ICMAT

Quarterly newsletter
Instituto de Ciencias Matemáticas
CSIC-UAM-UC3M-UCM

Fourth quarter 2013

Editorial

Breathing Mathematics

Researcher training is one of the most important aspects of a research center. It constitutes the basis for the future of the scientific community, and we at ICMAT are extremely aware of this duty. As a center of excellence, we have the responsibility of passing on this aspiration to new generations of mathematicians.
A short time ago, one of our researchers remarked on the impressions that a recent visitor had drawn about the ICMAT: "In this Institute one breathes mathematics". Indeed, our aim is for our senior scientists to contribute towards creating a mathematical environment similar to that of the great international centers, where mathematics is breathed in through the pores as soon as one enters the building.

This is the kind of atmosphere that we wish to provide for our doctoral students, and for them to assist in generating it too. The ICMAT is fortunate enough in having students who already have an outstanding academic track record when they arrive. The availability of grants regularly arising from the Severo Ochoa program through specific FPI pre-doctoral appointments provided by the Spanish Ministry of the Economy and Competitiveness Mineco), together with those provided by the La Caixa Foundation, constitute a permanent foundation that is complemented by other appointments arising from regular calls issued by the Mineco and the Autonomous University of Madrid, or those associated to the European Research Council.

But the task of recruiting promising mathematicians begins even before this; every year the ICMAT organizes the JAE School of Mathematics, with the aim of introducing young Mathematics degree students to research work. These are highly gifted students who spend two months at the center doing advanced courses that are somewhat different to those available at university faculties. They all show great keenness to extend their knowledge, and some of them go on to swell the ranks of PhD courses.

(continued on p. 2)

Contents

Report

Educating for Excellence

A new predoctoral research program under the auspices of La Caixa savings bank will provide young researchers with the chance to enjoy the same environment, the same resources and opportunities as the leading mathematical research centers in the world. The premises of the Institute of Mathematical Sciences (ICMAT) hold the key to producing the future leading lights in mathematical research.

Lorena Cabeza. Getting the best out of the best seems at first sight to be a complicated task, but as with any recipe, it is only necessary to know what the right ingredients are and how to combine them with care and know-how. This has been one of the aims of the ICMAT since its inception, even before it had its own premises and facilities. Since then, the efforts made by the Institute have begun to bear fruit, and the first scientists trained there are already working in some of the most renowned research centers the world over. Since September of this year, the Institute has been receiving fresh backing for its researcher training policies thanks to the new La Caixa International Doctorate Program, a scheme promoted by La Caixa Foundation in collaboration with the Spanish Ministry of the Economy and Competitiveness (Mineco), which is offering five pre-doctoral appointments in each one of the five centers distinguished with the Severo Ochoa accreditation.

The precedent for this initiative is La Caixa International Doctorate Program in Biomedicine, which in recent years has been responsible for training 200 students from 37 different countries. The results yielded by this Project have encouraged La Caixa to extend it to the Severo Ochoa research centers. The program for Biomedicine "was set in motion in March, 2008, and lasted until 2012, when it was decided to extend it to all those centers able to compete interna-

(Continued in p. 2)

Editorial

In addition to work with their thesis supervisors, their training during this stage consists of attendance at the courses, seminars and congresses that form part of the extraordinary scientific activity conducted at the center. The flow of top-flight visitors through the center and the existence of the five ICMAT Laboratories give students the chance to work alongside the best international mathematicians, all of which provides them with a substantial training experience.

Furthermore, the Institute also gives them the opportunity to participate in congresses that are held at its headquarters, without the need to pay any registration charges. The goal is to enable them to breathe mathematics unhindered. A further distinguishing feature of the ICMAT is to avoid any grouping of doctoral students according to subject. On the contrary, we wish them to interact mutually and learn how to attend seminars devoted to subjects different from their own, thereby providing them with a more enriching experience and the chance to break with what until now has been an ill-advised practice at our university faculties. Generally speaking, we try to create a welcoming and enriching environment that enables students to go on in the short-term to take up a postdoc appointment in other centers, and if possible to return later to the Institute that has trained them. Our website contains the names and positions of all the PhD students who have completed the doctoral stage of their careers at the ICMAT, thus testifying to the fruitful outcome of the training they have received. Our ambition is for "breathing mathematics" at the ICMAT to confer a hallmark of excellence on these new doctors of mathematics, and we are working hard to fulfill this aim.

Report

In the JAESchool of Mathematics, organized every year by the ICMAT, undergraduate students can know the work of researchers.

tionally to attract young talent to our country", explains Ignasi Calvera, deputy-director of La Caixa Foundation area in Science and the Environment, which is responsible for the grant program. "The beneficiaries of this program are not only grant students but also the research centers themselves. The aim is for a significant number of young scientists at their highest point of creativity to join centers of excellence". La Caixa has invested a total of 4.6 million Euros in 40 grants at the 8 Severo Ochoa centers, each grant being worth 115,000 Euros. These are grants of excellence with a decidedly international nature. As Calvera points out: "It is very important for the Foundation that the calls for these grants should be made internationally, and that they should be awarded through competitive competitions on the basis of peer assessment". The aim is to attract young researchers from all over the world.

> "Students at the Institute are encouraged to get in touch with researchers in different areas"

This call for submissions is not the only one to provide the ICMAT with a flow of young researchers to reinforce its main lines of research and to inject new blood into the system. Since last year, there has also been a specific funding scheme for the Severo Ochoa center Formación de Personal Investigador (FPI – Research Personnel Training) program, which provides an average of six annual grants for each one of the centers that have received this distinction. As ICMAT director Manuel de León says: "It is vital for the ICMAT to be able to benefit from schemes such as this one, thanks to which it can develop its own strategy for scientific policy and thus does not have to rely on the lottery of submitting projects without knowing whether or not it is going to be assigned contracts. Research rests largely on the training of researchers, and being able to count on permanent human resources enables us to make own scientific policy and decide on what lines of research we want to undertake or strengthen, and this is essential not only for keeping up the level of research but also for enhancing it".

