16TH JULY 2024 | #2

9TH EUROPEAN CONGRESS OF MATHEMATICS

ECM Sevilla2024

July 15th to 19th

9ECM Daily News

Information and current events from the Congress

Opening ceremony

For one day, the Maestranza Theatre in Seville has changed the music, dance and opera it is used to host on its stage for mathematics, as it has been the place chosen for the opening ceremony of the 9ECM. The amphitheater was the starting point for this five-day event, which brings together nearly 1,400 attendees from all

over the world, in a ceremony in which nothing was missing: thanks to all those involved in making this Congress happen in Seville, institutional speeches and the presentation of the European Mathematical Society awards, with the final touch of a musical performance by the group Dorantes.

"Andalusia is a great scientific and technological laboratory"

The conference was carried out without incident in terms of attendance and registration of participants, and numerous speakers took the floor: the president of the European Mathematical Society (EMS), Jan Philip Solovej; the president of the Organizing Committee, Juan González-Meneses, from the University of Seville; and the vice-president, Isabel Fernández-Delgado, as well as the other members of the committee. Among the authorities present at the ceremony were the Deputy Minister for University, Research and Innovation of the Regional Government of Andalusia, Lorena Garrido; the Secretary General for Research and Innovation, Antonio Posadas Chinchilla; the Vice-Rector for Research of the University of Seville, Julian Martinez Fernandez; the Third Deputy Mayor of the City of Seville, Alvaro Pimentel; and the presidents of the EMS Awards juries, Professors Pavel Exner, Peregrina Quintela Estevez, Karine Chemla and Patrick Farrell.

During the ceremony "the leading role of Andalusia as a great scientific and technological laboratory" and "the great involvement of the Spanish mathematical community and, in particular, of the Universities of Almeria, Malaga and Cadiz, as well as the Universities of Granada and Seville, in the organization of the Congress", according to the words of the president of the Organizing Committee of the 9ECM, Juan Gonzalez-Meneses.

The ceremony was undoubtedly the starting point of a meeting that broke the historical record in attendance of experts and experts and in number of papers and symposia. In data: during these days will be held 10 plenary conferences, 2 special, 64 mini-symposia, 270 thematic communications, 4 informative conferences, in addition to invited lectures, workshops and a cultural agenda that includes four exhibitions with mathematics as protagonists.

“It is important to develop theoretical ideas without seeking immediate applications, but a theory disconnected from any application would be sterile"

Étienne Ghys, Permanent Secretary of the French Académie des Science

Etienne Ghys (Lille, 1954) is currently Permanent Secretary of the French Académie des Science and emeritus senior CNRS researcher in UMPA, the École Normale Supérieure (ENS) de Lyon, where he contributed to the creation and development of the mathematics department. He obtained his PhD in 1979 from the University of Lille. Afterwards, his research focused mainly on geometry and dynamical systems, though his mathematical interests are broad, and he had a strong contribution on the topology of the Lorenz butterfly, a paradigm of chaos theory.

Ghys is particularly interested in historical and educational issues, and he also has been involved in several dissemination initiatives, such as production of mathematical films and the founding of an online journal aimed at the general public. He was an invited speaker at the International Congress of Mathematicians in Kyoto in 1990, in Seoul in 2014, and a plenary speaker in Madrid in 2006. He also was a plenary speaker in 2012 at the International Congress on Mathematical Education in Seoul. Talking about his many recognitions, all this earned him the 2015 Clay Prize for the Dissemination of Mathematics and the 2022 CNRS Scientific Mediation Medal.

Your work has enabled us to better understand the topology of the famous Lorenz butterfly, a paradigm of chaos theory. Could you please explain further about this?

About sixty years ago, Edward Lorenz gave a lecture titled 'Predictability: Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?'. This is the 'butterfly effect': a small change can have large consequences. Chaos theory tries to understand such phenomena.

It is the result of a long historical process beginning in the 19th century. Henri Poincaré, in particular, played a major role.

What is this butterfly and how the results connect with the chaos theory?

To illustrate his ideas, Lorenz used a highly simplified model of atmospheric movement. His model showed a point moving in space observed over a long period. The trajectory of this point is very complex, but it turns out that it describes an image resembling a butterfly. Lorenz's butterfly is not only complicated: it is also very beautiful and deserves to be studied.

Where is this used and applied?

