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EDITORIAL

After the last European Congress of Mathematics, held between July 18th and July 22nd in Berlin, Marta Sanz-Solé, professor at the University of Barcelona, speaks about the European Mathematical Society, of which she was the Chair person between 2010 a 2014.

The ECM: Preserving the Unity of Mathematics

Less than one year ago, in October, 2015, the European Mathematical Society (EMS) celebrated its 25th anniversary. The place chosen to commemorate the event was the Institut Henri Poincaré, the home of mathematics and theoretical physics in Paris since 1928. In that same year, the London Mathematical Society, one of the oldest mathematical societies in Europe, celebrated its 150th anniversary, while many other societies have recently commemorated their 100th anniversary or are about to do so. This difference in age may give rise to certain complexes, although there is no reason why this should happen. The EMS has enjoyed great success during its short existence, thanks to the well-defined space it occupies in a world that is advancing rapidly towards globalization, and the exclusively international scenario in which it carries out its functions.

The conception and creation of the EMS in 1990 is better understood in the political context of Europe that arose after the tragic experience of World War II. In 1958, the communitary structure that currently underpins the Europan Union (EU) was established, on the basis of which the identity of Europe has been consolidated, and the project, initially focused on the economy, has evolved along all fronts that affect the lives of those belonging to the member states; in particular, education, research and innovation. The need to have tools capable of facilitating and improving European cooperation, and international cooperation in general, is paramount. The EMS emerged with the vocation of being this instrument, at the service of the European mathematical community as understood in a geograpical sense.

The EMS has throughout its existence carried out its activity on several fronts, among which we may mention the creation and development of an associative, transnational fabric; a dialogue with the bodies governing and managing European policy on education, research and innovation; the provision of instruments indispensable for mathematical activity; the promotion of mathematical research, and the profiling of its most significant advances.

In the sphere of scientific policy, the EMS is recognized by the EU as the voice of mathematics in Europe. This entails a great responsibility for the Society, but at the same time an achievement. The EMS was closely involved in the creation of the European Research Council, and continues to be so its ongoing development.

Image: Fernando Rascon

CONTENTS

The recognition of the vital role of basic research for the progress of knowledge, especially in mathematics, has increased considerably, and it is only fair to attribute this recognition largely to the tireless work of the EMS in Brussels. Nevertheless, one of its major challenges still remains, and that is to make the EU authorities more aware of the specific needs of mathematics and its structural functions, which in turn should be translated into means of funding that are both more suitbale and more flexible.

At present, the members of the EMS consist of 55 societies of mathematical sciences, 30 research institute and centres, 10 university departments and approximately 2,500 individual members. Indeed, one of the achievements of the EMS has been to attain the cohesion and vitality of an extensive and varied control network such as the one formed by its members. In order to maintain this state of affairs, annual meetings of the Chairs of the different societies are organized. The research centers and institutes, whose heads also meet on a yearly basis, are grouped together in the ERCOM network (European Research Centres of Mathematics), to which the ICMAT also belongs. The existence of such a diversity provides a richness in points of view as well as a wealth of ideas of great value. Managing these differences properly, maintaining cohesion and following a consensual road map constitute one of the main challenges facing the Society. One of its most noteworthy successes in this regard is the organization of the European Congress of Mathematics (ECM).

On completion of the 7th European Congress of Mathematics (7ECM, held in Berlin between July 18-22, 2016), I would like briefly to outline the point of view of the EMS on what this activity contributes to mathematics, to its visibility and to the dissemination of and support for its most significant advances.

In the same way as in virtually all the scientific disciplines, mathematics has undergone a process of extreme specialization. Given this scenario, it may seem natural to ask if the celebration of general congresses is worthwhile. However, the continuing success of the ICM (International Congress of Mathematicians), which has been held since 1897, and the growing success of the ECMs (since 1992), demonstrate the interest and importance of these events. Not only the mathematical community, but also the related disciplines, are the beneficiaries of the impressive showcases and marvellous scientific fairs like the one provided by these congresses. It is for that reason that the EMS goes to such lengths to highlight its most important and visible scientific activity through the organization of the ECMs.

Without being divided into sections or grouped according to subject (unlike the ICM), every ECM has its own specific features: its scientific program, designed by a scientific committee appointed by the Society, is aimed at inspiring in the participants a mind open to learning and the exploration of subjects beyond the frontiers of their own specialized fields. The newest and most significant mathematical breakthroughs in many cases involve a complex and sophisticated combination of ingredients, techniques and knowledge coming from many different fields. This is one of the reasons why the unity of mathematics, and not its fragmentation, needs to be jealously preserved. The ECM meetings seek to promote a holistic conception of the discipline, and it is here where the diffusion of methodologies, theories and ideas among different areas gains strength. In any event, the long-term outcome is progress in fundamental terms.

A second aspect that comes to the fore in the ECMs is the encouragement and constant support from the EMS for the creative and innovative spirit of young researchers. The EMS Prizes are awarded to a maximum of ten mathematical scientists below the age of 35 in recognition of their excellent contributions in the field of mathematics. These awards are an expression of the vitality of this science and their prestige has been backed up by the fact that some 20% of all the award winners have gone on to obtain Fields Medals.

Finally, as a charcateristic of a congress of this type, the ECMs provide a forum for participation and the exchange of knowledge and experience, a place where discussions are held on subjects of interest for the mathematical profession as well as the opportunity to establish contacts and extend networks of collaboration. In addition to this fundamental structure, designed and monitored by the EMS, the ECM programs include other ingredients that the local organizers themselves contribute. This is particularly important factor to take into account at the next ECM.

The 7ECM has without doubt been a spectacular event with an outstanding attendance, in which we have had the great pleasure and satisfaction of listening to two speakers who are very close to us: Daniel Peralta-Salas (ICMAT) and Joaquim Ortega-Cerdà (UB). It has been the biggest and most important mathematical congress to be held in 2016, and we were delighted to be there.

Marta Sanz-Solé
Faculty of Mathematics, University of Barcelona
President of the EMS (2011-2014)

Image: ICMAT

INTERVIEW: Daniel Peralta, ICMAT researcher, ERC Consolidator and ECM plenary speaker

"I like to think that there's a lot of serendipity in cutting-edge research"

Image: ICMAT

Daniel Peralta

Elvira del Pozo Campos. Daniel Peralta Salas (Madrid, 1978) studies the interactions between dynamical systems, partial differential equations and differential geometry at the ICMAT. He graduated in Physics from the Complutense University of Madrid in 2001 with an Extraordinary Prize, and gained his PhD at the same university in 2006, when he was also awarded an Extraordinary Prize. Since then he has published more than 50 research papers in leading mathematical journals such as "Acta Mathematica", "Annals of Mathematics", "Journal of Differential Geometry" and "American Journal of Mathematics". In 2013 he obtained a European Research Council Starting Grant project, while in 2015 and together with Alberto Enciso he was awarded the "Barcelona Dynamicalal Systems" international prize for solving a Kelvin conjecture on vortex tubes. He presented this result at the 7th European Congress of Mathematics, held in Berlin in July of this year, and thereby became only the second Spanish mathematician in the history of the ECM to give a plenary talk at the congress.

Q: How did you participation in the ECM come about?

A: Well, it wasn't on my initiative: contrary to what happens in other similar events, my participation wasn't applied for or suggested. It was the scientific committee of the congress itself that decided to invite me to give a talk on the results of the work I published last year together with Alberto Enciso (another ICMAT researcher) in which we proved Kelvin's conjecture.