> "Research rests largely on the training of researchers"

The activity of the center in terms of seminars, workshops, advanced schools and so on is unceasing, and visits from leading researchers from all over the world who are outstanding in their respective fields also continue without interruption. Furthermore, students at the Institute are encouraged to get in touch with researchers in different areas and to participate in parallel activities such as the outreach committee, all of which helps them

Javier Gómez Serrano, a postdoctoral researcher at Princeton University.

David Martín de Diego, researcher and director of its ICMAT Culture Unit Mathematics, provides tutoring to PhD student.

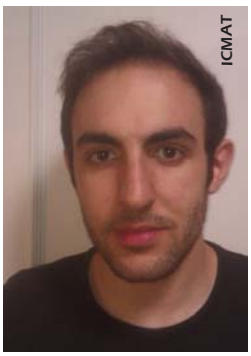
to broaden their horizons and acquire an interdisciplinary vision of research. It also helps them to become steeped in a different culture, a culture of excellence, an environment that guides the manner of working in the greatest centers of mathematical research throughout the world. Manuel de León goes on to add that, "If you create this atmosphere and then place in it students with the right aptitudes who come well-prepared from the previous stage of training, they are going to do much better than what they would do in a different environment".

The considered opinion of the Institute's director is that there are three factors involved in the quality of a doctoral student: "First, the initial background; that is, the subject studied at degree and master level; secondly, the thesis supervisor and the group to which he or she belongs, and thirdly, the environment in which the work is carried out. If these three things are right, then except for force majeure the result will be one of excellence. That's the strategy".

The ICMAT places special emphasis on the last two factors; the group in which work for the doctoral thesis is carried out (which includes top-rank researchers), and the atmosphere in which this work is conducted; that is, one with an interdisciplinary focus, together with the presence and collaboration of leading mathematicians of international renown. But what can be done regarding the initial training of the PhD student in relation to the first point?

According to Manuel de León, "At the moment, the Institute is exploring the possibility of setting up its own master and doctoral program, because we would like students to arrive here with the highest possible standard of preparation". These courses, which would be given by researchers belonging to the center itself, could be in place for the 2015-2015 academic year. In the meantime, degree students can enter into contact with the day-to-day research activity at the ICMAT through the JAE School of Mathematics, where for a month at the start of the summer vacation they are provided with a different approach to this discipline, with a greater focus on the creativity, innovation and freshness required for research work, and where students can work alongside front-rank scientists belonging to the Institute".

Juan Cavero, beneficiary of the international PhD scholarships Severo Ochoa-La Caixa.



Alvaro del Pino, beneficiary of the international PhD scholarships La Caixa-Severo Ochoa.

In addition, the ICMAT is also backing initiatives such as the Mathematical Olympiad, and the Estímulo del Talento Matemático (Estalmat–Stimulation of Mathematical Talent) program, which has recently yielded one of its most palpable successes; Javier Gómez Serrano, the first doctoral student in mathematics to have completed this program, read his thesis at the Institute and has already obtained a post-doc position at the University of Princeton. Says Gómez Serrano about that time: "I used to go once a week, on Saturdays, to a three-hour session at the Complutense University. We were doing mathematics, but in a very different way to what we were used to at high school. Getting up early on Saturday mornings to start class at 10.00 am was a bit of a pain, but I really enjoyed it there. It was great fun and we all got along together very well. It was always a positive experience".

> "The ICMAT is also backing initiatives such as the Mathematical Olympiad, and the Estalmat (Stimulation of Mathematical Talent) program"

Manuel de León points out that, "many of these young people get offers from various universities and research centers to do their post-doctoral stays there. The ICMAT is proud of this fact; it's a clear indication that we're doing things properly".

From the ICMAT to Princeton, Oxford or California

The concept of excellence can be rather difficult to pin down. The challenge is to make it explicit, to establish parameters that define it, and above all to materialize it. Impact ratings and bibliometric factors aside, one way of finding out if a center is one of excellence or not is to calibrate where its successful PhD students go to do their stays abroad. The final result is what proves if the training students have received has been excellent or not.

"After reading their theses, our PhD qualifiers can now be found in Princeton, California, England, Germany… We educate and train people to a very high standard; if not, they wouldn't be where they are now", says ICMAT director Manuel de León. One such researcher is Javier Gómez Serrano, the first scientist to have successfully completed

Creating a good working environment and contact between researchers from different areas are two of the pillars of training at the Institute.

the ESTALMAT program when he was still a secondary school student. He is currently a post-doc researcher at Princeton University, and has this to say about his time at the ICMAT: "… It gave me the opportunity to work on a subject I was really interested in, as well as to interact with

"The Institute is exploring the possibility of setting up its own master and doctoral program"

leading international researchers and do my thesis with the appropriate means".

Rafael Granero, another researcher who today is an assistant professor at the University of California, believes that at the Institute "you can find a large number of top-flight mathematicians. This is evident when one sees the ERC (European Research Council) Starting Grants that are awarded to ICMAT researchers. The center also offers a very good atmosphere to work in as well as first-class researchers, so it's not surprising that high-quality research work is conducted there".

Mario García, currently working on complex differential geometry at the École Polytechnique Fédérale de Lausanne, Switzerland, particularly points out "the opportunity to

"The center also offers a very good atmosphere to work in as well as first-class researchers"

conduct research work without any teaching obligations", as well as the fact that Luis Álvarez Cónsul and Óscar García Prada, his thesis supervisors, were "top-class researchers" and also that he "had the chance to visit prestigious centers in Paris and London".

After reading his thesis, Roberto Rubio enjoyed a stay of more than three years at Oxford and will soon be going to the Institute of Pure and Applied Mathematics in Río de Janeiro, a leading Latin-American center. Rubio particularly mentions his participation "in the creation of an outreach committee" as a result of a proposal for a mathematical graffito, an emblematic activity at the Institute carried out with the aim of "getting across to a public largely unacquainted with mathematics".