The relationship between mathematics and its applications is complex. On one hand, it is important to be able to develop theoretical ideas without seeking immediate applications, but a theory disconnected from any application would be sterile. Chaos theory, for example, is encountered almost everywhere, as soon as something is in motion, whether it is meteorology or the solar system. Understanding the movement of planets has been a major theme in mathematics, physics and astronomy for thousands years. Also, celestial mechanics, mechanics in general, fluid turbulence, etc. But there is also a message to communicate: maths cannot be reduced to immediate useful applications.

"Maths cannot be reduced to immediate useful applications"

It is true that applications attract the general public. In your dissemination activities, you have talked for instance about the geometry of a soccer ball. Do you think this is a way of approaching maths to people? How can theoretical and abstract mathematics be explained?

If you want to talk about mathematics to people who only have vague, often painful, school memories of it, it is better to talk to them about concrete objects they are familiar with and that, perhaps, they have never observed carefully. The various shapes of soccer balls or the many snowflakes are good examples.

However, there are people in the academic world that are still just focused on teaching & investigating. Would you say that dissemination should be a third part?

Disseminating mathematics is by no means an obligation for a mathematician. Some may find it interesting, sometimes personally because transmitting knowledge helps one understand it better! Some parts of mathematics are far too technical and are not easily disseminated. Finally, some researchers may devote themselves to this mission at specific moments in their careers and not at others.

You've also been involved in the production of mathematical films and the creation of an online journal. Young people now are all around social media. How do you think should mathematics be spread nowadays? Any new formula?

I am skeptical about social networks. At the same time, I understand well that it is the preferred mode of communication for almost all young people and that it is through this medium that they can be contacted. But on the other hand, I am convinced that mathematics and science, in general, cannot be transmitted through such short messages. Sometimes you need to take your time! Moreover, I am frightened when I see that many users measure credibility by the number of followers. These fake news terrify me!

Talking about young people, dissemination can be hand in hand with education somehow. In 2024, do you think the way maths are taught should change? Any headlines about how you see the landscape?

It is impossible to discuss the "right" way to teach mathematics in a few lines. That would be ridiculous I believe. The question of education is really complex and political. I cannot say anything sensible in a short way; even politicians do not answer questions on education in 5 lines... The only thing I can express here is that the current situation, at least in France, is not good. For the majority of French people, those who will not be mathematicians or scientists, and who will simply be citizens: what kind of mathematics do they need?

"It is impossible to discuss the 'right' way to teach mathematics in a few lines. That would be ridiculous I believe. The question of education is really complex and political"

The winners of Prizes of the 9ECM

During the opening ceremony of the congress, the European Mathematical Society has granted 14 prizes, recognizing the **most illustrious figures from the international mathematical landscape**. This includes the European 10 European Mathematical Society Prizes, the Felix Klein Prize, the Paul Lévy Prize, the Otto Neugebauer Prize and the Lanczos Prize. As Pavel Exner, chairman of the awards committee, said, "the EMS prizes have become very well known, and many of the winners have been also awarded with Fields Medals". In particular, "this year there have been many more nominees than in previous years, and this has been a great joy and also a frustration - we've seen **so great mathematics from young people**, but we had to make hard choices", he adds.

EMS Prizes

The European Mathematical Society Prizes are awarded every four years to **10 young mathematicians under the age of 35**, in recognition of exceptional contributions to mathematics. The winners must be of European nationality or have carried out their work in Europe. This year the winners are:

- **Tom Hutchcroft**, professor at the California Institute of Technology, has received the prize "for his revolutionary contributions to probability theory and geometric group theory, in particular to percolation theory on general graphs, using tools from geometry, operator theory, group theory and functional analysis." Hutchcroft studies the phase transitions in "percolation models in graphs". Instead of atoms moving chaotically, as in boiling water, these models consist of a network of interconnected "nodes" (like subway network of stations or the brain neurons).

Neighboring nodes are connected according to some probability; when it reaches a certain value the network suddenly changes its behavior. One of Hutchcroft's most celebrated works is the resolution of the so-called Schramm locality conjecture, which implies that, in many percolation models, one can understand the whole system by simply understanding what happens at very small scales (by zooming in).

