6$^{\text{TH}}$ EUROPEAN CONGRESS OF MATHEMATICS – REPORT OF THE PARTICIPATION

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In July 2008, before commencing the 5$^{\text{th}}$ Congress of Mathematics in Amsterdam, a decision was made to hold the next congress in Kraków. In a secret ballot Kraków defeated Vienna and Prague. The Polish side was represented by the late Prof. dr hab. Andrzej Pelczar (a former Rector of the Jagiellonian University), Prof. dr hab. Piotr Tworzewski and Dr Krzysztof Deszyński. The right to organize the next congress given to the Jagiellonian University and the Polish Mathematical Society was a reflection of the high esteem for Polish mathematics and the attractiveness of Poland and the city of Kraków.

988 mathematicians from all over the world participated in the Kraków congress which was held on 2-7 July 2012, among them: 288 represented Poland itself (including 15 from Wrocław), 78 the UK, 61 Germany, 57 the USA, 50 France, 41 Spain, 35 Russia, 26 Italy, 24 Japan, 21 Israel, 18 Finland, 17 Hungary, 16 Sweden, 15 Holland, 14 the Czech Republic, 12 Switzerland, 10 Belgium, 9 Austria, 9 Brazil, 8 Denmark, 8 South Africa, 8 Portugal, 8 Canada, 6 Lithuania, 6 Norway, 5 Mexico, 4 India, 4 Turkey, 4 China, 4 Taiwan, 2 Australia, 2 Bulgaria, 2 Cameroon, 2 Estonia, 2 Latvia, 2 Korea, 1 Greece, 1 Albania, and other countries. Previous congresses took place in the following European cities: Paris (1992), Budapest (1996), Barcelona (2000), Stockholm (2004) and in the already mentioned Amsterdam (2008).

The President of the Republic of Poland, Mr Bronisław Komorowski, held honorary patronage of the 6$^{\text{th}}$ European Congress of Mathematics. It was, as described by Jacek Michałowski, Chief of the Chancellery of the President of the Republic of Poland, an expression of the President's esteem for the great achievements of Polish mathematical thought and its signifi-

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cant contribution to the development of world mathematics. The 6th ECM provided an excellent opportunity to study the latest mathematical research and make direct contact with distinguished specialists representing a wide range of disciplines. An encounter with contemporary mathematics was (and is) particularly important for young scientists seeking inspiration and interesting research subjects. Scholarships were provided in order to facilitate their participation in the congress.

The programme of the ECM included lectures by the invited speakers, mini-symposia – i.e. cycles of short presentations on similar subjects and poster sessions. Additionally, lectures were given by the winners of the EMS prizes for young mathematicians, the winner of the Felix Klein prize and the winner of the Otton Neugebauer prize. The core programme of the congress was accompanied by panel discussions on financing scientific research in Europe, the social role of mathematics, its applications, education in mathematics and the popularization of the science, and the omnipresence of mathematics in the modern world. Traditionally, the commencement of the 6th ECM was preceded a day earlier by a joint symposium of the European Women in Mathematics Association (**www.european womeninmaths.org**) and the Women in Mathematics EMS-Committee. The congress was held in Auditorium Maximum of the Jagiellonian Uniwersity, in Krupnicza 33, in the vicinity of Planty – a historical Kraków park. During the opening ceremony ten young mathematicians were awarded the EMS Prize. Detailed information on the 6th ECM can be found on www.6ECM.pl.

Ten EMS prizes

Ten EMS prizes were awarded to young researchers not older than 35, of European nationality or working in Europe, in recognition of their excellent contribution to mathematics. The prize winners were selected by a committee of around 15 internationally recognized mathematicians covering a wide variety of fields and chaired by Prof. Frances Kirwan (Oxford, UK). Funds for this prize have been endowed by the Foundation Compositio Mathematica.

Previous prize winners have proved to continue their careers with great success. Several of them have won the most important distinction for young mathematicians, the Fields Medal, of which at most four are awarded every four years by the International Mathematical Union. Congress participants were thus able to attend a lecture by a prospective Fields Medal winner. European politicians should be concerned: from among the ten selected,

extremely talented young mathematicians, five have chosen to pursue their careers in the United States.