Q: What's it feel like to get news like that?

A: At first I was very suprised because I wasn't expecting it, and then I felt a great sense of responsibility because the ECM is the biggest mathematical event in Europe, and the second most important in the world after the International Congress of Mathematicians.

Q: Your talk was about what was regarded by many experts as "a milestone in the study of the geometry of fluids".

A: Yes, I spoke about the proof of Kelvin's conjecture. We showed that the streamlines of a fluid in equilibrium can become knotted and braided in a complex way (the so-called vortex tubes). I also presented some unpublished results that explore that line more deeply, and which will appear next year in the French journal Annales Scientifiques de l'École Normale Supérieure. These are the outcome of work undertaken by Alberto and myself, along with my PhD student at the ICMAT, Francisco Torres de Lizaur.

Q: Could you give us a foretaste of what's in this new paper?

A: Basically, it goes more deeply into the results already obtained and answers some small criticisms we received previously: namely, that the proof that complex knots exists only holds for certain types of fluids in equilibrium, those regarded as infinite. This consideration is a theoretcial approach that we took in order to model them, because in reality those fluids that are mainly found in nature are not infinite. Now we've included new ideas and developed new mathematical techniques coming from quantum mechanics which demonstrate what we already suspected: the turbulence we were talking about also appears in finite fluids. This new result has been described by the expert who reviewed it for the journal as being "very original".

Q: If we were in the field of physics, could it be understood that you've invented a new instrument, like a microscope, for measuring things that just wasn't possible before?

A: Exactly; we've developed new mathematical techniques that not only explain the turbulence found in fluids, but that also appear in other areas such as magnetic fields.

Q: Fluids and magnetic fields seem to be two very different things, but you're studying them in the same way...

A: This is the contribution that has been most highly valued by the scientific community; we've provided a new strategy and common mathematical techniques for tackling many problems that in appearance seem different. This area is much broader than the study of fluids, and in recent years it has been a focus of attention for Alberto and myself as part of our respective ERC Starting Grant projects.

Q: And are you going to pursue this research line?

A: Yes, at least until December 31st, 2018, when the ERC project comes to an end. On the one hand, by exploring this new strategy

that we've developed with the aim of tackling problems as dissimilar as quantum mechanics, temperature dynamics, in magnetic and gravitational fields. On the other hand, conducting research in order to introduce new ideas and techniques to help us solve other problems that have cropped up along the way and which the strategy we use isn't capable of solving.

Q: How far would you like to go with this research work?

A: We'd like to obtained concrete results in two topics in particular. First, we want to gain a deeper knowledge of the complex structures in fluids in equilibirum and to establish a link with chaos theory; we believe that chaos exists within the vorteces and we want to prove it. The second objective is to move on from ideal fluids, which is the approach we've been following until now, to fluids that may not be in equilibirum and which may disipate energy – because they have viscosity – which is what occurs most frequently. In this context, we want to show mathematically that reconnections are produced as well as to establish suitable geometric models capable of explaining them. This is a phenomenon that is observed constantly in nature and in which the streamlines in a fluid not only become deformed, but can even break up and reconnect again, thereby passing from one type of knot (turbulence) to the formation of another.

Q: And in the long-term?

A: We're moving towards other kinds of research lines, some even purer, such as dynamical systems problems that are not connected with mechanics. However, our future work will depend on whether we can achieve the twelve aims I set myself at the beginning of the ERC, five of which we have attained so far; then we'll decide. In any case, new questions have arisen throughout this time. I like to think that there's a lot of serendipity (what we call carambola, in Spanish) involved in cutting-edge research; fresh problems appear that weren't considered at first, and that makes it more difficult to arrive at a proof; on the other hand, you manage to resolve things that you didn't even imagine at the outset. For example, this new strategy we've introduced didn't even occur to us at first for fluid mechanics. Applying it for the proof of complex structures in this field was something of a coincidence.

Q: The introduction of these new techniques makes your contribution to basic mathematics quite clear, but what repercussions might it have in other disciplines or for society?

A: Knots are objects found in fluids that exist in real life. The rigorous proof we've come up with enables us to explain and explore more deeply our understanding of physical realities that until now were only suspected. Acquiring this additional knowledge about turbulence may open up fresh possibilities. In the future, it could be applied to magnetic fields, and specifically in subjects relating to plasma confinement. For instance, the Tokamak Fusion Reactor has the form of a simple knot (toroid), just like the donuts formed in turbulence, so this new knowledge opens the door to the design of new structures and confinement geometries. Although I have to say that at the moment this is merely speculative.

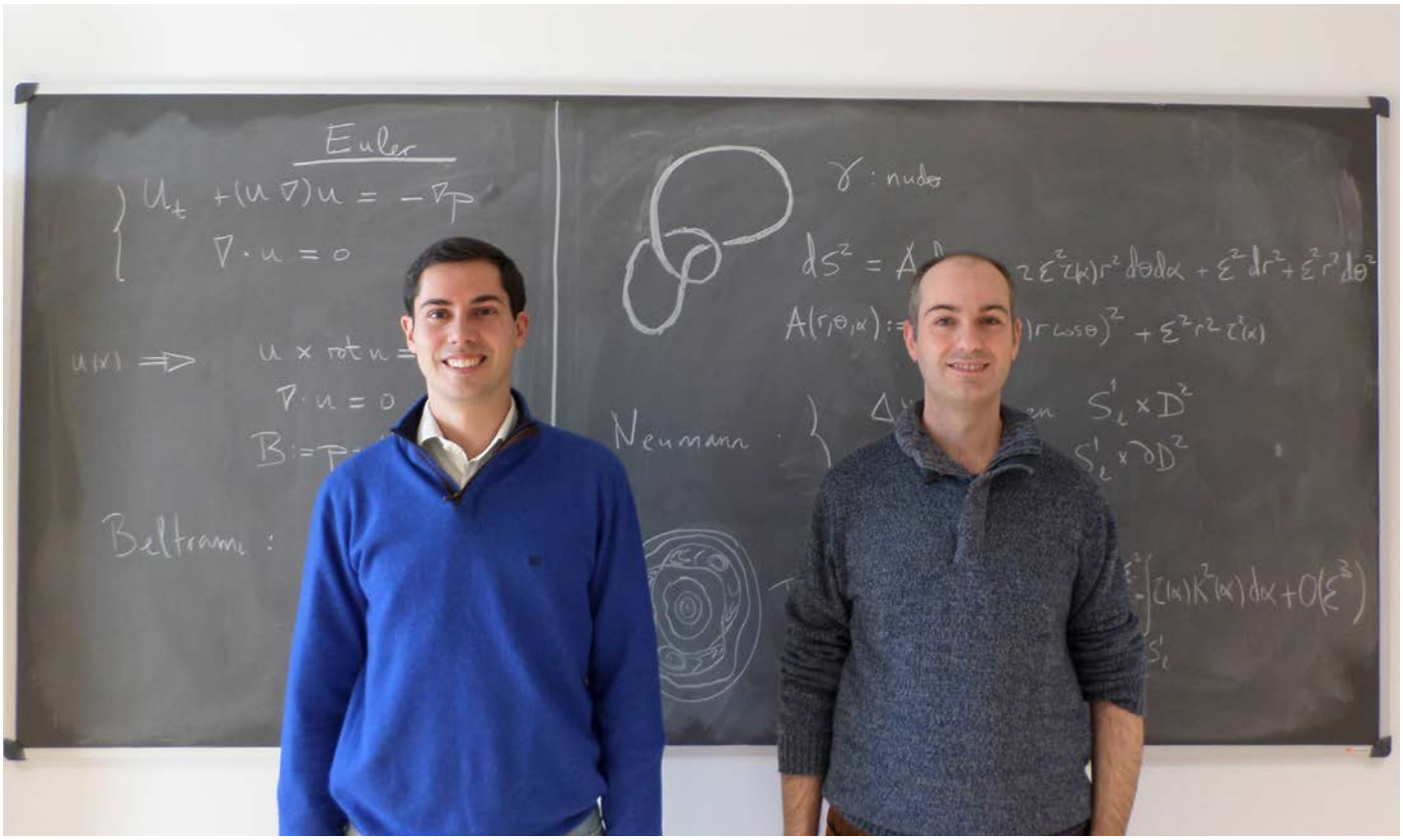


Image: ICMAT

Daniel Peralta (right) with Alberto Enciso

REPORT: 'ICMAT Severo Ochoa Laboratories'

