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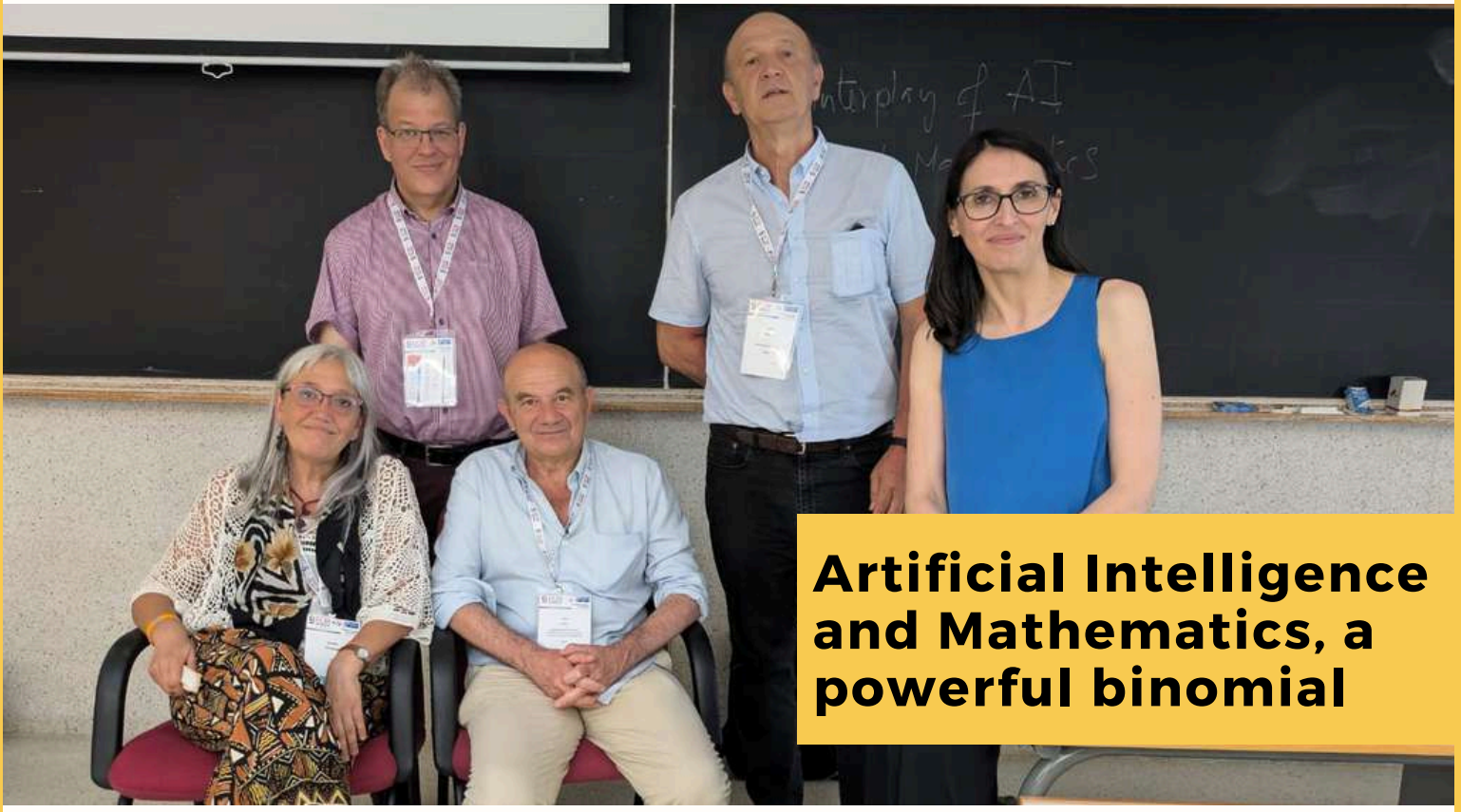
9TH EUROPEAN CONGRESS OF MATHEMATICS

ECM Sevilla2024

July 15th to 19th

9ECM Daily News

Information and current events from the Congress



Artificial Intelligence and Mathematics, a powerful binomial

Under the wide term '**artificial intelligence**' there is an amalgam of technologies that have a common basis: algorithms, computer science and, above all, **mathematics**. From Machine Learning to Neural Networks and Deep Learning, AI systems are becoming increasingly more complex and risky, and here mathematics has a lot to say. The reverse is also true: AI can be a powerful tool to address mathematical challenges, as well as a job opportunity and a bridge to industry.