- **Danylo Radchenko,** ukrainian mathematician, currently a researcher at the French CNRS, attached to the Paul Painlevé Laboratory of the University of Lille. The jury awarded him the prize "for the construction of optimal spherical designs and his seminal input in the new field of Fourier interpolation, as well as for his fundamental contributions to the theory of polylogarithms". Despite his youth, Radchenko has already made fundamental contributions to several areas of mathematics. He has dealt with the theory of polylogarithms, that have gone from relative curiosity to central concept in several areas of mathematics and physics, e.g. in new techniques to calculate what happens in particle accelerators. Radchenko became well-known for solving (with Andrii Bondarenko and Maryna Viazovska, Fields Medal 2022) the optimal sphere packing problem in dimension 24. Their solution is rather closely related to message encoding problems, and to the protocol that NASA used to communicate with the Voyager probes. The Radchenko's construction of optimal spherical designs, a special configuration of points on the sphere, is very useful in statistics, geometry and quantum computing.

- **Jessica Fintzen,** currently professor at the University of Bonn, has received the award "for her transformative work on the representation theory of p-adic groups, in particular for her spectacular proof that Yu's construction of supercuspidal representations is exhaustive". Fintzen studies the representations theory of p-adic groups. Her research is part of one of the most ambitious and profound projects in modern mathematics: the Langlands program, a network of conjectural relationships between geometry, harmonic analysis and number theory. Representation theory arises from the concept of symmetry (or transformation): it is about representing symmetries numerically, by means of tables of numbers with certain multiplication rules. In Fintzen's case, these tables do not contain everyday numbers but the so-called p-adic numbers. On the other hand, number theory arises from arithmetic: it studies objects such as prime numbers, systems of equations and their solutions. Between the two mathematical worlds, representation theory and number theory, apparently disconnected, Fintzen is discovering deep relationships, revealing an unexpected richness and unity in the mathematical universe.

- **Richard Montgomery,** currently professor at the University of Warwick, has been awarded the prize “for his solution of the Ringel tree packing conjecture, development of distributive absorption techniques with applications to graph embedding problems, and resolution of several classical conjectures of Erdős and others on cycle lengths in sparse graphs using the novel machinery of sublinear expanders". As an expert in combinatorics, Montgomery studies discrete structures, such as graphs, specifically extremal combinatorics, which seeks to understand how large these structures must be for certain patterns to emerge. His work aims to answer the question: can a network be decomposed into copies of simpler ones? Two examples are the Ringel tree packing conjecture, about decomposing complete graphs in trees, and the decomposition of graphs into cycles, which he has studied using a type of network called expander graph, now central in the area. These results have applications ranging from distributed computing to the design of experimental protocols.

- **Adam M. Kanigowski,** professor at the University of Maryland, has been awarded "for his outstanding contributions to the spectral classification and the mixing properties of slowly chaotic dynamical systems." Kanigowski is an expert in dynamical systems, focused on differential equations on surfaces, which model systems whose state at each instant of time is determined by two parameters. These equations appear naturally when studying the motion of planets, magnetic fields in plasmas, or electrons in a metal. He has shed light on slowly chaotic systems: those in which the famous butterfly effect occurs, but slowly. One of the questions that Kanigowski has solved is how to detect whether mixing processes will occur in these slowly chaotic systems - in particular, that the system will eventually reach almost every possible state as time goes by.

- **Jacek Jendrej,** researcher at the French CNRS at the Sorbonne University, receives the award “for his groundbreaking proofs of the soliton resolution conjecture and two-soliton collision problem for equivariant wave maps, developing new approaches using ideas from the theory of dynamical systems to describe the behavior of solutions near a multi-soliton configuration.” Jendrej studies nonlinear partial differential equations that describe the propagation and interaction of waves, whose type of solutions (the so-called solitons) are observed in many natural phenomena. Based on experiments and computer simulations, many experts in the field believe that the emergence of solitons is typical in many nonlinear wave equations - this is the “soliton resolution conjecture” Jendre has worked on.

- **Nina Holden,** professor at the Courant Institute of Mathematical Sciences of New York University, has won the EMS prize “for her profound contributions to probability theory and its applications to statistical physics, including results linking Liouville quantum gravity, the Schramm-Loewner evolution, and random triangulations.” Holden works at the boundaries of mathematical physics, complex analysis, and probability, in a very active area connected to statistical physics and quantum field theory. The central problem of her work is to develop a mathematically rigorous theory of random surfaces, whose notion is central to physicists' attempts at reconciling Einstein’s gravity with quantum mechanics, and where she has proved important results.