The new doctoral students who have just joined the ICMAT thanks to the La Caixa grants program have already experienced for themselves some of the advantages that come with working at the Institute. As one of them, Álvaro del Pino, remarks: "I'm able to travel a lot; there are resources for that. What's more, leading people in our field come to the ICMAT. I don't think you could ask for much more than that".

Juan Cavero, another beneficiary of the La Caixa grants, is of the same opinion: "At first I approached the ICMAT only because of research, but when I saw how they work here, the facilities and all the courses, seminars, conferences and so on, I thought to myself 'this is where I've got to be', and I'm delighted".

Both these PhD students are only just beginning their theses, but already they are starting to imagine where they might like to go to do their post-doctoral research stays. While both say that it is a little early to be thinking about such things, Del Pino states that he has his "sights set on France, where the strongest research group is" in his field (topology and differential and symplectic geometry). Cavero is not so specific, although he is aware that, being a La Caixa grant student and coming from the ICMAT, he "shouldn't have any problem".

Whether Spain is capable of making the most of this human capital that has taken so much time, effort and

"I would at least like to have the chance to settle down in Spain as a scientist, but I'm aware that this is a rather remote possibility"

money to achieve is another question. All the post-doc researchers interviewed for this report are in agreement that, a priori, it will be "very difficult" for them to return to Spain after their spells abroad. One of them, Mario García, who next year is coming back to the Institute for a period of at least two years, has this say: "I would at least like to have the chance to settle down in Spain as a scientist, but I'm aware that this is a rather remote possibility. I think it would be really hard for my wife and daughter to have to move again after returning home. Science is an important part of my life, but I'd consider giving it up if I had no chance of working in it in Spain". To be able to offer these researchers a job in our country would be a way to complete the circle of excellence that the ICMAT has worked hard to create.

Getting to know your idols

The Heidelberg Laureate Forum is a new scheme inspired by the example provided by the German town of Lindau, where for more than 60 years dozens of Nobel prize-winners have been meeting with promising young researchers. Since the mathematics and sciences of computation have no Nobel Prize, the most outstanding researchers in these disciplines are excluded from this award, even though in their own particular fields they have been distinguished with the highest awards that are equivalent to the Nobel Prize. In order to cover this absence, the Heidelberg Laureate Forum was held for the first time between September 22nd – 27th in Lindau, where some forty award-winning researchers got together with 200 young scientists, 100 mathematicians and 100 scientific researchers in computation, from more than 50 different countries.

Ágata Timón. The different colours of their identification badges served to establish the first individual contacts among the three hundred people who attended the forum in Heidelberg between September 22nd - 27th. Grey lanyards: young researchers; red lanyards: laureates, that is, renowned scientists awarded at least one of the following prizes: Abel, Nevanlinna, Fields Medal, in the field of mathematics, or the Turing Prize, in the field of computation. Black lanyards denoted invited guests; green, members of the scientific committee and sponsors; yellow, journalists; blue, organizers, and green, bloggers belonging to the official record of the event or support personnel, many of whom were the bodyguards of Klaus Tschira, director of the Foundation that bears his name and which funded the event.

Among the crowd, sitting on the floor in a corner of the Marshall Café, engrossed behind the screen of his laptop, was Cèdric Villani, director of the Henri Poincarè Institute. No red Fields Medal lanyard was necessary to identify him, since his usual garb of silk cravat, spider broach and shoulder-length hair parted in the middle made his presence unmistakable. Behind him, on the other side of the glass, on a wooden stage, men dressed in Bavarian regional costume danced energetically to the sound of an accordion accentuated by the cracks of a whip. Among those attending this mini-Oktoberfest, organized as part of the first Heidelberg Laureate Forum (HLF), was Sir Michael Atiyah – Abel Prize and Fields Medal award-winner – smiling throughout the show while he talked to a young researcher.

Not everything in science consists of practising science, that at least is what they believe at this forum. "Communication plays a vital role in scientific careers; we want the most successful scientists to speak with young scientists and create a wide-ranging connection across the whole community", said Sabine Kluge, HLF director of communication, in the square of the New University, during a pause before the round table discussion in which the new challenges in computational sciences came up for debate. "Motivation and inspiration are also essential in the scientific system. That's why we've set up an event in which these factors, which are so often left out of scientific meetings, can have their own space".

Meet your mathematical hero

Young people, 100 mathematicians and 100 computer scientists of graduate, doctoral and post-doctoral level from more than 50 different countries, responded to this call by attending the event. In the words of Alejandro Serrano, a pre-doc researcher at IMDEA Software, "The idea of meeting your own superheroes in research seemed really exciting to me." Says Long Pei, another doctoral student at the Norwegian University of Science and Technology Department of Mathematics; "Usually, there's a big gap between prestigious scientists and those who are just setting out on their careers, but here we've broken down the barriers and got to know them just like normal people".

Around 40 laureates attended this first occasion of the HLF: three Abel prize-winners, seven Fields medalists, three Nevanlinna prize-winners and some thirty recipients of the Turing prize. Their presence close up was for many young researchers such as Geir Bogfjellmo, also from Norway, "a source of inspiration to carry on working hard at research and getting results".

The social program of HLF was full of activities, including a mini Oktoberfest organized for participants.

> "Communication plays a vital role in scientific careers"

Furthermore, as illustrated by the wads of elegant cards that all the young researchers received with their Forum welcome pack, and as confirmed by Sabine Kluge, the purpose of the event is that "degree, PhD and post-doc students make new contacts". Ibrahim A. said that this was his main reason for attending the forum: "After your doctorate, you look for your own challenges and need to create a niche for your work, and for that it's important to have good contacts". He studied for his doctorate in the United Kingdom, but afterwards decided to return to his native Nigeria, where he currently works in the field of artificial intelligence.

Fields medalist Stephen Smale was one of the speakers at the first HLF.

A postdoctoral researcher at the Zuse Institute in Berlin, Natasa Durdevac said that, "Another particular thing about this event is that you can come into contact with people from all over the world, even from remote countries. There are a lot of women as well, which is not so usual in mathematical meetings".