After the success of the "ICMAT Severo Ochoa Laboratories" formula, which in its first edition was graced with the collaboration of four great international mathematicians between 2011 and 2015, the Institute now launches a second program that will last until 2019 with funds provided by the Severo Ochoa project. To embark on this new adventure, the ICMAT is able to count on the collaboration of Ignacio Cirac (Max Planck Institute of Quantum Optics), Simon Donaldson (Imperial College), Nigel Hitchin (oxford University), Robert Grossman (University of Chicago), Kari Astala (University of Helsinki) and Charles Fefferman (Princeton University). In addition, a new position has been created, that of Distinguished Professors, which is in line with this policy of international collaboration.

Laura Moreno Iraola. The new ICMAT Laboratories are now under way. They will be developed over the next four years with funding from the Severo Ochoa program of excellence (2015-2019), thanks to which mathematicians of worldwide prestige, including two Fields Medal winners, will join the Institute where they will co-direct research teams together with members belonging to the centre. They are the following: **Ignacio Cirac**, director of the Max Planck Institute of Quantum Optics and recognized internationally for his work on quantum computation; **Simon Donaldson**, Fields Medal winner and professor at Stony Brook University and Imperial College London, will co-direct a laboratory with **Nigel Hitchin**, recently awarded the Shaw Prize (known as the Nobel of the East) and professor at Oxford University; **Robert Grossman**, University of Chicago, known for his work on bioinformatics, data mining, cloud computing and related areas; **Kari Astala**, University of Helsinki, a specialist in mathematical analysis, and **Charles Fefferman**, Fields Medal winner (1978) and professor at Princeton University.

"The combination of all these factors will yield fantastic results, such as new theorems, publications in top-rank journals and our contribution to extending the horizons of mathematics"

As Severo Ochoa principal researcher and co-director of the Charles Fefferman laboratory, Diego Córdoba, explains: "The chief aim of this program is to link top-ranking mathematicians directly with the Institute in a scientific way. The purpose is to provide them with the opportunity of spending one or two months a year working with people belonging to the Centre". They are also committed to participating in other activities at the Institute such as symposia, workshops, courses and work meetings, thereby "giving PhD students and post-doc researchers the chance to deal directly with these outstanding scientists, to explain the work they are engaged on and perhaps in the future go to the Institutions to which these scientists belong", says Córdoba.

On the other hand, he says that "the program will raise the profile of the Institute outside, and thanks to this high-level scientific activity it will become more attractive for other researchers to spend time here as well".

"Many people from abroad know about this program and want to take part in it"

The laboratory scheme is vital for attaining the scientific objectives that the Institute wishes to reach. "The combination of all these factors can only bear fantastic fruit, such as new theorems, papers published in prestigious journals and an increase in our contribution to extending the horizons of mathematics", says ICMAT director, Antonio Córdoba.

The good impression created by these first four years has encouraged us to renew our commitment to the laboratories and the international excellence they provide. ICMAT former director and researcher, Manuel de León, states that; "I believe they have been a success. A lot of people abroad know about this program and have even told me that they want to participate".

The first ICMAT Laboratories started as one of the activities funded by the first Severo Ochoa program. According to Manuel de León, at that time the director of the ICMAT, "The General Foundation of the Consejo Superior de Investigadores Científicas (FGCSIC) wanted to set up a body called the 'CSIC General Foundation Laboratory' and was thinking about mathematics for the pilot scheme. We organized one, the Charles Fefferman Laboratory, but it turned out that it couldn't be done through the FGCSIC, so we included it together with the other four, already approved by the Severo Ochoa Executive Committee." De León goes on to say that, "In fact, it was the idea of the Foundation Laboratories that inspired me to organize the ICMAT labs." The international coordinators of this first venture were Marius Junge, Nigel Hitchin, Viktor Ginzburg and Stephen Wiggins, as well as Charles Fefferman.

Both in the first program and the second, the ICMAT has provided funding for travel expenses between two collaborating institutions to which the laboratory members belong, and the pre- and post-doc contracts are directly associated with the project. The international head undertakes this collaboration in a disinterested manner.

"The Distinguished Professors are committed to staying during a period of time at the Institute headquarters to interact with all its members"

As an extension of the laboratory scheme, although with fewer resources (cover for travel expenses, but not for appointing researchers), the position of Distinguished Professor has been created in order to expand the international collaboration programs of the Center with Marius Junge, professor at the University of Illinois, Viktor Ginzburg, professor at California University, and Rafael de la Llave, permanent professor at the Georgia Institute of Technology. As Diego Córdoba explans: "This new position will link them to the ICMAT and they are committed to spending some time at the Institute in order to interact with all the members".

ICMAT LABS

Ignacio Cirac Laboratory

Image: Max Planck Institute of Quantum Optics

This laboratory is focused on mathematics and quantum information; specifically, on building the "periodic table" of materials at very low temperatures, where quantum mechanics is the theory governing the behaviour of the systems. According to David Pérez-García, ICMAT coordinator, "Our aim is to classify the quantum systems formed by many particles into equivalence classes (called "phases") given by those systems having similar properties".

The head of this laboratory is Ignacio Cirac, director of the Max Planck Institute of Quantum Optics, who was awarded the Príncipe de Asturias Prize in 2006, The BBVA Frontiers of Knowledge Prise in 2008 and the Wolf Prize in Physics in 2013, among other awards.

The remaining members of the team are researchers who work in this field at the ICMAT, such as Alberto Ibort and Carlos Palazuelos, and at the Institute of Theoretical Physics (CSIC-UAM), like Germán Sierra, together with their respective groups. Also participating are Norbert Schuch (Max Planck Institute, Munich) and Frank Verstaete (University of Gante, Belgium). According to Pérez-García, the main aim they wish to achieve with this union is "to make progress in the classification of the quantum phases of matter and in the techniques of quantum information required to tackle this problem".

Robert Grossman Laboratory

Image: ICMAT

"This laboratory is devoted to data science, one of the most widely studied research fields on the current scientific scene," says David Gómez-Ullate, coordinator of the laboratory on behalf of the ICMAT. "Our intention is that Robert Grossman's presence at the ICMAT will open up and consolidate new avenues of research in data science. We also hope to establish collaboration with other research centers such as the Centro Nacional de Investigaciones Oncológicas (CNIO – Spanish National Center for Oncological Research) and the Barcelona Supercomputing Center". The Robert Grossman Laboratory is an interdisciplinary project focused on research problems ranging from pure to applied mathematics in topics concerning biology, control theory, medicine, informatics and genetics.