In recent years, artificial intelligence has exploded and reached the public, althought this technology that has actually been in the making since the 1950s and has a common basis: **mathematics**. What can AI do to help solve mathematical problems? And, in reverse, what can be the fundamental contributions of mathematics to the development of AI? What threats and risks may arise if there is not a correct mathematical formalization of AI problems? Many questions that the mathematical community is beginning to explore in order to know what steps to take to address these challenges and, at the same time, take advantage of the benefits of AI. That is why **artificial intelligence is being a cross-cutting theme at 9ECM.**

The first thing is to understand that AI is, at its core, mathematics - something that also helps to take scaremongering and science fiction away from the concept. “Although the challenges of AI are essentially computer science (such as the processing of huge amounts of data), all artificial intelligence is *based on mathematics,”* recalled Begoña Vitoriano, researcher at the Complutense University of Madrid, at the round table *Mathematics and Artificial Intelligence*, organized on Tuesday by the Basque Center for Applied Mathematics (BCAM).

For example, the explosion of AI has led to the concept being associated with everything, although many things can just be statistical methods. “The difference is that in statistics you need a statistician to interpret the results for you, and AI automates it and gives it directly to the user,” the mathematician explained. “**We have been doing AI without knowing for many years**,” joked Justo Puerto, director of the Institute of Mathematics at the University of Seville (IMUS).

Mathematics to avoid bias and black boxes

One of the dangers of AI systems - under which there are algorithms and training data - is that we may not be able to understand where their results come from. It's what's known as a black box, and that lack of explainability has consequences. “Any AI system that interacts with humans can have risks. We have to take into account our personal data and the right to privacy,” said Rosa Crujeiras, professor at the University of Santiago de Compostela. “Explainability is very important, particularly when working with people. For instance, banks need to have AI models that are fully explainable since they have to justify the reasons behind doing certain operations with clients' money”, exemplified Vitoriano.

It is true that "we now have AI programs that work very well but that we cannot understand, and the technology is advancing very fast. Is there a way to bring light into the black boxes of AI in a realistic way?", wondered Luis Vega, of BCAM and moderator of the panel. **Maybe the answer lies in mathematics.** "In these systems, we need to understand how they work in order to improve the answers they

provide and, above all, to ensure that these results are accurate and free of bias. If we do not understand why an algorithm works, we will hardly be able to improve or even identify under what conditions it may fail," stresses Crujeiras. In this sense, "mathematics is key to understanding, improving and guaranteeing the performance of AI systems".

"**Mathematics has historically proven to be very useful** in this regard", agrees Vega, "but traditionally the answer is slow and time-consuming. It is therefore a formidable challenge for which time is of the essence". In general, Crujeiras believes that "mathematics is destined to play a fundamental role in the development of artificial intelligence systems, software that is developed based on learning techniques (machine learning or deep learning) and that is integrated into different tools and devices with which we coexist on a daily basis".

AI to develop mathematics

The question goes in two directions: not only what can mathematics do for AI, but what can AI do for mathematics. "Implementing AI can also change the way mathematicians work together, allowing for research groups of up to 100 people or for mathematical problems to be broken down into smaller ones that AI tools can check," suggested IMUS's Puerto. Matti Lassas, professor at the University of Helsinki, also mentioned the potential benefits of machine learning for branches such as functional analysis and interest in working on programs that can work on "noisy data, a very mathematical concept."

Vega adds other areas that are being affected, such as Inverse Problems and Control Theory, "since the use of deep neural networks has allowed the implementation of theoretical results in a much more effective way". They are not the only ones: "The same kind of ideas are also affecting other mathematical communities such as statistical learning or signal and image analysis, commonly known as Fourier analysis".

Does this mean... **artificial intelligence is everywhere, the same as with Mathematics**? "My particular view is that we are clearly at a crossroads and that this is a before and after in certain areas or types of issues. I don't think it is easy to predict what these areas are or what issues are most likely to be affected", concludes Vega.

Opportunities for mathematicians in AI

Seeing the potential of AI, if you're reading this and you're a mathematician, maybe you're wondering what you can do if you feel like pursuing it. You're not alone. Much of the interest in Mathematics studies, increasingly in demand and with university entrance grades much higher than in previous years in the case of

Spain, is driven by this professional world, says Alfonso Gordaliza, President of the Spanish Committee of Mathematics: "Most students are attracted by the ability of current mathematics to be a cutting-edge technology to address the large and complex problems that society is currently facing on all fronts, such as biomedical, environmental and digital". That's where we find artificial intelligence, which provides a **great opportunity to relate mathematics to the industry**.

Mathematicians already have a strong basis for this. Crujeiras believes that "students who finish their studies in mathematics generally have a solid background in aspects that allow them to integrate into projects that use artificial intelligence tools, simply by overcoming the language barrier". Opportunities are found in very different fields. For example, Crujeiras says that since their experience at the Center for Mathematical Research and Technology of Galicia (CITMAga) they have collaborated in projects that used or developed artificial intelligence tools in fields as diverse as banking, health, education or engineering.