- **Frederick Manners,** professor at the University of California, wins the prize “for his remarkable contributions to additive combinatorics and related areas, in particular to the foundations of higher-order Fourier analysis, as well as for miscellaneous other results such as the solution of the pyjama problem." Manners is interested in the idea of pseudorandomness: whether a certain object seems to be formed by chance, or whether, on the contrary, there is some structure, an underlying order that allows us to analyze it. Talking about the pyjama problem, the idea is to determine whether, by rotating this striped pattern of a pyjama several times and superimposing the result, you can cover the image entirely in black. Manners proved this to be true, no matter how thin the original pattern of stripes, with techniques from the theory of dynamical systems and from p-adic analysis.

- **Cristiana de Filippis,** researcher at University of Parma, has won the prize “for her outstanding contributions to elliptic regularity, in particular Schauder estimates for non-uniformly elliptic equations and non-differentiable variational integrals, and minima of quasiconvex integrals". De Filippis is an expert in the calculus of variations and in elliptic partial differential equations, which describe the equilibrium states of classical physical systems, such as the electric field created by a distribution of electric charges. The solutions to equations of classical physics minimize or maximize a certain magnitude called the action, as if nature was performing an optimization exercise behind the scenes. We can picture all the potential behaviors of a physical system as an abstract landscape, where each behaviour would be a region, and think of the action the height of the corresponding region. The calculus of variations, of which De Filippis is an expert, studies how to find the peaks and valleys, that is, the maximum and minimum values of the action, in this territory. He is mainly interested in properties of regularity.

- **Maria Colombo,** professor at the École Polytechnique Federale de Lausanne, has received the award “for breakthrough results in fluid dynamics, optimal

transport and kinetic theory, and for her impact on analysis more broadly." In the broad field of mathematical analysis, Colombo is an exceptionally prolific and versatile mathematician. A recurring theme in her work is the study of irregular solutions to nonlinear partial differential equations, which describe both physical processes and geometric problems. In particular, she has developed new techniques for the study of irregular or "rough" flows, which appear in everyday phenomena that still remain little understood, such as the movement of turbulent fluids.

Felix Klein Prize

The winner of the Felix Klein Prize is **Fabien Casenave**, a researcher at the French multinational technology company Safran, specialized in the design and manufacture of aerospace machinery, such as airplanes and rockets. He develops AI techniques to improve simulations of physical processes. To find the best design for a machine, it is necessary to iteratively simulate its physical behavior under different conditions, but computational models of the machines have so many variables, that this iterated simulation is prohibitively expensive, when not impossible. The AI techniques developed by Casenave make it possible to systematically find "reduced models", with fewer variables, and to control the error one has to pay with these simplifications. Casenave has applied his techniques to problems of great practical importance, such as estimating the durability of turbines.

The Felix Klein Prize is awarded to young mathematicians 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." It's named after the German geometer and analyst Felix Klein (1849-1925).

Paul Lévy Prize in Probability Theory

Paul Lévy Prize in Probability Theory has been granted to **Jeremy Quastel**, professor at the University of Toronto, who uses probability theory to understand the large-scale behavior of interacting many-particle systems. For example, the partial differential equations describing liquids, gases or plasmas emerge from the approximately one hundred sextillions of equations that describe the motion of their individual particles. Recently, he has focused on the study of the KPZ equation (by Kardar-Parisi-Zang), which models growth and aggregation processes, such as those of a tumor, a city, or a crystal that captures atoms from its surroundings. These processes have their laws and patterns, but also a component of randomness, which is why the equations that describe them are called stochastic differential equations. Stochastic equations such as KPZ are a challenge for mathematicians. Quastel and his collaborators were the first to find an exact solution to this equation.

The Paul Lévy Prize named after the French mathematician of the same name (1886-1971) was created by the European Mathematical Society, the École Polytechnique and Paul Lévy's family, with the financial support of BNP Paribas.

Otto Neugebauer Prize

Reinhard Siegmund-Schultze, German historian of mathematics at Adger University, Kristiansand, Norway, is the winner of the Otto Neugebauer Prize awarded by the EMS "for highly original and influential work in the field of history of mathematics that enhances our understanding of either the development of mathematics or a particular mathematical subject in any period and in any geographical region." Siegmund-Schultze studied mathematics at the Martin Luther University of Halle-Wittenberg, and did a PhD at the University of Leipzig, on the history of the branch of mathematics known as functional analysis. He is especially renowned for his historical research on the emigration of European mathematicians during Nazism.

