicz, M. Wojciechowski, P. Wojtaszczyk	Będlewo
13.	Perspectives of Modern Complex Analysis (conference)	20–25.07.2014	K. Barański, W. Bergweiler, D. Drasin, A. Gabrielov, F. Przytycki, D. Schleicher, B. Shapiro	Będlewo
14.	Arithmetic Methods in Mathematical Physics and Biology (conference)	03–08.08.2014	G. Banaszak, J. Milewski, P. Waliszewski	Będlewo
15.	Workshop in Set Theory	14–17.09.2014	S. Friedman, P. Koszmider, B. Loewe, S. Solecki	Będlewo
16.	5th Polish Combinatorial Conference	21–27.09.2014	J. Grytczuk, J. Jaworski, P. Micek, P. Naroski, M. Nikodem, K. Rybarczyk-Krzywdzińska, A. Szelecka	Będlewo