There are also many names of mathematicians who excel in academic work related to artificial intelligence, including some of the plenary speakers at the 9ECM, such as Anna Wienhard, Director of Research at the Max Planck Institute for Mathematics in the Sciences. She is known for her interest in the applications of geometry to science, especially quantum field theory and machine learning. Some of her recent work deals with Persistent Homology, an **application of topology to big data** that has become popular among geometers in recent years. Also Annalisa Buffa, who focuses on **mathematical simulations and algorithms for testing the machines of future industry**. Buffa is a professor at the Ecole Polytechnique Fédérale de Lausanne and a member of the European Academy of Sciences, and her work focuses on achieving faster and more reliable algorithms for computer simulations of the mechanical and electromagnetic behavior of machines with complicated geometries.

In addition, one of the 14 prizes awarded at the congress went to a mathematician working in artificial intelligence. The Felix Klein Prize, which is awarded to young mathematicians under the age of 38, went to Fabien Casenave, a researcher at the French multinational technology company Safran, who develops AI techniques to improve simulations of physical processes. Casenave has applied his AI techniques to problems of great practical importance, such as estimating the durability of turbines.

It is no coincidence that there are so many topics related to artificial intelligence at the second most important mathematics congress in the world. Justo Puerto believes that we have to "make the mathematical community more aware that **we have a very important role to play in artificial intelligence**. If we don't do it ourselves, it will be in the hands of other groups, and we will lack the foundations, which is our greatest strength"

"Physics provides inspiration and motivation: it gives us an idea of what models and questions are important and interesting"

Nina Holden, Associate Professor at the Courant Institute of Mathematical Sciences at New York University

Nina Holden (Oslo, 1986) is a Norwegian mathematician who does research in probability theory and mathematical physics, including topics such as Liouville quantum gravity, Schramm-Loewner evolutions, random planar maps, and statistical physics. She's been an Associate Professor at the Courant Institute of Mathematical Sciences at New York University since 2022. She took her bachelor and master degrees at the University of Oslo with a Bachelor in Mathematics and Computational Science and a Master in Mathematics. Then, she finished her PhD in mathematics at the Massachusetts Institute of Technology in 2018 under the supervision of Scott Sheffield, and afterwards she was at ETH Zurich as a Junior Fellow and postdoc in the group of Wendelin Werner.
With a large academic production, Holden has also been awarded with recognitions from her early years. Back at the secondary school in Oslo, she became the first woman to win the Abel competition, Norway's national Mathematical Olympiad. In association with the 2021 Breakthrough Prizes, Holden was awarded one of three 2021 Maryam Mirzakhani New Frontiers Prizes, for early-career achievements by a woman mathematician. She has recently become a mum of her third children, and she's as willing to keep working and researching as ever.

How does probability and physics converge in your research?

I am using tools from probability theory (and other areas of mathematics such as analysis and combinatorics) to prove theorems. Physics provides inspiration and motivation: it gives us an idea of what models and questions are

important and interesting, and it also provides us with predictions and heuristics.

In concrete, your research includes random planar maps and statistical physics. What are the particularities of random planar maps? Why are these kinds of graphs interesting?

Planar maps are graphs embedded in the sphere without edge-crossings, such that two planar maps are identified if one can be obtained from the other via a continuous deformation of the sphere. They are studied in many different branches of both mathematics and physics. For example, random planar maps are used as natural models for random surfaces in probability theory and theoretical physics. One research direction is to study the asymptotic properties of random planar maps as their size goes to infinity, establish scaling limit results (i.e., convergence results) and study the continuum random surfaces that arise in the limit.

You were awarded one of three 2021 Maryam Mirzakhani New Frontiers Prizes for your "work in random geometry, particularly on Liouville Quantum Gravity as a scaling limit of random triangulations". Could you please tell us more about this work and its applications in mathematical physics?

In this work, Xin Sun and I prove a scaling limit result for random planar maps. A triangulation is a planar map where all faces have exactly three edges. We sample a triangulation uniformly at random from the set of triangulations of a given size and prove that it converges as its size goes to infinity. There are several ways to formulate such a convergence result and we establish a first convergence result for a uniformly sampled triangulation under what is called conformal embedding.

"It's important not to forget that women are able to produce very good research, also after becoming mothers"

The limiting surface is a highly fractal surface called a Liouville quantum gravity (LQG) surface, which has its origin in string theory and conformal field theory. The result is of interest in mathematical physics since it provides a first convergence result for a uniform planar map model under conformal embedding. Strong relationships between random planar maps and continuum LQG were predicted in the physics literature and our result, along with other recent results established by probabilists, give rigorous evidence for this link.