The Prize is named after Otto Neugebauer (1899-1990), an Austrian-American mathematician and historian, who laid the foundations of our current understanding of the mathematical knowledge of Mesopotamia, Egypt, and Greece.

Cornelius Lanczos EMS/ECMI Prize for Mathematical Software

Cornelius Lanczos EMS/ECMI Prize for Mathematical Software has been granted to **MUMPS** software library, developed by researchers Patrick Amestoy, Jean-Yves L'Excellent and Chiara Puglisi. MUMPS is able to solve systems of linear equations with speed and accuracy. The numerical simulation of many processes, from geophysical to quantum, involves solving enormous systems of millions of linear equations and millions of unknowns. This step is often the most expensive part, where the bottleneck of numerical simulation is found, in terms of speed and data storage. The company that manages this software says that "the time spent solving linear systems usually reaches 80% of the total simulation time."

The Lanczos Prize was established in 2023 by the EMS and the European Consortium for Mathematics in Industry (ECMI). It is named after Cornelius Lanczos (1893-1974), mathematician of Hungarian origin, pioneer in the development and implementation of numerical algorithms in digital computers.

ON TODAY'S MENU

ABEL LECTURE

Avi Wigderson: “The Value of Errors in Proofs”

09:00. BARCELÓ CONVENTION CENTER

Avi Wigderson is the Herbert H. Maass Professor in the School of Mathematics at the Institute for Advanced Study, Princeton University. He Works in computational complexity theory and its interactions with mathematics, including randomness and pseudorandomness; algorithms and optimization; circuit and proof complexity; quantum computation and communication; and cryptography. Among others awards has received the 2021 Abel Prize, Knuth Prize, Gödel Prize, Conant Prize, and Nevanlinna Prize.

PLENARY SPEAKERS

Vlad Vicol: “Anomalous difusión”

10:30. BARCELÓ CONVENTION CENTER

Vlad Vicol, Professor of Mathematics at Courant Institute of Mathematical Sciences, New York University, received his Ph.D. from the University of Southern California in 2010. He held positions at the University of Chicago (Dickson Instructor) and Princeton University (Assistant Professor). His research focuses on the analysis of nonlinear PDEs arising in fluid dynamics.

Eero Saksman: “Gaussian multiplicative chaos in random geometry and analytic number theory”

11:30. BARCELÓ CONVENTION CENTER

Eero Saksma leads the Academy of Finland Center of Excellence Randomness and Structure. He has been a professor at Tampere Technical University, Jyväskylä University and University of Helsinki. His work touch several areas of analysis and probability, including operator theory, complex and geometric analysis, PDE’s random geometry, applied inverse problems and adaptive Markov Chain Monte Carlo methods.

PUBLIC LECTURE

José López-Barneo: "A search for a new neuroprotective therapy in Parkinson's disease"

16:00. SCHOOL OF ENGINEERING ROOM A

José López-Barneo is emeritus professor of Physiology and Biophysics in the Universidad de Sevilla. He has been visiting professor in Stanford University and Columbia University. He founded the Instituto de Biomedicina de Sevilla (IBiS), which he directed from 2006 to 2020. He received an Advanced Grant from the ERC for studying molecular mechanisms of acute oxygen sensing, and in 2023 the Santiago Ramón y Cajal National Science Award. His main research interests are related to the study of the mechanisms of acute oxygen sensing in mammals as well as the cellular adaptations to hypoxia. He also works on the molecular bases of neuroprotection and neurodegeneration, with special emphasis on Parkinson's disease.

SPECIAL LECTURE

Heather Harrington: Application Driven Topological Data Analysis

17:30. SCHOOL OF ENGINEERING ROOM 7

Heather Harrington is Royal Society University Research Fellow. Her fields of research interest are Applied algebra, chemical reaction network theory, mathematical modeling, topological data analysis, systems and biology. Has received the Philip Leverhulme Prize (2020), Adams Prize (2019) and LMS Whitehead Prize (2018). In her talk she will present two directions in application-driven point cloud persistence. First, she will focus on the spaces of point clouds with the same persistence. This inverse problem asks the following: What is the shape of the fiber of the persistent homology map? The second problem is motivated by spatial data arising in biology, which includes outliers (eg histology) or dynamic metric spaces (eg collective dynamics). She will present statistics for multiparameter persistence and then apply it to complex biological data. To study these two Persistent Homology directions, we adapt tools from applied and computational algebraic geometry.