Science, music, beer

The week-long program was intense; the mornings were devoted to great lessons in science from the laureates. They gave talks without any fixed topic, some speaking about their recent work, others about the past history of the discipline, and some about their thoughts on the future, while one lesson consisted of a decalogue of advice about survival in the world of research. In the afternoons, young researchers were split up into small workshops coordinated by post-doc researchers, in which specific subjects were addressed, such as Quantum Mechanics and Topology, Crowd-sourcing, and how to develop a scientific career and a growing family. As Alejandro Serrano commented, "Exchanging points of view is very important in science. However, discussion is usually reserved for the private sphere. That's why doing it in public has been very interesting for me, because you can listen to many points of view".

After the round-table discussions, in which every day different laureates addressed various general issues in science, the main attraction, the extensive program of the Forum, got under way. Said Sabela Ramos, assistant lecturer with the Computer Architecture Group at the Universidade da Coruña, "The social nature of this event is what makes it so different. The usual congresses are focused on the exposition of results of one's own work, but here this takes second place".

"Motivation and inspiration are also essential in the scientific system"

No, the Heidelberg Laureate Forum is no usual congress: Sunday, charity concert given by the SAP Symphonic Orchestra; Monday, evening reception at the majestic Schwetzingen castle; Tuesday: Oktoberfest; Wednesday, a boat trip; Friday: tour and dinner at the Heidelberg castle, overlooking the city. As Srinivasa S. R. Varadhan, Abel Prize award-winner in 2007 and researcher at the Courant Institute of Mathematical Sciences, University of New York, remarked: "I've had the chance here to talk informally with young researchers from all over the world, while having tea, at the Oktoberfest, on a boat trip… We've been able to discuss research work, but also other things like politics and culture".

"We've been able to discuss research work, but also other things like politics and culture"

Like him, nearly all those who attended said they had enjoyed a week devoted to the more human and social side of science. As Sabine Kluge concluded, "an academic career is quite hard and competitive. It can be a rather hostile environment for young people, and at times it must be difficult to pursue a scientific career and remain in the system. With this gathering we wanted to show that science is also something that is all around us – it's life".

Advice for becoming a young researcher

"The truth is that I don't like giving advice to young researchers, because when I was a student I didn't like the advice I was given"; so says quite frankly Fields Medal winner Gerd Faltings. However, other laureates were ready to offer their guidance:

-During his talk "Advice for young mathematicians", Michael Atiyah, the only mathematician to be awarded both the Abel Prize and a Fields medal, recommended: "Never stop asking questions; that way you'll find good ideas for working on".

-"The important point in research is relevance. Interdisciplinary fields are especially crucial", said Silvio Micali, researcher at MIT and Turing prize-winner in 2012. "I'd like to encourage young researchers in mathematics to study the computational sciences that might be interesting for them, and vice-versa. It's important to have a broader and more multidisciplinary vision of science".

-Natasa Durdevac, a postdoctoral researcher at the Zuse Institute in Berlin said: "Various laureates have repeatedly said to me that we should try to work with the best person in the field we're interested in, even though it might be intimidating. We have to approach these people and ask for their advice".

-Michael Atiyah also added that: "Proofs are what mark mathematicians out from other scientists. That's the kernel of our science. However, the proof is long-term; first you have to pass through various stages of creation. Proofs are a technical not a creative matter. They are the verification of ideas".

-Atiyah went on to say, "Don't lose hope in the early years of research. Almost all mathematicians have a slow start. Collaboration is very important; it has both personal and profesional benefits".

"It's good that there are visible examples of professionally successful women, and especially in mathematics"

Ágata Timón. Recognized in July this year as the best young researcher in mathematics in 2012 by the Spanish Royal Academy of Mathematics, with its award of the José Luis Rubio de Francia Prize, María Pe (Burgos, 1981), who works on Singularity Theory in the field of analytic and algebraic geometry, graduated in Mathematical Sciences from the Complutense University in Madrid, where she also completed her doctoral thesis under the supervision of ICMAT researcher Javier Fernández de Bobadilla. She subsequently spent two years at the Institut de Mathématiques de Jussieu, and in 2013 joined the Institute of Mathematical Sciences on a postdoctoral contract.

Maria Pe Pereira, José Luis RubioFrance award 2012.

Question: What's your most notable result obtained to date?

Answer: Without doubt, jointly with Javier Fernández de Bobadilla, the solution to the arc conjecture formulated by the mathematician John Nash; all the work on the Nash problem has been satisfactory, from the first complete examples, the system of techniques to finish the study of all the family of cases I did in my thesis, to the most synthetic and general arguments that led to the final proof of the conjecture. In hindsight, it appears to be the paradigm of research in mathematics.

Q: What's the conjecture about?

A: It states that the number of components of arc spaces, that is, paths that pass through the singularity, gives an important topological invariant of the singularity. This invariant appears in the resolution of the singularity. The resolution is a smooth manifold containing a sub-manifold from which, if we collapse it to a single point, we can recover the singularity we started from. The invariant is the number of irreducible components of this sub-manifold.

Q: How did you arrive at this problem?

A: It's a very attractive classical problem about which I'd heard when attending conferences. Javier got interested in it because he thought it might have some impact on what I was studying at the time.

Q: How much work did it take to arrive at the solution?

A: In the first stage we studied examples with the help of a computer, trying in fact to find a counter-example, in other words, to show that the conjecture was not fulfilled. Then, with topological techniques, we showed that the conjecture was true in some cases that had been previously been studied without success. Thanks to the groundwork already done by Javier Fernández de Bobadilla, the topological study was enough. In these examples we observed some key phenomena for an understanding of the problem. This is what constituted the contents of the doctoral thesis. Finally, in collaboration, we managed to arrive at an overall understanding by providing a proof of the general case.

Q: What was it like reaching a solution together, with several minds following the same train of thought?

A: Well, each of us did a lot of thinking on our own, and then we often got together to discuss our conclusions and intuitions. What's more, in our case, there were a lot of examples and experimental work that helped us to obtain and compare information.

Q: This result was one of those worthy of particular mention by the RSME when it awarded the José Luís Rubio de Francia Prize (JLRF). How did you feel when you found out that you were the first woman ever to have received this award?