What are you working on now?

I am working in several different directions. One common goal of several current projects is to extend the scaling limit results for planar maps to new cases. One can consider a number of different planar map models and notions of convergence, and the different cases often need to be approached by rather different methods.

As a Norwegian mathematician working in the US, we would like to know your vision of mathematics in Europe. How are they seen from outside? What would you say is its relevance from a worldwide perspective?

Europe has many fantastic mathematicians and Europe is definitely an important center for mathematics worldwide. Probability theory, and more specifically my research area of random geometry, is very active in Europe. I communicate frequently with researchers in Europe and attend conferences in Europe every year.

Last but not least, you've recently become a mum. What extra challenges do you think a woman has to face in the academic career when talking about maternity?

Women face several challenges which men do not, for example it is physically demanding to go through pregnancy and childbirth, and one is set back by the career disruption that comes from maternity leave. Another issue is that women, on average, take on more responsibilities for their children also later in life, although this is something which varies between families. Still, it's important not to forget that women are able to produce very good research, also after becoming mothers.

What do you think is still necessary to change so that mathematician women have an easier way to pursue their careers?

This is a difficult question since there are already a number of good initiatives directed towards women, and the situation varies between different countries and institutions. Personally, I've experienced a lot of support from several people in my career. Regarding maternity and children, I find it important with access to good childcare, equal expectations to both parents and the possibility to get tenure-track or tenured position at an early stage of the career. More generally, I find it important with recruitment and visibility of women, and it's also important with awareness around unconscious biases.

ON TODAY'S MENU

PLENARY SPEAKERS

Annalisa Buffa: "On the impact of geometric simplification in the numerical simulation of partial differential equations"

09:00. BARCELÓ CONVENTION CENTER

Annalisa Buffa is professor of mathematics at Ecole Polytechnique Fédérale de Lausanne. Leading expert in the numerical analysis of PDEs, her interests include geometric design, computational mechanics, computational electromagnetics and approximation theory. She received an ERC Starting grant (2008) and an ERC Advanced grant (2016). Collatz prize at ICIAM 2015 and AWM-SIAM Sonya Kovalevskaya lecturer at ICIAM 2023.

Martin Bridson: "Chasing finite shadows of infinite groups through geometry"

10:30. BARCELÓ CONVENTION CENTER

Martin Bridson is the Whitehead Professor of Pure Mathematics at Oxford and President of the Clay Mathematics Institute. He is renowned for his work in Geometric Group Theory. His honours include the LMS Whitehead Prize (1999), AMS Steele Prize (2020), and Wolfson Research Merit Award (2012). Fellow of the Royal Society (2016), AMS (2015), and Academia Europeae (2020), he was an Invited Speaker at the ICM in 2006.

Tamar Ziegler: "Sign Patterns of the Mobius Function"

11:30. BARCELÓ CONVENTION CENTER

Tamar Ziegler is the Henry and Manya Noskwith Chair of Mathematics at the Einstein Institute of Mathematics at the Hebrew University. She is known for her work in ergodic theory, combinatorics and number theory. Distinguished visiting professor at the IAS in Princeton, received the Erdos Prize (2011), and the Bruno memorial award (2015). She was the EMS lecturer of the year (2013), and invited speaker at the ICM-2014.

PUBLIC LECTURE

Eleonora Viezzer: Wave-particle interactions in tokamak fusion plasmas

16:00. SCHOOL OF ENGINEERING ROOM A

An expert in plasma physics and fusion energy, Eleonora Viezzer is head of the Plasma Edge Physics research group and co-IP of the SMART tokamak at the University of Seville. She has received an ERC Starting Grant (2018), an ERC Consolidator Grant (2023), the Princess of Girona Research Award (2022) and the RSEF-BBVA Physics Award (2022), among other Prizes. Her talk begins by recalling the global energy problem and the role of nuclear fusion as a possible source of cheap and sustainable energy, to explain some details of the scientific and technological challenges posed by its development, especially those affecting the maintenance of plasma and its stability in tokamak-type magnetic confinement reactors due to wave-particle interactions.