Robert Grossman currently holds the post of professor at the University of Chicago as well as being the Chief Research Informatics Officer and Head of Intensive Data Science at the same university. In addition, he is also the founder of the Data Open Group. He specializes in the fields of bioinformatics and big data. He has been awarded the AAAS Fellow Prize and the Federal100 Award (2013).

Together with Grossman, the work team is composed of the SPOR group (Statistics, Probability and Operations Research) that belongs to the Institute. "Recently set up," explains Gómez-Ullate, "and has already benefitted from the confluence in the Institute of researchers from different universities." This group is made up of ICMAT members Antonio Gómez-Corral (UCM), David Gómez-Ullate (UCM), David Ríos (CSIC-AXA), Kurusch Ebrahimi-Fard (CSIC) and Isabel Molina (UC3M). Manuel de León (CSIC-ICMAT) is also taking part, with external collaborators such as Jesús Sanz-Serna (UC3M) and Esteban Moro (UC3M). According to Gómez-Ullate, "they will contribute their knowledge on big data in social sciences and human behaviour." All together, they constitute "a wealth of vision and experience, which is one of the mainstays of the laboratory."

The purpose of the laboratory is also to provide an opportunity for a group of young mathematicians, to develop their PhD research work in this area. Gómez-Ullate goes on to say that; "in the same way, we hope to create links with the different initiatives in which Grossman is engaged in the USA, as well as creating contacts with the different companies in Europe that are interested in these topics."

Kari Astala Laboratory

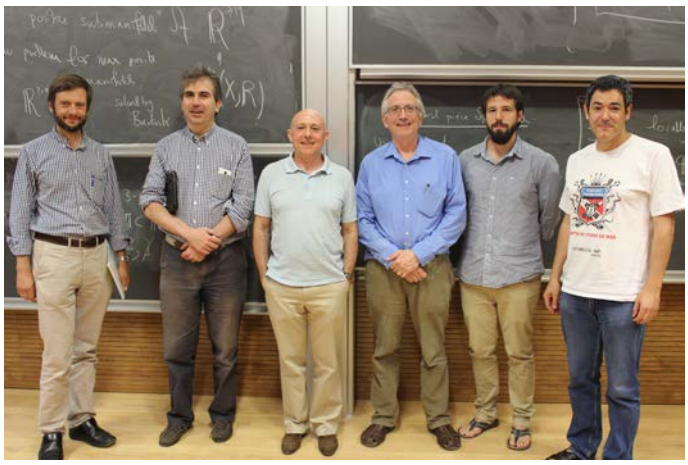
Image: University of Helsinki

The activity of this laboratory is concerned with research into harmonic analysis; in particular, the study of elliptic operators. The head of this laboratory is Kari Astala (University of Helsinki), distinguished among other things by the Salem Prize in 1994 and the Finnish Cultural Foundation Prize in 2011. Thanks to his long-standing relation with the Institute, where he has both collaborators and students, it has been possible to count again on his participation.

The team is coordinated through the ICMAT by Daniel Faraco, who is accompanied by other ICMAT members such as Luis Guijarro, Keith Rogers, Alberto Ruiz, Pablo Angulo, Sauli Lindberg, Renato Lucà, Martí Prats and Jorge Tejero, in addition to the external collaborators José Luis Fernández (UAM) and Fabricio Macià (UPM).

Donaldson-Hitchin Laboratory

Image: ICMAT



This laboratory is focused on the field of interaction between geometry and physics. It will tackle problems such as Higgs bundles, specular symmetry, Langlands duality, Kähler-Yang-Mills equations, Gauge Theory in manifolds with special holomony and generalized geometry.

It is laboratory is co-directed by **Simon Donaldson**, professor at Stony Brook University (New York) and Imperial College London, who is also a winner of the Fields Medal (1986) and the Breakthrough Prize in Mathematics 2014, and also by **Nigel Hitchin**, professor at Oxford University and a recent winner of the Shaw Prize (the "Nobel of the East"), who will be director for the second time.

On behalf of the ICMAT, the coordinator of the laboratory is Óscar García-Prada and the team consists of Luis Álvarez-Cónsul, Mario García-Fernández, Tomás Gómez de Quiroga and Francisco Presas, as well as PhD students and post-doctoral researchers who will be working alongside them. Researchers from other institutions are also involved: Lucas Branco (Oxford University), Xiuxiong Chen (Stony Brook), Xenia de la Ossa (Oxford University), Song Sun (Stony Brook) and Richard Thomas (Imperial College London).

According to Donaldson, "the laboratory is on another level of collaboration, something more informal; we're people around a whiteboard debating something that doesn't necessarily have to result in a paper. There are various aspects of the laboratory in which I'm very interested and I'm looking forward to studying them at the Institute." For his part, Hitchin highlights the fresh possibilities opened up after the previous laboratory, which "are proving to be very beneficial," and that is why he is coming back.

Charles Fefferman Laboratory

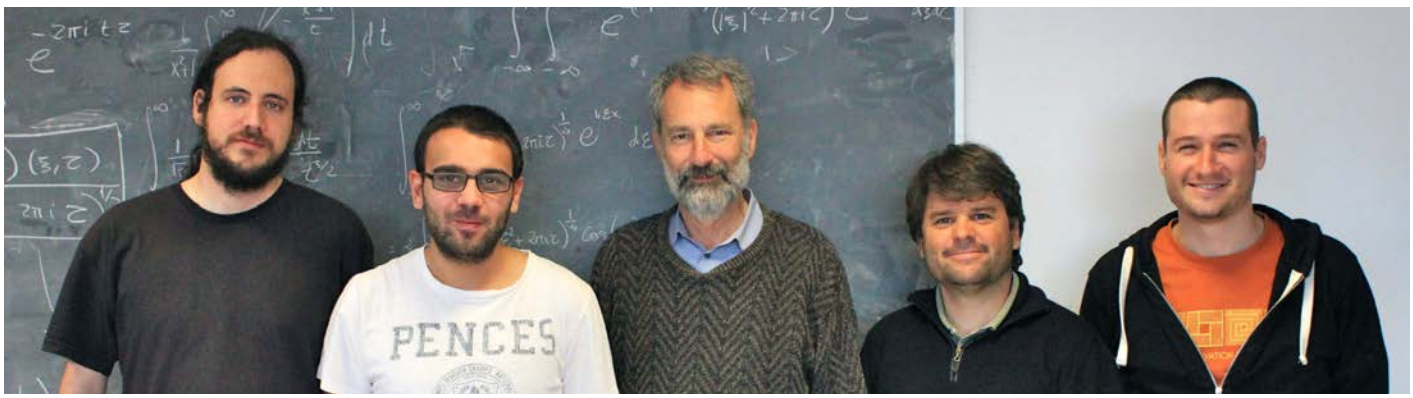
Image: ICMAT

The laboratory head by Charles Fefferman (Fields Medallist in 1978) is a continuation of the first one and is devoted to the same research area: fluid dynamics. The aim of the group is "to analyze from a mathematical point of view the models for the motion of incompressible fluids," says Diego Córdoba, the ICMAT codirector of this laboratory. "Once the equations governing the motion of the fluid have been worked out, we will try to look for the solutions, which give the velocity and the pressure."