A: I didn't give it too much importance; in my professional environment it seemed pretty normal. In other fields it's still remarkable, because young women are still not singled out in this way, and therefore it's good that there are more visible examples of professionally successful women, especially in mathematics.

Q: What does this prize mean for you?

A: It's an hour and a satisfaction to receive it, and it's a recognition of all the work done.

Q: What do you think about initiatives such as the JLRF prize?

A: They help to motivate young people and provide us with visibility.

Q: What's it like being a young mathematician in Spain?

A: I think it's a very nice profession for mathematicians of either sex, both for the work to be done and for the human and professional environment in which we work.

Q: What are your aspirations as a researcher?

A:To carry on enjoying the work, and if possible with a stable appointment that enables me to work without worry.

Q: How do you see mathematical research in Spain in an international context?

A: One has the perception that the country has woken up and is becoming fully engaged in mathematical research. I think progress will be unstoppable if we don't lose the momentum we've gained by investing so many resources and so much effort.

Q: What's the outlook for the near future?

A: In September I took up a postdoctoral appointment for a year at the ICMAT, extendible to three years. I'm very fortunate because this appointment, which is linked to the Severo Ochoa Program, come up just at the time when there were very few opportunities for research in Spain.

Q: Why did you choose the ICMAT to do your post-doc?

A: Because I wanted to go on working on projects in collaboration with Javier Fernández de Bobadilla; what's more, the institute has a very good interdisciplinary team, and I think I can learn a lot there.

"My articles have changed the way other people do research"

Ágata Timón. On September 18th of this year, the professor of Applied Mathematics and former rector of the University of Valladolid (UVA), Jesús María Sanz Serna, was honored at a ceremony that formed part of the International Conference on Scientific Computation and Differential Equations (SciCADE 2013), in an event that paid tribute to the scientific and professional career one of the most internationally renowned mathematicians. Sanz Serna is also a founder of the Spanish Society of Applied Mathematics (SEMA), and has been Vice-president of the Royal Spanish Mathematical Society (RSME) as well as president of the Exact Sciences Division of the Royal Academy of Sciences. During the month of November, this mathematician gave an advanced course on "Markov Chain Monte Carlo and Numerical Differential Equations" at the ICMAT, and we now take this opportunity to speak to him about his career, the current situation of mathematical research and scientific policies in Spain. This interview also provides us with the opportunity to join in the tribute to his scientific achievements.

Jesús María Sanz Serna, full professor at the University of Valladolid

Question: On the occasion of this tribute to your career, what results would you particularly like to mention?

Answer: It's like with your own children; you regard them all with a certain favor. As regards impact, I could mention some papers that have had more than 1,000 citations, but beyond that, I think that my papers, apart from the contributions they might have made, have changed the way in which other people do research. Many articles that are being written now are similar to things I was writing 15 or 20 years ago.

Q: What fields of science have especially drawn your interest?

A: I began my research work in functional analysis and then went on to numerical methods, in conversation with differential geometry, in what today is a new field in mathematics that everyone knows as geometric integration, a term I invented. Following the thread of geometric integration I also worked on the theory of dynamical systems and classical mechanics, Hamiltonian problems.

Q: How did you get the idea for geometric integration?

It was latent in various communities, and specifically in the case of Hamiltonian systems this research line had been vigorously taken up in China by Professor Feng Kang. In 1987 he invited me to China for a month, and there I got to learn about all these approaches. Then I brought the concepts back to Europe and more people started working on them.

Q: Where did the name come from?

A: In 1995, I was invited to give a talk in England that dealt with synthesizing all the advances in the field over the previous 10 years, and I thought of "geometric integration" because geometry was the common denominator of this new approach.

Q: What does this method consist of?

A: Numerical methods seek to provide a calculable solution to a certain magnitude of interest that can't be calculated analytically. Since the development of modern numerical methods in the 1940s and 1950s, and with the introduction of computers, the analysis of the method was based on seeing how close the number obtained was to the real answer, and while there are many applications in which this approach is insufficient, the solution we give must have properties of a geometric type. To put it this way, if we draw the true numerical solutions, they must have the right geometric appearance.

Q: What are you working on at the moment?

A: In recent years I've been developing an interest in how all this is related to the calculation of probabilities and stochastic processes. It's remarkable how much geometric integration has to show us in this context.

Q: What mathematical problem in your opinion presents the greatest challenge in your field?

A: The field of numerical methods is different from other fields in mathematics, in which there are big problems such as the so-called Millennium Problems, and certain rules for determining whether or not the problem has been solved. With numerical methods the approach is less ambitious; there are many small problems, and everything is perfectible; if for a certain problem we find an algorithm we believe to be good, it can be improved. When ten years have gone by the ideal solution is no longer ideal, because you can still alter it slightly and improve the results.

Q: What are your latest results?

A: I've co-authored a series of papers with Ander Murua from the University of the Basque Country, and with Philippe Chartier from Rennes (France), in which we employ techniques we've learned from geometric integration in order to adopt a completely different approach to the averaging technique in dynamical systems, one which provides a very powerful and unexpected connection between these two branches of mathematics.

Q: Why did you decide to devote yourself to mathematics?

A: When I was doing my Baccalaureate I had an exceptional physics teacher, Father Oñate, now deceased. On my course and previous courses the number of mathematicians and physicists was very high. The key to that is that Oñate loved physics and we learned in a laboratory doing experiments. That was a big motivation for me, and I went to university to study physics, but things were very different there; I didn't like the physics teachers I had and everything was very theoretical. So I thought that if I wasn't going to do experiments I'd study mathematics

instead, ready to do equations and everything. I switched courses, but all my research work has been associated with physics. I completed my degree and my PhD in functional analysis at the University of Valladolid. After that I went to Dundee University in Scotland and did a very full post-doc course, because in Spain at that time there was virtually nothing on numerical methods. That course enabled me to learn a lot in a relatively short time.