PANEL DISCUSSIONS

New Scenarios in Open Science

17:30. SCHOOL OF ENGINEERING ROOM 301

Open Access to Scientific Literature (OA) allows any user to read, download, copy, print, distribute or otherwise use it, without any financial, technical or any other barriers. This movement emphasizes the opportunities offered by the Internet and other technologies to communicate research, while questioning the prevailing publishing system, more interested in its economic benefits than in the social value of research. This panel discusión, organized by Centre de Recerca Matemàtica, will address the changing world in which science is immersed due to open science and how mathematics, as a cross-cutting area, specifically addresses this change. In summary, the objective of the panel discussion is to discuss the current regulatory, research and editorial aspects of Open Access with the invited experts: Miguel Benítez (Basque Center for Applied Mathematics), André Gaul (EMS Publishing House), Ignasi Labastida i Juan (Universidad de Barcelona) and Pilar Rico (FECYT)

Celebrating and supporting women in mathematics

17:30. SCHOOL OF ENGINEERING ROOM 208

The presence of women in the world of mathematics has increased over the years, but there are still great inequalities and specific obstacles for those who want to embark on a career in academia and research. What are the good practices that should be continued? What challenges remain to keep moving towards a more inclusive mathematical community? These will be the questions that will be raised in this round table organized by the European Women in Mathematics (EWM) association and which is framed around the traveling exhibition "Women in Mathematics From Around the World. A gallery of portraits". The panel discussion will also give a brief introduction to the exhibition, which features 34 broad profiles of women mathematicians from around the world, through photographs, interview excerpts and videos. Inaugurated in 2016 at the ECM in Berlin, it can be visited during the congress at the Higher Technical School of Engineering of the University of Seville. Speakers to be confirmed.

PRIZE LECTURE

Jacek Jendrej: Recent progress on the problem of soliton resolution

14:05. SCHOOL OF ENGINEERING ROOM 7

Richard Montgomery: Transversals in Latin squares

14:05. SCHOOL OF ENGINEERING ROOM 301

OTTO NEUGEBAUER PRIZE LECTURE

Reinhard Siegmund-Schultze: On the 125th anniversary of his birth: My “encounters” with Otto Neugebauer

14:05. SCHOOL OF ENGINEERING ROOM A

YESTERDAY AT A GLANCE

The meaning of truth, proof, and computation

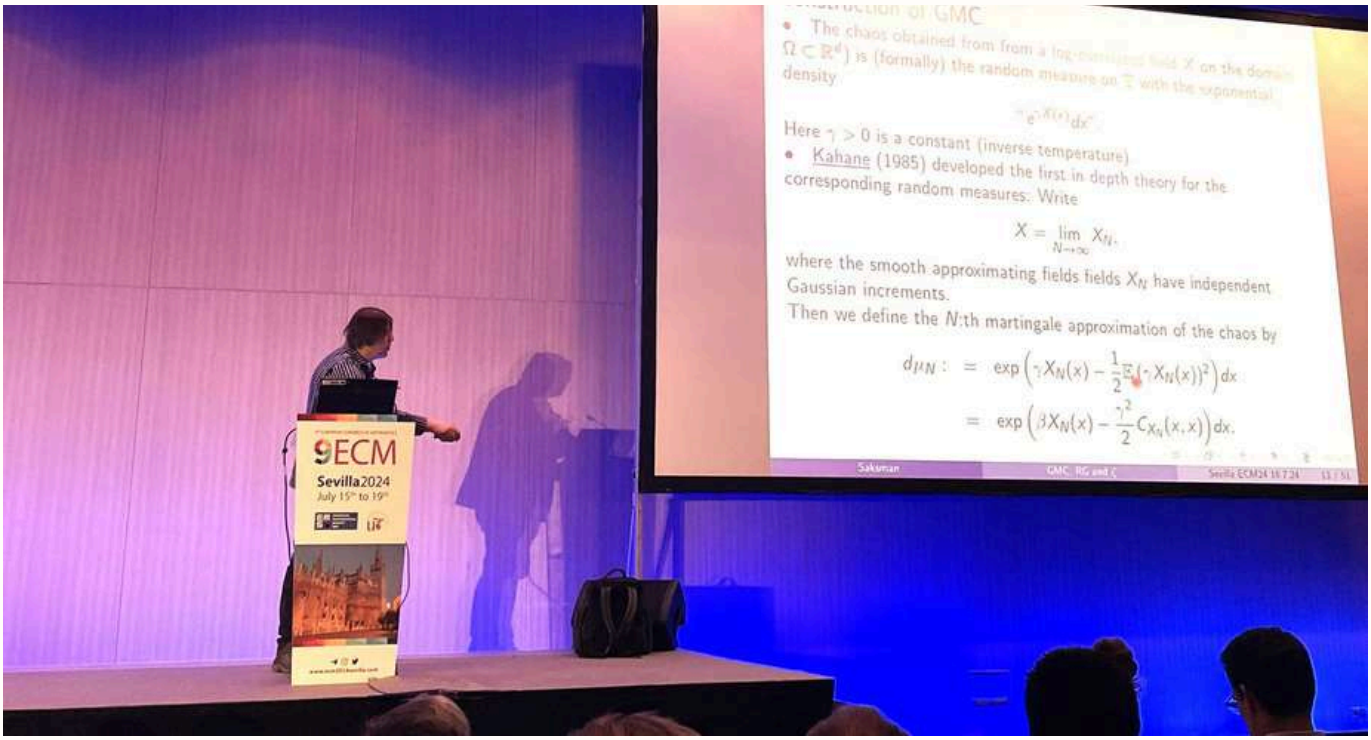
The idea of proof is essential to mathematics: this is why its conclusions are not just reasonable but True. But what can be proved? And what is a proof anyway? The last 100 years of mathematical research have revolutionised our thinking about these questions, as Professor Avi Widgerson (Institute for Advanced Study, Princeton, NJ) explained yesterday in his Abel lecture on “The value of errors in proofs”.