PANEL DISCUSSIONS

Translating European Mathematics

17:30. SCHOOL OF ENGINEERING ROOM 301

This round table has been organized by the Institute of Mathematical Sciences (ICMAT) and the International Commission on the History of Mathematics (ICHM) to discuss the importance of translating historical and current mathematical works to ensure their accessibility and global understanding. The participants are Norbert Schappacher of the University of Strasbourg, June Barrow-Green of The Open University and The London School of Economics, Frances Goldman of the University of Glasgow, and François Lê of the Claude Bernard University of Lyon. They will debate how accurate translations facilitate knowledge sharing and promote international collaboration, and also the challenges of correctly interpreting concepts and technical terms. The objective is to propose strategies to improve accessibility, such as the creation of online platforms to share translated works, thus contributing to greater dissemination and understanding of mathematics worldwide.

European Research Council Panel

17:30. SCHOOL OF ENGINEERING ROOM 304

The European Research Council (ERC) organizes this debate on ERC Grants, the most prestigious for researchers in Europe. These scholarships are crucial for the development of science research in Europe, including mathematics. The main recipients countries of the grants are Germany, the United Kingdom, France, the Netherlands, Italy and Spain. Since 2007, the ERC has allocated 776 million euros to mathematical projects in Europe. María González, coordinator of the ERC Mathematics Panel and organizer of the event, will highlight how mathematical research, being very transversal, can further increase its funding. Together with her, Annalisa Buffa from the Ecole Polytechnique Fédérale de Lausanne, Giovanni Forni from the University of Maryland, Stefanie Petermichl from the University of Toulouse and Jan Philip Solovej, president of the EMS, will explain the “art of applying” for these grants.

YESTERDAY AT A GLANCE

Mathematics and Artificial Intelligence, a duo

Can mathematics help Artificial Intelligence? Can Artificial Intelligence help mathematics? The answer to the first question is simple: **AI cannot be imagined without mathematics**; most AI, if not all, is based on mathematics. The participants in the round table organised by the Basque Centre for Applied Mathematics (BCAM) yesterday agreed on this question. Begoña Vitoriano (Complutense University of Madrid), Matti Lassas (University of Helsinki), Justo Puerto (University of Seville) and Rosa Crujeiras (University of Santiago de Compostela), chair by Led by Luis Vega, from BCAM, discussed on how mathematics can clarify lack boxes of AI algorithms.

They also talked about the **role that AI plays for mathematical proofs** and in the explanation, for example, of statistical results. The experts also reflected on the importance of data, how AI bridges the gap between mathematics and industry, and how to include it in the education system.

The infinite from Cantor to Hilbert

Is the infinite in the natural world? “Cantor definitely would not be happy with the answer”, according with José Ferreirós, professor of Logic and Science in the University of Seville, that yesterday gave a public lecture about the ‘Tales of (Mathematical) Paradise’. Ferreirós discussed three key events in the foundations of mathematics, and the vivid scientific and methodological debates they provoqued. First, 1925, with D. Hilbert's lecture "On the infinite"; then back to 1874, with Cantor-Dedekind's proof of the countability of algebraic numbers, and finally, 1905, with Zermelo's well-ordering theorem and the subsequent debate between formalist and constructivists. Ferreirós emphasized how key to these polemics is the use both by Cantor and Dedekind of not just infinite, but arbitrary infinite sets: "**Does the idea of a completely arbitrary function make actual sense? That is the question**."

Is life fair? No!

Svitlana Mayboroda gave a lecture yesterday about the harmonic function and whether it verifies certain rules of proportion (which does not! Then says that “is life fair? No!”). She started to talk about Partial reflected Brownian Motion, then went on to talk about the harmonic measure. Mayboroda then explained the issue of connectivity and dimension of the domains (specifically in a real space of dimension greater than 2). After going through different results (some of them being 100 years apart from each other) the lecture concluded with the idea that the harmonic measure associated to partially reflective Brownian motion is absolutely continuous with respect to the Hausdorff measure for a large class of operators and domains.