In addition to Córdoba and Fefferman, the Laboratory consists of ICMAT members Ángel Castro, Omar Lazar and Nastasia Grubic, post-doctoral researchers, and Diego Alonso, Tania Pernas and Daniel Lear, Córdoba's own PhD students. Furthermore, two external participants are also involved: Javier Serrano (Princeton University) and Francisco Gancedo (University of Seville).

They expect to provide the answers to questions about the formation of singularities in fluids. Diego Córdoba poses the following questions: "Imagine a fluid – it could be air or water – that moves smoothly without sudden stops and starts or changes in velocity or temperature. Then all at once fronts of cold and hot air are formed, tornadoes, whirlwinds or sudden changes in velocity. What is the origin of this? Are external forces required? Do the equations governing the motion of the fluid cause this directly?"

Image: ICMAT



First Charles Fefferman Laboratory

DISTINGUISHED PROFESSORS

Image: ICMAT

Marius Junge (professor at the University of Illinois in Urbana-Champaignes) enjoys worldwide recognition for his work on quantum probability, operator theory, non-conmutative harmonic analysis and the theory of quantum information. He was the director of one of the previous laboratories and now collaborates with ICMAT researcher Javier Parcet.

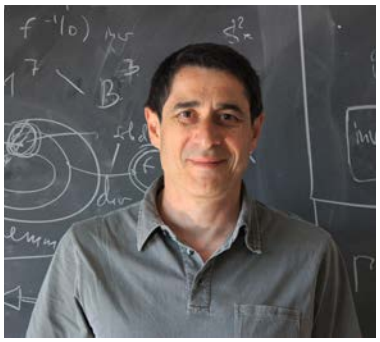


Image: ICMAT

Viktor Ginzburg (professor at the University of California in Santa Cruz) specializes in the study of the existence of periodic orbits in Hamiltonian dynamic systems from the point of view of symplectic topology, fields in which he is an expert. Ginzburg works together with Francisco Presas from the ICMAT and was also the head of one of the previous laboratories.

Image: The University of Texas at Austin

Rafael de la Llave (permanent professor at the Georgia Institute of Technology, USA) is one of the leading international researchers in dynamic systems and mathematical physics. He is particularly interested in the study of certain types of trajectories that organize the global evolution of a system. He undertakes his collaboration at the ICMAT with Florentino Borondo.

Image: ICMAT

Marius Junge Laboratory, developed during the first edition

Image: ICMAT

Matilde Marcolli

SHE MAKES MATH: Matilde Marcolli

MATILDE MARCOLLI

Professor of mathematics at the California Institute of Technology (Caltech) Department of Physics, Mathematics and Astronomy.

Among her other distinctions, she was awarded the Heinz Maier Leibnitz Prize del Deutsche Forschungsgemeinschaft in 2001, and in 2002 the Sofja Kovalevskaya Prize from the Alexander von Humboldt Foundation and the German Government ZIP Program. In addition, she was a plenary speaker at the 2008 European Congress of Mathematics in Amsterdam, as well as being a guest speaker at the 2010 International Congress of Mathematicians, held in Hyderabad (India)

Marcolli gave the course "Feynman integrals, periods and motives" as part of the Clay Institute of Mathematics Summer School "Periods and Motives: Feynman amplitudes in the 21st century", held in 2014 at the ICMAT.

Field of Research:

Marcolli's research work covers a broad area of mathematics and theoretical physics. She has worked on Gauge Theory, Low-dimensional Geometric Topology, Algebraic-Geometric Structures in Quantum Field Theory, Non-commutative Geometry, Quantum Mechanics, Feynman integrals, periods and motivos... She is currently interested in Computational Linguistics.

Laura Moreno Iraola. Matilde Marcolli (Como, Italy, 1969) is a professor at the California Institute of Technology (Caltech) Department of Physics, Mathematics and Astronomy. She is a curious scientist who has never been afraid to change her field of research. After pursuing a brilliant career in Geometry and Topology, she has in recent years devoted her research to Computational Linguistics. Her work in this field consists in parametrizing the way in which languages function. To this end, and based on human language, models are constructed that can be applied to computers, without addressing the evolution or the acquisition of languages.

At the outset of her career she focused on theoretical physics in subjects relating to the so-called Gauge Theory, which are used to describe the fundamental forces of nature. She subsequently applied these tools to the study of Low-dimensional Topology. She then switched fields again, this time to Non-commutative Geometry, a subject in which she is regarded all over the world as an expert.

While acknowledging that much of her work has been carried out shoulder to shoulder with leading researchers who in general have been men, Marcolli believes that the inequality gap between the sexes in the world of mathematical research is narrowing.

SCIENTIFIC REVIEW: A pointwise inequality for fractional Laplacians

Title of article: A pointwise inequality for fractional Laplacians.

Authors: Antonio Córdoba (UAM-ICMAT); Ángel D. Martínez (UAM-ICMAT).

Source: Advances in Mathematics. 280 79–85.

Date of publication: 6th of August 2015.

The Laplacian is a mathematical object involved in certain mathematical-physics theories such as celestial mechanics, heat conduction, electromagnetism and quantum mechanics. The study of this object is a subject of great interest in mathematical research. Antonio Córdoba (UAM-ICMAT) and Ángel D. Martínez (UAM-ICMAT) wrote on article on this subject entitled *A pointwise inequality for fractional Laplacians,* which was published last year in the journal *Advances of Mathematics.*

In 3-dimensional Euclidean space, the Laplacian can be defined with a formula in which the second derivatives appear in the directions of the Cartesian axes:

$$\Delta_{\mathbb{R}^3} = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$$

In this case, a very useful equality is (any real function of the Euclidean space that is differentiable at least twice being denoted by *f*):

$$\frac{1}{2}(-\Delta)(f^2) = f(-\Delta)f - |\nabla f|^2$$

Ruling out the last term on the right, which is always positive, implies that:

$$\frac{1}{2}(-\Delta)(f^2) \leq f(-\Delta)f$$

The inequality (3) still holds in n-dimensional Euclidean space if the Laplacian is replaced by one of its fractional powers. The fractional version of this operator is important because it models both viscosities and stochastic processes known as Lévy Flights. These are processes similar to Brownian motion, the random motion of some microscopic particles in a fluid (a drop of water, for example). This phenomenon was described by the botanist Robert Brown in 1827, although it was Albert Einstein who eventually managed to explain it in a famous paper published in 1905.

The inequality appears in the study of equations that model thermal flows in some layers and latitudes of the atmosphere, and in the evolution of fluid interfaces, which includes the study of wave motion or groundwater in a porous medium such as sand (known as the Muskat problem).

This result is surprising given that, unlike the previous example, these operators cannot be calculated locally. On this basis one may ask: Does it still remain valid if the Euclidean space were to be replaced by the earth's crust, a tyre or the metallic surface of a pair of scissors? Not only that, but what would happen if the physical medium, which is usually the case, were not isotropic or homogeneous? In other words, if it were either a conductor or an insulator according to which direction we were moving in, or does this property depend on the place in which one finds oneself?

Another way of understanding the above from the geometric rather than the physical point of view is to consider the problem for some of the imaginable versions of a sphere that can be created with a piece of Plasticine. To this end, it is convenient to extend the validity of the pointwise inequality to a generic context. In the paper published in *Advances in Mathematics,* Antonio Córdoba and Ángel D. Martínez study the case in the general context (of a compact Riemannian manifold (M,g), which is a mathematical model containing the particular examples of the sphere just outlined), as well as a further related operator, the so-called Dirichlet-Neumann operator in Euclidean domains.