After being introduced by Jan Philip Solovej, president of the EMS, Widgerson started recalling “Hilbert’s dream”: what is true, can be proven; what can be proven, can be computed. Godel and Turing woke us up, starting the computer revolution.

Widgerson then led the public on a fascinating exploration of the ever paradoxical (in appearence!) notions of proof being developped during the past 40 years, where randomness, and interaction between “provers” and “verfiers”, are crucial ingredients: from interactive and zero knowledge proofs (“can a convincing proof be uninformative?”), to probabilistically checkable proofs (where the verifier simply reads 20 random bits of the argument!). In a sense, all these types of proof are equally powerfull and can prove the same things, and Widgerson emphasized that these ideas have had a profound impact beyond mathematics, for instance in the design if cryptographic protocols.

In the last part of his lecture, Widgerson moved to quantum computing, and briefly explained a recent breaktrhough by Ji, Natarajan, Vidick, Wright and Yuen that “stunned everybody”: Quantum Interactive Proofs can go beyond the classical proofs previously presented, entering Turing’s uncomputable realm. The key reason for this unexpected power lies in quantum entanglement: the unintuitive phenomenon that Einstein called “spooky action at a distance” and motivated Schrodinger’s cat paradox. Unlike in classical proofs, provers and verifiers share information that is entangled, making it possible to reach the uncomputable.