List of Prize winners

Simon Brendle, 31 years old, received his PhD from Tübingen University in Germany under the supervision of Gerhard Huisken. He is now a Professor of Mathematics at Stanford University, USA. An EMS prize was awarded to him *for his outstanding results on geometric partial differential equations and systems of elliptic, parabolic and hyperbolic types, which have led to breakthroughs in differential geometry including the differentiable sphere theorem, the general convergence of Yamabe flow, the compactness property for solutions of the Yamabe equation, and the Min-Oo conjecture.*

Emmanuel Breuillard, 35 years old, graduated in mathematics and physics from Ecole Normale Superieure (Paris), he then pursued graduate studies in Cambridge (UK) and Yale (USA) where he obtained a PhD in 2004. He is currently a Professor of Mathematics at Universite Paris-Sud, Orsay. He received an EMS prize *for his important and deep research in asymptotic group theory, in particular on the Tits alternative for linear groups and on the study of approximate subgroups, using a wealth of methods from very different areas of mathematics, which has already made a long lasting impact on combinatorics, group theory, number theory and beyond.*

Alessio Figalli, 28 years old, graduated in mathematics from the Scuola Normale Superiore of Pisa (2006) and received a joint PhD from the Scuola Normale Superiore of Pisa and the Ecole Normale Supérieure of Lyon (2007). Currently he is a Professor at the University of Texas at Austin. An EMS prize went to him *for his outstanding contributions to the regularity theory of optimal transport maps, to quantitative geometric and functional inequalities and to partial solutions of the Mather and Mañé conjectures in the theory of dynamical systems.*

Adrian Ioana, 31 years old, obtained a bachelor of Science from the University of Bucharest (2003) and received his Ph.D. from UCLA in 2007 under the direction of Sorin Popa. Currently, he is an Assistant Professor at the University of California in San Diego. An EMS prize was awarded to him *for his impressive and deep work in the field of operator algebras and their connections to ergodic theory and group theory, and in particular for solving several important open problems in deformation and rigidity theory,*

among them a long standing conjecture of Connes concerning von Neumann algebras with no outer automorphisms.

Mathieu Lewin, 34 years old, studied mathematics at the École Normale Supérieure (Cachan), before he went to the University of Paris–Dauphine where he obtained his PhD in 2004. He currently occupies a full-time CNRS research position at the University of Cergy-Pontoise, close to Paris. He received an EMS prize *for his ground breaking work in rigorous aspects of quantum chemistry, mean field approximations to relativistic quantum field theory and statistical mechanics.*

Ciprian Manolescu, 33 years old, studied mathematics at Harvard University, where he received his PhD in 2004 under the supervision of Peter B. Kronheimer. He worked for three years at Columbia University, and since 2008 he has been an Associate Professor at UC in Los Angeles. An EMS prize went to him *for his deep and highly influential work on Floer theory, successfully combining techniques from gauge theory, symplectic geometry, algebraic topology, dynamical systems and algebraic geometry to study low-dimensional manifolds, and in particular for his key role in the development of combinatorial Floer theory.*

Grégory Miermont received his education at Ecole Normale Supérieure in Paris during 1998-2002. He defended his PhD thesis, which was supervised by Jean Bertoin, in 2003. Since 2009 he has been a Professor at Université Paris-Sud 11 (Orsay). During the academic year 2011–2012 he was on leave as a Visiting Professor at the University of British Columbia (Vancouver). An EMS prize was awarded to him *for his outstanding work on scaling limits of random structures such as trees and random planar maps, and his highly innovative insight in the treatment of random metrics.*

Sophie Morel, 32 years old, studied mathematics at the École Normale Supérieure in Paris, before earning her PhD at Université Paris-Sud, under the direction of Gerard Laumon. Since December 2009, she has been a Professor at Harvard University. She received an EMS prize *for her deep and original work in arithmetic geometry and automorphic forms, in particular the study of Shimura varieties, bringing new and unexpected ideas to this field.*

Tom Sanders, studied mathematics in Cambridge; he received his PhD in 2007 under the supervision of William T. Gowers. Since October 2011, he has been a Royal Society University Research Fellow at the University of Oxford. An EMS prize went to him *for his fundamental results in additive*

combinatorics and harmonic analysis, which combine in a masterful way deep known techniques with the invention of new methods to achieve spectacular applications.