The techniques employed in the proof in the case of the fractional Laplacian in the Euclidean space (represented as a singular integral) are no good for working in more general contexts, so authors require other ideas such as Hopf's Maxim principle, the Bernstein-Hausdorff-Widder theorem[1], Weyl's Law and L. Hörmander's estimates of the eigenfunctions of the Laplace-Beltrami operator. Despite the complexity of the technique used, the main idea in the article is surprisingly intuitive; it is sufficient to study the properties of an equation of fractional diffusion similar to that of heat[2]. It is here where the subordination techniques developed by S. Bochner in the early 20th century are crucial.

1 Characterizes the representable functions as Laplacian transforms of a certain type.

2 This idea also appears in a work by D. Chamorro and P. G. Lemarié-Rieusset (Rev. Mat Iberoam. 28 (2012), no. 4 1109-1122) in the context of Euclidean spaces in the framework of the formalism of semigroups.

ICMAT QUESTIONNAIRE: Lorenzo J. Díaz

"I'd advise young mathematicians to be patient, make the most of the present, talk a lot and listen a lot"

Image: Pontifical Catholic University of Rio de Janeiro

Lorenzo J. Díaz

Lorenzo J. Díaz was born in 1961 in Madrid. He is a full professor of the Department of Mathematics at the PUC University of Rio de Janeiro and a member of the Brazil Academy of Sciences. He graduated in mathematics from the Complutense University of Madrid and gained his doctorate at the IMPA in 1990 under the supervision of Jacob Palis.

Q1: Why did you chose mathematics over other subjects?

A1: I hesitated a lot between physics and mathematics. In the end, I decided on the elegance and clarity of mathematics.

Q2: Apart from mathematics, what other activities do you like best?

A2: I like listening to music (mainly classical and jazz), reading, walking in the country (what's now known as hiking), cooking and spending time with friends.

Q3: Would you recommend a film, a book or a play?

A3: "The 400 Blows" by Truffaut (and all the films by this director), and as regards books, I'd chose "The City and the Dogs" by Vargas Llosa, for example. I like a lot of books, although lately I've mostly been reading McEwan and Chirbes. As far as theatre is concerned, I'd recommend "Uncle Vania" by Chekov (and all his works).

Q4: What was your first experience of mathematical research like?

A4: I was doing some courses in Jarandilla de la Vera (Cáceres, Extremadura). At that time I was interested in knot topology and I followed a course on that, subject given by José María Montesinos [professor of Geometry and Topology at the Complutense University of Madrid, an internationally renowned expert on the Topology of Manifolds and the Theory of Knots and Links].

Q5: What stands out from these early experiences?

A5: The truth is I don't remember very much, unfortunately, although I do remember that it was all very exciting. I didn't see anything too clearly, but now I think that's changed a lot.

Q6: Which scientist has impressed you most throughout your professional career?

A6: Ricardo Mañé and Etienne Ghys.

Q7: If you could talk for an hour with a mathematician from the past, who would it be and what would you talk about?

A7: With Ricardo Mañé, who died shortly after I got my PhD, so we had the chance to talk a bit. It's true that at that time I wasn't really ready to do so, but now I think the conversations would be very interesting. Obviously, I'd also like to talk to Bowen, one of the fathers of thermodynamic formalism, and also with Poincaré, although I don't know what that conversation would be like.

Q8: Is there a theorem or a formula you particularly like?

A8: I like theorems without long calculus, like Brouwer's fixed-point theorem.

Q9: What's your favourite book on mathematics?

A9: That's a tough one. I'd probably choose "Counterexamples in Topology" by Steen and Seebach. But since that answer is rather strange, I'm also going to mention "Topology from the differentiable point of view" by Milnor.

Q10: How would you describe your research work in a few words?

A10: I try to understand and describe typical chaotic dynamics that are not hyperbolic.

Q11: Your last visit to the ICMAT was as part of the ICMAT-UAM discussions, where you gave a talk called "Non-hyperbolic Ergodic Measures: why, how, when and where", in which you showed how the many facets of non-hyperbolicity *destroyed the dream* of Stephen Smale (Fields Medal winner 1966) about generically classifying dynamic systems. Could you explain what Stephen Smale's dream was all about?

A11: Smale thought that most dynamic systems could be described simply: a finite number of attractors and repellers with good statistical and geometrical properties (which corresponds to hyperbolicity).

Q12: How can you be so sure that it isn't possible?

A12: Fortunately, Smale's dream wasn't true for many reasons. Sometimes typical systems exist with infinite attractors. Sometimes these attractors are finite, but wth a bad dynamic behaviour.

Q13: What perspectives does this impossibility leave?

A13: It opens up a lot of possibilities, such as understanding systems with infinite attractors (the so-called wild dynamics) or attempting finer statistical descriptions (non-uniform hyperbolicity). The fact that Smale's dream was wrong opens a lot of doors. What's more, if it were true I'd already be looking for another job.

Q14: What recent resuts stand out in your field?

A14: The theorems on perturbation in dynamic systems and the perspectives they open up.

Q15: What mathematical problem do you think constitutes the greatest current challenge?

A15: I don't know; there are many and to suit all tastes. Personally, I'd love to prove (or see proven) a "closing lemma C2".

Q16: What subjects outside of your field would you like to learn more about?

A16: Topology, combinatorics and probability.

Q17: Have you any advice you'd like to give to young mathematicians?

A17: Patience, make the most of the present, talk a lot and listen a lot.

Image: shutterstock

PROFILE: Juan José Marín

"Mathematics provides the basis for all sciences. For this reason, it is different"

Juan José Marín in Varsovia (Poland)

Juan José Marín

Juan José Marín was born in Cartagena (Murcia) in 1991. Since he was a child, he likes sciences and eventually he was drawn to mathematics. He gained his degree in Mathematics from the University of Murcia and completed his studies with Master in Advanced Mathematics with a dissertation on Measure Theory. In September, 2014, he joined the ICMAT, where he is currently a predoctoral researcher under the supervision of José María Martell (CSIC-ICMAT). Juan José studies Harmonic Analysis, Partial Differential Equations and Geometric Measure Theory. His ambition is to go on conducting research in these fields.

Patricia Ruiz Guevara. The plane that brought Juan José back from the United States had just left and he was already thinking about new destinations. This young mathematician returned at the end of April from his first research stay abroad after joiing the ICMAT almost two years ago. Starting in February, he spent three months at the University of Missouri (USA), which enabled him to combine two passions: mathematics and getting to know new countries.

The research group to which Juan José Marín (1991, Murcia) belongs uses techniques of harmonic analysis to study partial differential equations; specifically, those in which the solution is defined in a domain with a very irregular boundary. That accounts for the peculiarity of his work, boundary geometry, the study of which uses the geometric measure theory. As he himself explains: "A lot of people study these types of equations, but with a *smooth* domain or Lipschitz domain [that is, with *more manageable* conditions]; we work in a general domain with less demanding conditions as far as regularity is concerned." In Missouri there is also a group that studies the equations in this new context; in particular, using the type of methods that Marín researches, the so-called *layer potentials*, and so while he was there he felt like a fish in water. "My stay in the USA was very enriching. I met a lot of people, and in the world of mathematics it's good to have contacts, interact with other colleagues and put the faces to the authors of papers you've read," he says. A young fish that now swims with big sharks, but far from being scared he swims energetically alongside. "You have to take things philosophically and modestly. You never know what you might like, and that's why you have to try to learn as much as you can and make the most of these experiences."