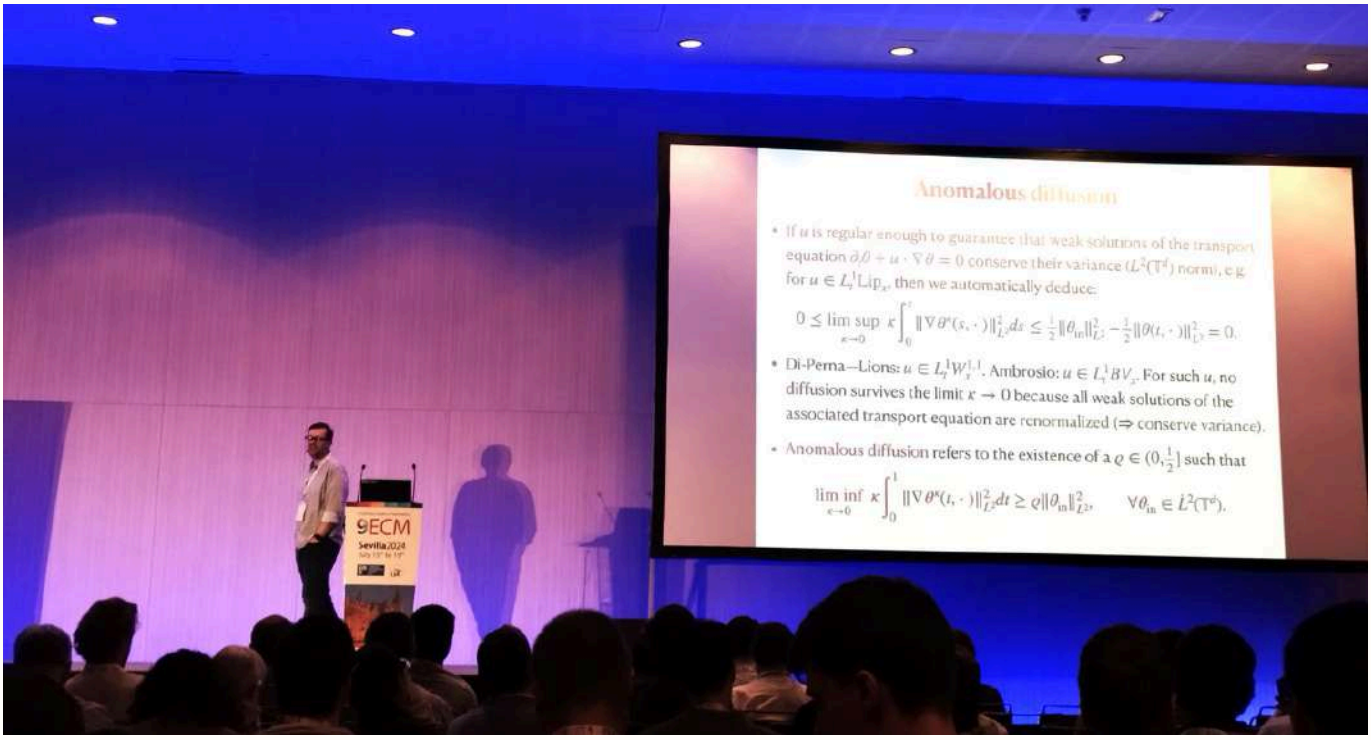
Gaussian Multiplicative Chaos



Yesterday's second plenary lecture was delivered by Eero Saksman, a professor at the University of Helsinki, where he directs the Centre of Excellence in "Randomness and Structures." His expertise in randomness was evident in his talk, "Gaussian Multiplicative Chaos in Random Geometry and Analytic Number Theory." The session focused on Gaussian Multiplicative Chaos (GMC), which Saksman defined as a random measure obtained as the limit of a certain absolutely continuous measure related to a Gaussian Random Field. He discussed examples of such structures, including the Gaussian Free Field and Log-correlated Fields.

Saksman went into details of the construction of GMC and the concept of Critical Chaos before delving into its applications. He highlighted its role in the modeling of quantum areas in Liouville quantum gravity (LQG) and its connections to analytic number theory, where he presented a toy model for studying the statistics of the logarithm of Riemann's zeta function. He concluded the lecture by presenting two conjectures in the field: one that he believes remains distant from resolution, and another that he more optimistically expects could soon become a new theorem.
The session ended with the chair, Eva A. Gallardo-Gutiérrez, asking Saksman for more detailed information on the relationship with Riemann's zeta function.

Turbulence: a challenge for mathematicians



Turbulence was the phenomenon at the center of yesterday's first plenary talk. Vlad Vicol, of the Courant Institute, NYU, was introduced by Francisco Gancedo, Professor of Mathematical Analysis at the University of Seville.

If we drop some dye in an ideal fluid, the ink will go with the flow, that is, it will be transported, not diffused…or so the equations of fluid motion, if naively interpreted, tell us. However, if the same fluid is in turbulent motion, the dye is diffused even thought the equations say it shouldn't. Hence the term "anomalous" diffusion. The way to study this phenomenon is to consider the dye being transported by fluids of ever smaller diffusivity, and see what happens in the limit. During the past 100 years physicists have made remarkable predictions on this limit, and mathematicians are interested in proving whether these claims are right or not.

After given a very illuminating summary of 80 years of previous work on the subject, Vicol explained the fundamental new steps he has made together with his NYU colleague Scott Armstrong to construct anomalous solutions with realistic properties, using a subtle renormalization scheme, that takes into account not just the velocity field, but the particle trajectories in the flow, to counterbalance the dreaded "sweeping effect".

Vicol ended his talk by proposing to the audience a conjecture: by proving or disproving it, he emphasized, we could learn tremendously about the connection between the PDEs of fluid mechanics and actual turbulence.

A search for neuroprotective therapy in Parkinson's disease

"I come here today to talk about research that is far from mathematics. I started with the search for a neuroprotective therapy in Parkinson's 25 years ago and in all this time experimental research has put us in our place". Working in the Institute of biomedicine of Seville (IBiS), José López Barneo talked about the Parkinson disease, a condition in which parts of the brain become progressively damaged over the years. It is the second most common disease affecting the brain. There are more than 10 million cases in the world.

"Experimental research is different from mathematics, it is much less exact, more variable, it depends on many factors, and the important thing is the experiment", López Barneo explained. "But what unites both mathematics and other scientific researchers is curiosity and the true engine of science: knowledge for the sake of knowledge".

During his intervention, he explained neurodegeneration is a big problem, modern medicine is advancing in problems such as heart diseases, but neurons are very different, they don't regenerate and their ability to repair is very limited. The speaker said he hopes to one day hold the proliferation of the Parkinson's disease, improve it even in the next few years, thanks to the research… "but not cure".

Building the European Union of Mathematics

The panel discusión Erasing borders: translating European mathematics, celebrated yesterday, started with an introduction by Norbert Schappacher, where he briefly touched on the ideas of the necessity and importance of good translations, especially when there is an idea echoed in certain spaces that mathematics is a universal language,

alongside the problems that arise. The first intervention was by June Barrow-Green, who looked at the history of the different translations of Newton's Principia, from Andrew Motte in 1729 to Charles Leedham-Green in 2021. She then went on to explain the difference between an active and a passive translator, and also to mention important historical figures associated with translators, with a focus on women translators like Emilie du Chatelet, Mary Somerville and Ada Lovelace. The next talk was given by François Le, who talked about what is an "untranslatable" term. The speaker continued talking about certain mathematical terms with different translations, which may cause problems and push the limits of translation. The last speaker was Frances Goldman, who talked about how The London Mathematical Society started translating Russian journals in the post-WW2 decades (even if translation of journals is rather expensive), when the political landscape was rather turbulent, and also mentioned the benefits that the Russian Academy of Science gets out of this situation.