Corinna Ulcigrai, 32 years old, obtained her diploma in mathematics from the Scuola Normale Superiore in Pisa (2002) and defended her PhD in mathematics at Princeton University (2007), under the supervision of Ya. G. Sinai. Since August 2007 she has been a Lecturer and a RCUK Fellow at the University of Bristol. An EMS prize was awarded to her *for advancing our understanding of dynamical systems and the mathematical characterizations of chaos, and especially for solving a long-standing fundamental question on the mixing property for locally Hamiltonian surface flows.*

Felix Klein Prize

The Felix Klein prize, endowed by the Institute for Industrial Mathematics in Kaiserslautern, is awarded to a young scientist (normally under the age of 38) for using sophisticated methods to give an outstanding solution, which meets with the complete satisfaction of industry, to a concrete and difficult industrial problem. The Prize Committee that selected the winner consisted of six members, chaired by Prof. Wil H.A. Schilders from Eindhoven in the Netherlands.

Emmanuel Trélat, 37 years old, obtained his PhD at the University of Bourgogne in 2000. Currently he is a full Professor at the University Pierre et Marie Curie (Paris 6), France, and Member of the Institut Universitaire de France, since 2011. He received the Felix Klein Prize *for combining truly impressive and beautiful contributions in fine fundamental mathematics to understand and solve new problems in control of PDE's and ODE's (continuous, discrete and mixed problems), and above all for his studies on singular trajectories, with remarkable numerical methods and algorithms able to provide solutions to many industrial problems in real time, with substantial impact especially in the area of astronautics.*

Otto Neugebauer Prize

For the first time ever, the newly established Otto Neugebauer Prize in the History of Mathematics was awarded for a specific highly influential article or book. The prize winner was selected by a committee of five specialists in the history of mathematics, chaired by Prof. Jeremy Gray (Open

University, UK). The funds for this prize have been offered by Springer-Verlag, one of the major scientific publishing houses.

Jan P. Hogendijk obtained his Ph.D. at Utrecht University in 1983 with a dissertation on an unpublished Arabic treatise on conic sections by Ibn al-Haytham (ca. 965-1041). He is now a full Professor in History of Mathematics at the Mathematics Department of Utrecht University. He is the first recipient of the Otto Neugebauer Prize *for having illuminated how Greek mathematics was absorbed in the medieval Arabic world, how mathematics developed in medieval Islam, and how it was eventually transmitted to Europe*.

The Science Committee of the 6th ECM, appointed by the EMS, invited to give plenary lectures the following ten prominent scientists representing different mathematical specializations, listed here in the alphabetical order:

Adrian Constantin, Universitat Wien, Austria.
Field: Partial Differential Equations, Fluid Mechanics.

Camillo De Lellis, Universitat Zurich, Switzerland.
Field: Calculus of Variations, Partial Differential Equations, Geometric Measure Theory.

Herbert Edelsbrunner, Institute of Science and Technology, Vienna, Austria.
Field: Computational and Applied Topology.

Mikhail L. Gromov, Institut des Hautes Etudes Scientifiques, France.
Field: Geometry.

Christopher Hacon, University of Utah, USA.
Field: Algebraic Geometry.

David Kazhdan, The Hebrew University of Jerusalem, Israel.
Field: Representation Theory.

Tomasz Łuczak, Uniwersytet im. Adama Mickiewicza in Poznań, Poland.
Field: Random Graphs.

Sylvia Serfaty, Universite Pierre et Marie Curie – Paris 6, France.
Field: Partial Differential Equations, Calculus of Variations.