And that is what Marín likes: learning and researching. "It's the type of work that requirtes a lot of patience. On some days you go home with the feeling that you have made no progress at all and that's very frustrating. While on other days it's just the opposite and that's rewarding." Although there is a big difference between some days and others, Marín says that research is "gratifying" and regards his time at the ICMAT as "productive and pleasing".

Although he opted for mathematics, he also likes physics and thinks that it would be very interesting to understand how they can be complementary. "Sometimes we lack an overall vision and don't often look beyond what we are researching", says Marín. His studies are highly theoretical, but partial differential equations are directly related to physics: for modelling heat, sound and elasticity. As he says: "I think it must be very interesting to understand how mathematical theories are applied. Of course, it's vital to develop a theory rigorously, because this provides a solid mathematical base on which to build other sciences. That's why mathematics is different." His decision to choose mathematics was also influenced by his academic experience in his youth. "Teachers can often be decisive and that's one the responsibilities they have – to awaken interest." This is something he knows well, because in the last academic year he taught for the first time a class in Telecommunications at the Autonomous University of Madrid, an experience that he enjoyed very much.

Some people take their (mathematical) problems home with them, but Marín tries to disconnect. One chance to break with routine is travel. "When I travel I disconnect completely. I try to travel as much as I can; it seems to me a great way to invest money." Last year he travelled on Interrail between Poland and Belgium, passing throgh the Czech Republic, Germany and Holland. "Visiting these countries one after the other, I was able to appreciate better their different cultures. There's a big difference between eastern Europe and western Europe," he says. So far this year he has been to London, the USA and Morocco. His next stop – Italy: "I love travelling because it opens you up to reality. You learn a lot of things and also unlearn others that are taken for granted. This happens especially when you immerse yourself in completely different cultures. It's good to see different ways of life, and then choose your own way". This is what both life and mathematics is all about, learning and unlearning in order to go on learning.

Javier Cilleruelo, the man who heard the music of numbers

Image: Colegio Mayor Luis Vives

Javier Cilleruelo

Here at the ICMAT we feel great sorrow at the loss of our friend and colleague, Javier Cilleruelo, who died on May 15th after a long illness. We at the Institute wish to express our deepest condolences to his family and friends, many of whom belong to the international mathematical communuty.

Javier was a full professor at the Autonomous University of Madrid (UAM) and a very active member of the ICMAT. His work on Number Theory, Additive Combinatorics and Graph Theory, which appeared in the most prestigious journals, helped to push back the frontiers of mathematics. He also supervised five doctoral theses, some of them at the ICMAT, and ran many degree courses as well as writing various books.

His death is a great loss for the mathematical community and above all for his colleagues. In the words of ICMAT director, Antonio Córdoba: "Those who knew him closely will miss the privilege of his friendship, as well as the conversations over coffee, when his eyes would light up when he told us about some new observation he had made on numbers and which filled him with so much joy".

ICMAT-trained researchers shine in the national prizes for young mathematicians

Image: Fundación BBVA

Prize winners and authorities at the award ceremony

The José Luis Rubio de Francia, the RSME Vicente Caselles and the BBVA Foundation Awards for young Spanish researchers of those trained in Spain were announced in July of this year. Roger Casals, who completed his thesis under the supervision of Fran Presas (CSIC-ICMAT), was the winner of both the José Luis Rubio de Francia Prize and the Vicente Caselles Prize. Leonardo Colombo, Martín López and José Conde, who are also students trained at the Institute, together with Jesús Yepes, a Severo Ochoa postdoctoral researcher, were awarded four of the five Vicente Caselles Prizes.

Four ex-students, who trained while being members of the Instituto de Ciencias Matemáticas (ICMAT – Institute of Mathematical Sciences), and a postdoctoral researcher at the Center, were the winners of the latest prizes awarded to young Spanish researchers, which were announced by the *Real Sociedad Matemática Española* (RSME) and the BBVA Foundation: the José Luis Rubio de Francia Prize and the Vicente Caselles Prizes.

Roger Casals (postdoctoral researcher at the Massachusetts Institute of Technology –MIT, USA), who read his thesis in 2015 under the supervision of Dr. Fran Presas (CSIC-ICMAT), was recognized as the "best young mathematician" by the award of the José Luis Rubio de Francia Prize for mathematicians under the age of 32. The jury made special mention of "the importance of his demonstration of the Chern conjecture for five dimensional manifolds, regarded as the greatest finding in contact topology and which has given rise to a revolution in the field". Casals was also one of the Vicente Caselles prize-winners, awards which have been made by the RSME and the BBVA Foundation since 2015.

Including Casals, five of the six award-winners are connected with the ICMAT: Leonardo Colombo (University of Michigan, Ann Arbor, USA), whose thesis was supervised by Dr. David Martín de Diego (CSIC-ICMAT); José Conde (Autonomous University of Barcelona), a student of Dr. Javier Parcet (CSIC-ICMAT); Martín López (Leeds University, United Kingdom), a PhD student of Dr. Antonio Gómez Corral (UCM-ICMAT), and Jesús Yepes, who is currently a Severo Ochoa postdoctoral researcher at the Institute. As ICMAT deputy director, David Martín de Diego, pointed out: "These awards reflect the quality of the training received by researchers at the ICMAT".

The José Luis Rubio de Francia awards carry a cash prize of 3,000 euros, together with funding for a three-year research project provided by the BBVA Foundation and an invitation to give a plenary talk at a leading congress organized by the RSME subsequent to the award of the prize. Each of the Vicente Caselles awards also carry a cash prize of 2,000 euros.

Mathematics, chess and literature at the Cervantes Institute in Stockholm and Sofia

ICMAT post-doctoral researcher and chess player, Razvan Gabriel Iagar, gave a talk entitled "Mathematis and chess, the two faces of human intelligence" as part of a series on Mathematics, Chess and Literature organized by the Cervantes Institute in Stockholm and Sofia throughout April and May. According to this expert, this pure science and computation contribute permanently and vitally to the development of chess.

Image: ICMAT

Razvan Iagar

On April 18th of this year, Razvan Gabriel Iagar (postdoctoral researcher at the ICMAT and chess player) and David Vivancos (author of the collection of short stories "*Cruentos ejemplares y otras microficciones*" -Seleer, 2012- and contributor to the magazine *Jaque*) discussed the common ground shared by mathematics, chess and literature. This round-table discussion was organized by the Cervantes Institute in Stockholm (Sweden) in collaboration with the Institute of Mathematical Sciences (ICMAT). The initiative was repeated on May 14th in Sofia (Bulgaria), with the sole participation of Iagar.

"Mathematics and chess are two faces of human intelligence and creativity", says Iagar, and goes on to state that they are exercises in which "the way of thinking is very similar". Furthermore, the relation between the two is quite evident. The role of geometry is vital for the positioning of the pieces on the chessboard, and as Iagar explains, "the first chess players employed a mathematical way of thinking, specifically geometrical thinking, to study the simplest endgames". The introduction and evolution of computer modules, whose algorithms are largely based on mathematics, have also contributed decisively to the development of the current quality of play, which has further led to an improvement in the human understanding of chess and which in turn chess masters have included in their strategies. In additon, the study of chess has likewise contributed to mathematics and the science of computation, particularly where the development of artificial intelligence is concerned.