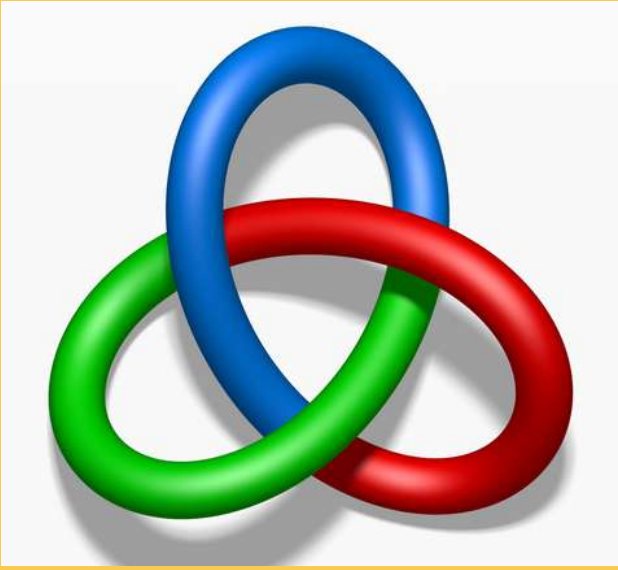
ERC Grants: try, and try again!

Maria González, an esteemed panel member of the European Research Council (ERC) and organizer of yesterday's panel discussion, shared valuable insights about the ERC, an organization responsible for funding scientific research projects. She elucidated the various types of grants available post-PhD, like Starting or Sinergy Grant detailing the application process and the structure of the ERC. A key takeaway, conveyed through her intention and tone, was the powerful message: "Contrary to what we may think: FAILING IS NOT A FAILURE." Drawing from her 10 years of panel experience, she noted that some candidates that do not succeed on their first attempt do so on subsequent ones.

Following this, attendees had the opportunity to hear personal experiences from various individuals who have received ERC grants, that provided guidance and encouraged everyone to take the plunge. Among these: Annalisa Buffa, Giovanni Forni, Stefanie Petermichl and Jan Philip Solovej. The speakers emphasized confronting fears and doubts with perseverance, and reflecting on how achieving the grant would feel and how it would be valued by one's peers. Their message was clear: "Apply if you have a reasonable chance." They stressed the importance of encouraging others: if you believe you have a chance, take the initiative and give it your best effort.

Exhibitions

The mathematics of knots



The Higher Technical School of Engineering (ETSI) of the University of Seville is hosting the exhibition "Knots", which can be visited during the Congress. This exhibition, opened at the general public, has ten three-dimensional models of mathematical knots specially selected for their particularities, symmetries and beauty, which will guide the visitor through the fascinating world of Knot Theory. With interactive explanations, each knot represented will serve as a model to illustrate some of the most interesting aspects and properties of this branch of mathematics, from its origin (linked to Chemistry) to the most innovative techniques that allow us to distinguish molecules. Has been designed and prepared by Juan González-Meneses (Department of Algebra of the University of Seville and president of the 9ECM Organizing Committee), Marithania Silvero (Department of Algebra of the University of Seville) and Francisco Manuel Vega (Department of Applied Physics of the University of Seville).

Enjoying Seville

Plaza de España

Speaking of knots, all the provinces of Spain are connected in the Plaza de España in Seville. As if it could be joined together by a single rope, they meet in this semicircular plaza that has a large central building where the Army headquarters is located, galleries with monumental stairs, a central fountain and a kind of elongated lake crossed by four bridges. But without a doubt the most characteristic are its 48 benches covered in ceramic and full of color, dedicated to the Spanish provinces. In each of them there is a large panel that represents an event in the province and its coat of arms, and on the floor you can see a map of the territory.

Declared an asset of cultural interest, the Plaza de España was designed by the architect Aníbal González and was built between 1914 and 1929 and is the largest construction of the Ibero-American Exhibition of that year. It is located in the María Luisa Park and the visit is free. Make sure you bring sunscreen and something that protects you from the sun if you are going to visit it in the middle of the day, even if it has a special light at dusk. Without a doubt, it is a visit that you should not miss to travel, from a single place, to all of Spain.

Erratum

The version of the 9ECM Daily News sent out on Tuesday, July 16 stated that 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. Instead of Chiara Puglisi it should read Theo Mary.

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The content of this magazine does not necessarily reflect the opinion of the organisation.