Q: The situation has changed a lot since then. As a founder of the Spanish Society of Applied Mathematics (SEMA) and Vice-president of the Royal Spanish Society of Mathematics (RSME), what's your view of the current situation of mathematics in Spain?

A: The answer I'd give today, in 2013, is very different from the one I'd have given five years ago. At that time, I would have said that mathematics in Spain had undergone a development that I could never have imagined when I started out. The first time I attended an international congress, in 1977 or 1978, I and a colleague of mine were asked where we came from, and when we replied the reaction was: "What strange countries you come from!". My colleague came from Sri Lanka. The field of numerical methods in Spain in 1978 was like that in Sri Lanka. This situation improved tremendously until five years ago, in terms of the number of mathematicians, international projection, journals and so on. So five years ago I would have replied that the challenge was to improve quality; quantitatively we were in the place we should have been in, given the number of Spanish mathematicians, but we had to gain in quality, tackle problems of greater scope, have potential Fields Medal winners, and so on.

> "Talent and excellence require a certain geographical concentration"

Q: What would your answer be now?

A: Unfortunately, scientific policy in Spain over the last few years has been a disaster. Access has been closed off to up-and-coming generations, which is the most important thing for any scientific community. We're going through a time in which resources are desperately scarce, combined with a hyper-bureaucratization of all processes. If this situation isn't remedied quickly, much of what we've achieved in the last 35 years is going to be squandered.

Q: How do you think it can be remedied?

A: In Spain we have to accept that we're not in a situation of crisis; by definition, a crisis is a sudden change that occurs over a short period of time. We're in a different scenario, and so we've got to adopt the right policies for this situation, which entail closing down certain structures that are dispensable or of special interest, while maintaining adequate funding for the most important sectors. However, we're doing just the opposite, cutting 25% right across the board, and this means the death knell for everyone.

Q: What structures do you think are dispensable?

A: The means adopted should be conducted hierarchically, cutting out bodies that are duplicated, putting degree courses in place with fewer students, etc. Politically it's a very difficult problem, and that's why nothing is being done.

Q: What projects would you strengthen?

A: The ICMAT is a good example. It's a new center that should continue to be supported financially in a rational way. Its budget will never match those of its counterparts in Germany of the USA, but it constitutes a commitment to excellence. The whole community ought to realize that this institute, or any other of a similar nature, is a reference point for all of us, and cease trying in parallel to have one like it in very town or city, which is financially inconceivable. Furthermore, talent and excellence require a certain geographical concentration.

Q: You were rector of the University of Valladolid for eight years. How do you see the current state of our universities?

A: Spain has a university system with a standard that befits it. The situation is not so serious that it requires new legislation or has to start again from scratch, as some ministers believe. That said, it's true that problems exist, but nobody is doing anything to solve them; neither the rectors nor the ministerial departments; for instance, the lack of mobility of students and lecturers, or the lack of diversification of the different institutes. We have the idea that all the universities should follow the same fixed pattern, but that's not good; there ought to be one, two or three Spanish universities of international renown, with many more resources than any Spanish university has at present, and capable of competing with the top centers of excellence abroad. At the same time, there should be other universities based on a model of service to the local community and with other approaches to research. As long as we fail to accept this we are condemned to suffer the current situation; we have no outstanding university, but then we don't have any bad universities either. It's true that there is no Spanish university in the top 100 of the international ranking, but there aren't any among the positions 1,500 to 2,000 either; almost all of them are in the USA.

> "There's a great mistrust in science in Spanish society, and that has to change"

Q: As chairperson of the Exact Sciences Division of the Royal Spanish Academy of Sciences (RAC), what are the challenges facing the institution in the future?

A: The RAC ought to be playing a more forceful role than the one it has now, above all when it comes to relations with science and society. The world is becoming increasingly scientific, but rational thought is on the retreat and magical thinking is acquiring greater importance. There's a great mistrust in science in Spanish society, and that has to change. The RAC has a fundamental role in changing the social perception of science in Spain.

"For a mathematician, being here means growing in leaps and bounds"

Tania Pernas, ICMAT researcher.

Tania Pernas has spent more than a year devoted to mathematical research at the Institute of Mathematical Sciences (ICMAT), although she is more attracted to the numbers that have accompanied with her ever since primary school. As she herself says, apart from having good teachers who made mathematics easy for her, she has never liked memorizing things and mathematics was the only subject that enabled her to study using logic alone.

"I realized the applications fluids had to real life problems"

She also likes drawing, so she thought about the possibility of studying architecture. However, she finally opted for calculation and eventually graduated in Mathematics at the University of Santiago de Compostela in 2011. It was in this city that she took her master in research, and where she was introduced to the mechanics of continuous media and decided to devote herself to research in fluids.

In spite of having published some papers on differential equations and dynamical systems prior to this, she took the decision to write her thesis on fluid mechanics, because as she says, "I realized the applications fluids had to real life problems". She completed her doctorate with an FP grant from the Institute of Mathematical Sciences: "It seemed an incredible opportunity to me, because of the personal experience of being able to study away from my home town and come to Madrid to work at a center like this".

Her research work during her first year has been devoted to studying the dynamics of the interface between two fluids; in this case between a vacuum and a fluid, in which the equation of evolution is obtained from Darcy's law. The study of this interface enables ne to determine how, in two fluids, for example, the air above and the water below create the formation of waves as well as when they will meet. Pernas says that, "You can find mathematics everywhere and there are always new things to discover. With fluid mechanics we can study the motion of waves or air, which enables us to get into the world of renewable energy. We can also go into the field of medicine; for example, with the study of the flow of blood or to investigate how air circulates through our noses".

"You can find mathematics everywhere and there are always new things to discover"

She says that what she likes best of all about studying mathematics is the atmosphere in the workplace: "Because those of us who choose this career are few, we create a family atmosphere". When asked about the future, she replies that she prefers to concentrate on the present, although she acknowledges that she'd love to work at a university or a research center, doing science as well as teaching future mathematicians.