The ICMAT joins ERCOM, "the network of the best mathematical centres in Europe"

The ICMAT is now a member of ERCOM, the European Mathematical Society committee and one of the most important bodies in the organization of European mathematics. Other centres already belonging to ERCOM are the Isaac Newton Institute for Mathematical Sciences, the Institut Henri Poincaré, the Max-Planck-Institut für Mathematik and the Basque Center for Applied Mathematics, among others.

Image: EMS

The last ERCOM meeting took place in May

After applying for membership in 2015, the ICMAT received the news on May 22nd of this year that its application had been accepted and was now a full member of the European Research Centres on Mathematics (ERCOM), a select group that already includes leading institutes in the European Union (EU) such as the Isaac Newton Institute for Mathematical Sciences, *L'Institut des Hautes Études Scientifiques* (IHÉS) and the Stefan Banach International Mathematical Center. This body is a committee of the European Mathematical Society composed of the directors of "the best European research centres in mathematics in the EU, to which the ICMAT now also belongs", says David Martín de Diego, deputy director of the Institute.

In order to be a member of this network, among other requirements it is necessary to have an international scientific committee, a program of visits by high-level scientists, and a broad range of research lines in the field of mathematics. As David Martín de Diego explains: "This is a recognition of the excellent work carried out by ICMAT members to attain a high level of mathematics, together with the ability to organize top-ranking scientific events over recent years, which in the short period since its foundation have attracted a large number of visitors." He goes on to say that, "Now we are able to participate together with the best research centers in Europe in joint activities of multilateral programs as well as gaining access to new sources of funding, all of which could provide a final boost for setting up teaching programs of the highest quality."

The Community of Madrid Prize for Scientific Communication awarded to Manuel de León and Ágata Timón

"The most romantic person in mathematics" was the post chosen by the jury of the Foundation for Knowledge Madri+d for this year's Community of Madrid Prize for Scientific Communication. The text, authored by Ágata Timón and Manuel de León, forms part of a series belonging to Manuel de León's blog 'Mathemtaics and its Frontiers" on the Madri+d platform. This blog is the barometer for mathematics in the Madri+d collection in which the latest developments in national and international research in mathematics can be found.

Mathematics as a vital narrative component in literature for young people

Mathematics may serve to pose an enigma in a short story, as well as being the key for solving it and then interpreting the solution obtained; it is much more than just the profession of a character based on a boring or excentric teacher of mathematics. This was what writer and mathematician, Carlo Frabetti, said on May 5th during his talk entitled "The Book of Nature". Fabretti gave this talk as part of the *Matemáticas en la Residencia* outreach activities organized by the ICMAT together with the *Consejo Superior de Investigaciones Científicas* (CSIC) Department of Scientific Culture and the *Residencia de Estudiantes.* In Fabretti's own words, "mathematics is not only necessary as a tool for structuring and expressing scientific knowledge, but also for acquiring a coherent and gratifying vision of the world".

David Gómez-Ullate and Fernando Chamizo, awarded prizes by the *Journal of Physics* and the *Journal of Mathematical Analysis and Applications*

One of the three prizes for the best scientific article 2016, awarded by the "Journal of Physics A: Mathematical and Theoretical", has been awarded to David Gómez-Ullate, professor at the Complutense University of Madrid (UCM) and member of the ICMAT. The paper "Rational extensions of the quantum harmonic oscillator and exceptional Hermite polynomials" was published by Gómez-Ullate, together with Yves Grandati (Université de Lorraine–Site de Metz) and Robert Milson (Dalhousie University) in Issue 47 of the journal. The publication of "Lattice points in the 3-dimensional torus" (J. Math. Anal. Appl. 429(2015) 733-743), a paper written by ICMAT researcher Fernando Chamizo and Dulcinea Raboso, Severo Ochoa post-doctoral researher at the ICMAT until December 2015, was also chosen as the most outstanding article to appear in the "Journal of Mathematical Analysis and Applications" in 2015.

Nigel Hitchin recieves the Shaw Prize for Mathematics

The Shaw Prize, which bears a monetary award of 1.2 million US dollars, is awarded every year to scientists who have achieved outstanding results in three fields of research: astronomy, life science and medicine, and mathematical sciences. The only mathematician to be awarded the prize this year is Nigel Hitchin, professor at Oxford University and co-director catedrático of the ICMAT Laboratories in the current Severo Ochoa program. Hitchin is one of the leading figures in the field of algebraic and differential geometry, in particular its relations with equations in mathematical physics. The jury highlighted his "his far-reaching contributions to geometry, representation theory and theoretical physics. The fundamental and elegant concepts and techniques that he has introduced have had wide impact and are of lasting importance".

The 10th International Congress on Harmonic Analysis and Partial Differential Equations

El Escorial (Madrid) provided the setting for the 10th International Conference on Harmonic Analysis and Partial differential Equations, held between June 12th-17th this year. This congress is held regularly every four years and is one of the most highly recognized international events in this field, attended by the leading international figures in Harmonic Analysis. The ICMAT participated in the organization of this year's edition, which included four short courses given by renowned experts: Pascal Auscher, Université de Paris-Sud; Ciprian Demeter, Indiana University; Marius Junge, University of Illinois at Urbana-Champaign, and Camilo de Lellis, Universität Zurich. A series of plenary talks was also given by other prestigious mathematicians.

Congress at the ICMAT on symplectic techniques in Hamiltonian dynamics

The congress on "Symplectic Techniques in Hamiltonian Dynamics" was held at the ICMAT between June 13th and June 17th this year. This event is devoted to the interaction between symplectic topology and modern contact with Hamiltonian systems. More than fifty international experts on Floer Theory came together to share their latest developments in the field. According to Francisco Presas, ICMAT researcher and one of the organizers: "We hope that during this week we were able to engage in fruitful exchanges that will help to popularize Floer Theory in Spain".

The 10th ICMAT School on Geometry, Mechanics and Control

Once again, the ICMAT School on Geometry, Mechanics and Control brought together in La Cristalera (Madrid) the leading international figures in these areas. This meeting falls within the framework of the ICMAT-Severo Ochoa program of excellence and has already become and international point of reference. Together with international specialists, young researchers from all over the world met between June 20th-24th to give different talks and courses. The main aim of the school is to provide specialized training of excellence as well as to disseminate the results of the latest research work to students who are beginning their academic careers, and also to mathematicians from other fields.

New ICMAT grants for Master students

This year, the ICMAT is for the first time providing grants for graduate students who wish to study for a Master in mathematics at any of the three state universities in Madrid. Seven students have been selected to receive these grants and will also receive 1,000 euros per month as well as the enrolment fee. The director of the ICMAT Severo Ochoa program, Diego Córdoba, points out that: "The aim is to make known the professional possibilities available at the ICMAT for students interested in pursuing a research career". This scheme is the first step towards the fulfilment of a more ambitious idea; to create a Doctorate School in Madrid that brings together Master courses in the Community in order to make them competitive on an international level.

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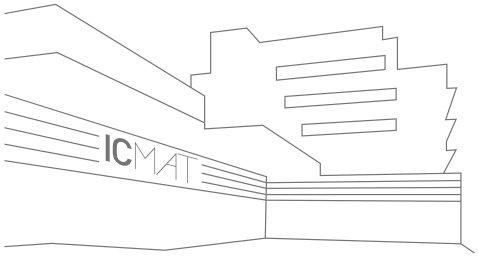

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