Saharon Shelah, The Hebrew University of Jerusalem, Israel.
Field: Logic.

Michel Talagrand, Universite Pierre et Marie Curie – Paris 6, France.

Field: Probability Theory and Analysis.

The formula assumed by the congress enabled the participants to influence its programme through the mini-symposia organized within the framework of the 6th ECM, i.e. thematic sessions comprising of a series of short communiques, coordinated by their organizer. The mini-symposia provided an excellent form of promoting research groups and the subject matter complementary to that represented in the lectures of the invited guests.

Another form of presenting their own research results was participation in the poster sessions. The most interesting posters were awarded prizes in the competition.

The list of panel subjects remained open up to the penultimate day of the congress.

The 6th ECM was an important event for the promotion of mathematics and its particular disciplines because it provided a great opportunity for a wider and closer international scientific cooperation. In the programme there were included 35, so-called "invited", lectures, for the presentation of which the Science Committee of the 6th ECM selected the following speakers.

Invited lectures

The complete list of invited speakers. The prize winners were also invited to deliver lectures.

Anton Alekseev, Université de Genève, Switzerland.
Field: symplectic geometry.
Title of the lecture: *Bernoulli numbers, Drinfeld associators and the Kashiwara-Vergne problem.*

Kari Astala, University of Helsinki, Finland.
Field: quasi-conformal mappings.
Title of the lecture: *Holomorphic deformations, quasi-conformal mappings and vector valued calculus of variations.*

Jean Bertoin, Université Pierre et Marie Curie, France.
Field: probability.
Title of the lecture: *Coagulation with limited aggregations.*

Serge Cantat, CNRS, Département de Mathématiques et Applications Ecole Normale Supérieure de Paris, France.

Field: algebraic geometry.
Title of the lecture: *The Cremona Group*.

Vicent Caselles, Universitat Pompeu Fabra, Spain.
Field: image processing, functional analysis.
Title of the lecture: *Exemplar-based image in-painting and applications*.

Alessandra Celletti, Università di Roma "Tor Vergata", Italy.
Field: KAM theory, stability problems.
Title of the lecture: *KAM theory: a journey from conservative to dissipative systems*.

Pierre Colmez, CNRS, Institut de Mathématiques de Jussieu, Université Pierre et Marie Curie, France.
Field: p-adic Representations and Langlands' Programme.
Title of the lecture: *The p-adic Langlands program*.

Alessio Corti, Imperial College London, the United Kingdom.
Field: algebraic geometry.
Title of the lecture: *Extremal Laurent polynomials and Fano manifolds*.

Amadeu Delshams, Universitat Politécnica de Catalunya, Spain.
Field: dynamical systems.
Title of the lecture: *Irregular motion and global instability in Hamiltonian systems*.

Hélène Esnault, Universität Duisburg-Essen, Germany.
Field: algebraic geometry.
Title of the lecture: *On flat bundles in characteristic 0 and p > 0*.

Alexandr A. Gaifullin, Moscow State University and Steklov Mathematical Institute, Russia.
Field: topology, combinatorics.
Title of the lecture: *Combinatorial realisation of cycles and small covers*.

Isabelle Gallagher, Université Paris-Diderot, France.
Field: partial differential equations with applications in fluid mechanics, harmonic analysis.
Title of the lecture: *Remarks on global regularity for solutions to the incompressible Navier-Stokes equations*.

Olle Häggström, Chalmers University of Technology, Sweden.
Field: statistical physics on graphs.