For the moment, she says that she is "very happy" at the Institute of Mathematical Sciences, when she has been welcomed by her colleagues from the very beginning. She finishes by saying that, "For a mathematician, being here means growing in leaps and bounds; it places within reach any subject you might be interested in learning about. I'm surrounded by very good mathematicians, and there are always seminars, congresses and interesting discussions you can attend".

"The most important thing is to do good math"

Xavier Tolsa Domènech was born in Barcelona, Spain, in 1966. He studied Mathematics at the Universitat de Barcelona and gained his PhD under the supervision of Mark Melnikov, at the Universitat Autònoma de Barcelona. He is currently a research professor at ICREA (Catalan Institution for Research and Advanced Studies).

Xavier Tolsa Domènech, ICREA researcher professor.

Question: Why did you choose mathematics over other subjects?
Answer: For its beauty; because I enjoyed learning it and solving problems; because I thought I was good at it; and also to a large extent by chance.
Q: Apart from mathematics, what other activities do you like most?
A: Being with my family, doing some sport (for example, mountain-biking), reading a good book…
Q: Could you recommend a film, a book or a play?
A: I've recently become of fan of Haruki Murakami's books. I'd recommend most of them.
Q: What was your first experience of mathematical research like?
A: My first experience was when I was doing my doctoral thesis. Like most mathematicians I suppose, I went through various stages; first a period of learning and excitement with the problem I was posed by my thesis supervisor, Mark Melnikov, the solution of which was a big challenge for me; then a phase of very hard work and frustration when I had the feeling that I was making no progress at all. Then finally one day, after many attempts, my efforts began to bear fruit, and from that moment I started to make rapid progress and my delight at having overcome those difficulties fully compensated for all my previous frustrations.
Q: What was the most memorable of those first experiences in research?
A: The excitement of learning something completely new; in my case, particularly working in topics related to harmonic analysis and analytic capacity. I also remember with pleasure the good working atmosphere at the Umniversitat de Barcelona and at Autònoma de Barcelona, both in a personal sense and as a scientist.
Q: Which scientist has impressed you most during your professional career?
A: Many of the big names in current mathematical analysis; Carleson, Bourgain, Tao, Peter Jones… Ferran Sunyer i Balaguer as well, because of the enormous difficulties he had to overcome and the magnificent research work he did in spite of them.
Q: If you could have an hour's conversation with a mathematician from the past, who would it be and what would you talk about?
A: Maybe Fermat, and I'd ask him about the proof of his theorem, which certainly wouldn't fit in the margin of a book. Anyway, I'd willingly give up my place to a historian of mathematics, who'd probably make more of that hour than me.
Q: Is there any one theorem or formula you particularly like?
A: I like Pythagoras' Theorem very much, especially its nice geometric proofs. It was perhaps the first result that showed the importance of the idea of orthogonality, which is the basis of almost all harmonic analysis.
Q: What's your favourite book on mathematics?
A: Perhaps the one on the geometry measure theory by Pertti Mattila.
Q: How would you describe your research work in a few words?
A: A lot of effort, a lot of excitement, a lot of frustration, and a lot of pleasure that makes up for all those frustrations.
Q: What recent results in your field would you highlight?
A: The quantitative theory of rectifiability developed by Jones and continued by David and Semmes some years ago. It has enabled different problems in harmonic analysis to be connected to others belonging to geometric measure theory.
Q: Which problem in mathematics do you think presents the biggest challenge at the moment?
A: There are many difficult and interesting problems, and I'm not sure if there's one that's more important than the others. As an analyst, I might mention the Kakeya problem, Navier-Stokes, the dimension of quasicircles, Brennans conjecture, and so on. If I were engaged in logic or computation, I suppose I'd say the P-NP problem, and if my field were geometry I'd probably say another…
Q: Which area of mathematics outside your own field would you most like to learn about?
A: Combinatorics, for example, and number theory.
Q:What interaction between the different branches of mathematics do you think will be the most fruitful in the future?
A: The combination of geometry and analysis, which already showed its potential with the proof of Poincaré's conjecture, for example.
Q: Do you have any advice or message for young mathematicians?
The most important thing is to do good mathematics. Although the employment situation is difficult for many young mathematicians at the moment, if you devote yourself to good mathematics, sooner or later you'll find a job associated with this discipline, even though it might not be close to home.

Ant Foraging and Geodesic Paths in Labyrinths: Analytical and Computational Results

Authors: M. Vela-Pérez (Universidad Europea de Madrid), M. A Fontelos (ICMAT) and J. J. L Velázquez (ICMAT).
Original title: Ant foraging and geodesic paths in labyrinths: Analytical and computational results.
Date of publication: March 2013
Source: Journal of Theoretical Biology 320 (2013), 100–112.

This work consists of a study of the behavior of ants when searching for food, and in particular how they generate paths between the nest and food. The authors proposed a mechanism for tracing the shortest paths between two points, which mainly takes into account two main factors: persistence (the tendency not to change direction in the absence of external effects) and the deposition of pheromones (reinforcement of zones already visited).

In order to obtain their results, subsequent to analysis of the experimental data from studies carried out on real ants in the laboratory, the authors considered a model for this behavior that includes the smallest possible number of variables. Unlike in previous studies, analytical results in simple networks are provided. These conclusions are employed a posteriori in the numerical modeling with the use of reinforced random walks in Monte Carlo simulations rather than the deterministic models used in other works.

The study of self-organization in complex systems, such as the behavior of trails of ants, flocks of birds or shoals of fish, is aimed at the basic mechanisms governing

the collective movement of individuals. In addition to their strictly biological interest, these findings could be applied to designing the coordination of a group of robots for cleaning up a contaminated area.

Research into modeling the organization and coordination of the behavior of animals consists of a multidisciplinary approach involving the collaboration of biologists (who conduct experiments in the laboratory and provide real-life data), physicists and mathematicians (who develop and resolve the models).

About the authors

Marco Antonio Fontelos is a scientific researcher belonging to the CSIC and a professor of Applied Mathematics. He graduated in Physics at the Complutense University in Madrid, where he also obtained his Doctorate in Mathematics. He has occupied positions of visiting professor at the Universities of Minnesota, Bristol and Paris VI. His research work covers Fluid Mechanics, Plasma Physics and Mathematical Biology. In this latter field he has developed and studied models for tumor growth, the development of angiogenesis and signal propagation in excitable media.