"Everything you always wanted to know about mathematical Education research (but where afraid to ask)"

Every student is supposed to learn the same mathematics. But who exactly is supposed to learn it? What are they supposed to learn? And who takes those decisions? There are some of the questions that were debated yesterday during the panel discussion covered large-scale assessments (LSA) in mathematics education. It was presented by Luis J.Rodríguez-Muñiz (Universidad de Oviedo, Spain), Andreas Eichler (Universität Kassel, Germany), Nuria Climent (President of SEIEM. Universidad de Huelva. Spain), Susana Carreira (Universidad del Algarve, Portugal), Giorgio Bolondi (Free University of Bozen-Bolzano). Rodríguez-Muñiz made a description of the discussion using the famous name of the Woody Allen film.

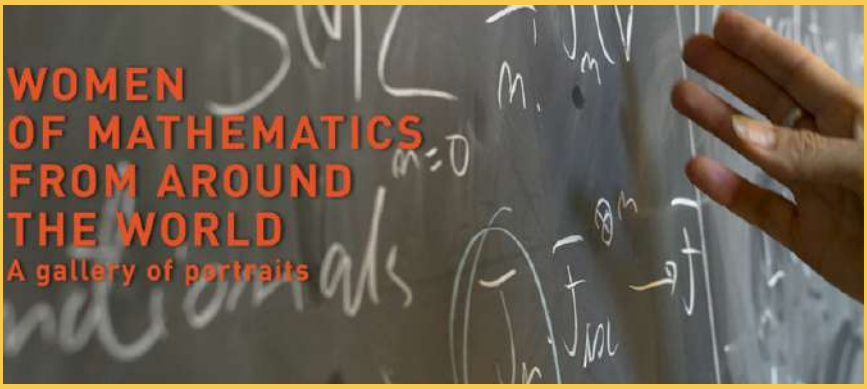
LSA return quantitative results form a (metaphorically speaking) highly complex and chaotic system whose input and context variables can be usually described only in a qualitative way. There are many variables that alter the students' performance. Studies show it depends on socio-economic status, culture, political dimensions, gender, etc. But it is no secret that the mathematics level worldwide is decreasing. For instance, according to Andreas Eichler: "In Germany half of the students usually drop out after the first year. Future teachers always ask me: Why do I have to learn such specific things? I want to be a teacher, not a mathematician". We have to find answers to why they have to.

It is clear that we have to make informed decisions; we need to better address the different type of mathematical students in terms of academic endeavors. Maybe not to put so much focus on the number of things we teach, but on the bulk of mathematical competence.

Exhibitions

Celebrating and Supporting Women in Mathematics

During the Congress, an exhibition project that has already been exhibited in different countries on several continents arrives in Seville: Women in Mathematics From Around the World. A gallery of portraits, which will be located at the headquarters of the Congress, during a week. It presents 34 broad profiles of women mathematicians from all over the world, through photographs, texts and videos. The aim is to raise awareness of the difficulties that women still face today in being able to pursue an academic career on an equal footing with men, which causes a huge disparity in the proportion between the two sexes. Initially, it portrayed only 20 European mathematicians and has since been enriched by the incorporation of researchers from other countries, such as



Japan, Costa Rica and India. The exhibition has already traveled to more than 150 locations in Europe, South America, Australia and Africa. The photographs shown are the work of Noel Tovia Matoff and the interviews have been conducted by Sylvie Paycha, together with Sara Azzali on a few occasions. The exhibition was the origin of the project, but it currently covers other activities through a platform (https://womeninmath.net/), which allows networking and exchanges and mutual aid. A printed catalog with the initial 20 profiles can also be purchased.

Enjoying Seville

Cathedral and Giralda

The Cathedral of Seville is the largest Gothic cathedral in the world and in 1987 it was declared a World Heritage Site by UNESCO. However, its floor plan does not have the Latin cross shape typical of this type of temple, but is square. The reason is that it was built on the old main mosque of the city, adapting to the existing structure. Thus, the Arab minaret became the bell tower of the building, the Giralda, which at almost a hundred meters high became the tallest tower in the world at the time. The Patio de los Naranjos and the Puerta del Perdón are also heritage of the mosque.

In addition to its architectural importance, it houses a spectacular art gallery, with masterpieces by Murillo, Velázquez, Goya and Zurbarán. Also inside you can visit the tomb of Christopher Columbus

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