Title of the lecture: *Why the empirical sciences need statistics so desperately.*

Martin Hairer, University of Warwick, the United Kingdom.
Field: stochastic PDE's.
Title of the lecture: *Solving the KPZ equation.*

Nicholas J. Higham, University of Manchester, the United Kingdom.
Field: numerical linear algebra.
Title of the lecture: *The matrix logarithm: from theory to computation.*

Arieh Iserles, University of Cambridge, the United Kingdom.
Field: numerical analysis, differential equations.
Title of the lecture: *Computing the Schrödinger equation with no fear of commutators.*

Alexander S. Kechris, California Institute of Technology, USA.
Field: set theoretic methods in analysis.
Title of the lecture: *Dynamics of non-Archimedean Polish groups.*

Bernhard Keller, Université Paris Diderot, France.
Field: algebra.
Title of the lecture: *Periodicity from the pentagon.*

Sławomir Kołodziej, Uniwersytet Jagielloński, Poland.
Field: Monge-Ampère equations.
Title of the lecture: *Weak solutions to the complex Monge-Ampère.*

Gady Kozma, The Weizmann Institute of Science, Israel.
Field: discrete probability, mathematical physics.
Title of the lecture: *Phase transitions in self-interacting random walks.*

Frank Merle, Université de Cergy-Pontoise, France.
Field: partial differential equations, solitary waves.
Title of the lecture: *On blow-up curves for semilinear wave equations.*

Andrey E. Mironov, Sobolev Institute of Mathematics, Russia.
Field: integrable systems.
Title of the lecture: *Commuting higher rank ordinary differential operators.*

David Nualart, University of Kansas, USA.
Field: stochastic calculus, Brownian motion, applications to PDE's.
Title of the lecture: *Stochastic calculus with respect to the fractional Brownian motion.*

Alexander Olevskii, Tel Aviv University, Israel.

Field: harmonic analysis.
Title of the lecture: *Sampling, interpolation, translates*.

Leonid Parnovski, University College London, the United Kingdom.
Field: spectral theory, Schroedinger operators.
Title of the lecture: *Multidimensional periodic and almost-periodic spectral problems: Bethe-Sommerfeld Conjecture and integrated density of states*.

Florian Pop, University of Pennsylvania, USA.
Field: non-Abelian geometry.
Title of the lecture: *About covering spaces and numbers*.

Igor Rodnianski, Princeton University, USA.
Field: PDE's applied to general relativity.
Title of the lecture: TBA.

Zeev Rudnick, Tel-Aviv University, Israel.
Field: number theory and mathematical physics.
Title of the lecture: *Quantum Chaos and Number Theory*.

Benjamin Schlein, University of Bonn, Germany.
Field: mathematical physics.
Title of the lecture: *Effective equations for quantum dynamics*.

Piotr Śniady, Uniwersytet Wrocławski, Poland.
Field: algebraic combinatorics.
Title of the lecture: *Combinatorics of asymptotic representation theory*.

Andrew Stuart, University of Warwick, the United Kingdom.
Field: numerical analysis of PDE's, inverse problems.
Title of the lecture: *Probing probability measures in high dimensions*.

Vladimír Sveřák, University of Minnesota, USA.
Field: PDE's, fluid mechanics.
Title of the lecture: *On 2d incompressible Euler flows*.

Stevo Todorčević, Mathematički Institut SANU, Institut se Mathématiques de Jussieu, University of Toronto, Canada.
Field: topology and Ramsey theoretic methods in Banach spaces.
Title of the lecture: *Ramsey-theoretic analysis of the conditional structure of weakly-null sequences*.

To sum up, the 6th Congress was a very successful mathematical event. The academic side of the congress, the organizational formula, the selection of presented subjects and the choice of speakers deserve the highest praise. I am quite convinced that both Polish and foreign participants were pleased to attend it. It is also worth mentioning the fact of the organized events accompanying the 6th ECM, such as the exhibition of old mathematical publications and manuscripts from the collection of the Jagiellonian University Library. The library has an extensive collection of mathematical manuscripts and old publications dating from the 14th to 19th century, of which the most famous and valuable exhibited works is the 16th century *De revolutionibus* by Mikołaj Kopernik, describing the heliocentric theory of the universe. The guests also visited the Library of Polish Academy of Arts and Sciences, and its collection of works by Albrecht Dürer, the most famous buildings and museums of Studium Generale, the basilica and monastery of Franciscan friars, the churches of St Michael Archangel and of St Stanislaus Bishop and Martyr, adjacent to the Pauline monastery and a sacral complex, the so called Skałka.

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