Juan José López Velázquez is a Full Professor with the Department of Applied Mathematics at the University of Bonn. He graduated in Mathematics at the Complutense University of Madrid, where he also obtained his doctorate in Mathematics, and then went on to complete a post-doctoral stay at the University of Minnesota Institute of Mathematics and Applications. He has been a Full Professor at the UCM University and Research Professor at the ICMAT. He has completed research stays at various centers, including the University of Madison, Isaac Newton Institute (Cambridge), the Mathematical Institute in Florence, and the Max Planck Institute for Mathematics in the Sciences in Leipzig. His field of research is in Partial Differential Equations. His current interests include the study of diverse problems in which deterministic or stochastic interactions among many particles give rise to collective effects.

María Vela Pérez
She is currently completing a post/doctoral stay at the Institut Supérieur du Commerce de Paris and at the CEA Centre National de la Recherche Scientifique (CNRS). She presented her doctoral thesis in mathematics at the Complutense University of Madrid in May, 2011, and has worked as a lecturer in various universities (Universidad Rey Juan Carlos, RJC, IE and the Universidad Europea de Madrid)..

The First Congress on Mathematics and Geosciences held at the ICMAT

The congress "Mathematics and Geosciences: local and global perspectives" was held at the Institute of Mathematical Sciences last month at the beginning of November. This meeting was regarded as the most important scientific event in our country as part of the Year of Mathematics Planet Earth 2013.

The congress addressed subjects such as climate change, the increase in desertification and the dynamics of subsoils, with the aim of bringing Mathematics into closer contact with Earth Sciences in order to build tools to help tackle the challenges facing our planet. The participants included speakers of international prestige such as Andrew Fowler, researcher at Oxford University and an expert in mathematical modeling applied to the different areas of geophysics, who spoke about mathematical models for predicting climate change; ICMAT researcher Ana María Mancho, who gave a talk on the dynamics of the earth's mantle, and Ehud Meron of the Ben-Gurion University in Israel and world expert on the application of mathematics to the study of desertification.

Held between November 4th – 8th, the congress was organized by the ICMAT in collaboration with the Instituto de Geociencias (IGEO), a mixed research center composed of the CSIC and the Complutense University of Madrid (UCM), and in which other collaborators were the Technical university of Madrid (UPM) and the Institute of Interdisciplinary Mathematics (IMI), a university institute belonging to the UCM.

Mathematics and Social Networks, together in Science Week

Every year, the Institute of Mathematical Sciences participates in the Science and Technology Week, an important date in the calendar for all those passionate about science. On this year's program, the ICMAT organized a round-table discussion that brought together two apparently separate subjects that are in fact closely allied; mathematics and social networks. The meeting was held in the Residencia de Estudiantes, where an interdisciplinary group of researchers, communicators and disseminators of mathematics replied to the following questions through social networks: What do social networks have to say about mathematics? And what does mathematics have to say about social networks?

The round-table consisted of Clara Grima, a mathematician from the University of Seville, creator of the comic-book character Mati and disseminator of science in different media; Esteban Moro, lecturer at the Carlos III University in Madrid and the IBM "Shared University Award" prize-winner in 2007 for the modeling of diffusion of information in social networks and its application to viral marketing; José Antonio Prado Bassas, lecturer in the Department of Mathematical Analysis at the university of Seville and author of the networked mathematics blog Tito Eliatron Dixit; Francis Villatoro, lecturer at the University of Computational Sciences and Artificial Intelligence, Escuela Técnica Superior de Ingeniería Industrial of the University of Málaga and author of the blog Francis (th)E mule Science's News, and Daniel Mediavilla, a journalist specializing in science and team member of Materia, the website devoted to scientific news. Ignacio Fernández Bayo, journalist and vice-president of the Asociación Española de Comunicación Científica (AECC), was the moderator.

In addition to this round-table discussion, the ICMAT Schedule during this Science Week included a series of talks aimed at secondary school students and given by mathematicians José María Barja de from the University of La Coruña and the above-mentioned Clara Grima.

From left to right: E. Moro, F. Villatoro, J. A. Prado Bassas, I F. Bayo, C. Grima and D.Mediavilla, participants of the round table"Math and Social Networks.

Agenda

Function Theory on Infinite-dimensional Spaces XIII

Date: From l4th to february 7th 2014.
Place: ICMAT, Madrid (Spain).

Research Trimester on the Geometry and Physics of Moduli Spaces

Organized by :

Luis Álvarez-Cónsul (ICMAT–CSIC), Steven B. Bradlow (University of Illinois), Oscar García-Prada (ICMAT–CSIC), Tomás L. Gómez (ICMAT–CSIC), François Labourie (Orsay), Kenji Ueno (Yokkaichi University), Richard A. Wentworth (University of Maryland), Graeme Wilkin (National University of Singapore).

Date: From april 14th to4 july 11th 2014 .
Place: ICMAT, Madrid (Spain).

Origami, Fractals, Soap Bubbles and Fluid Mechanics Graffiti at The Mathematics of Planet Earth Week

From the 10th to 13th of October, the National Museum of Natural Sciences (CSIC) was the venue for the Mathematics of Planet Earth Week, a great event aimed at the general public and organized by the Institute of Mathematical Sciences in collaboration with the Museum and the CSIC Associate Vice-presidency of Scientific Culture, the purpose of which was to highlight the importance of mathematics for understanding planet Earth. The program consisted of workshops for secondary school students in which they learned how to create figures with origami to help them understand complex mathematical relations. They also built their own fractals with scissors and paper and discovered the mathematics hidden beneath the surface of a soap bubble. Talks on biodiversity and fluid mechanics networks were also held, and those who attended had the chance to see an exhibition under construction about fluid mechanics, in which visitors were able to take part.

Secondary school students participated in the Week of MPE13.

The exhibition was entitled 'Fluid Mathematics: Graffiti and Math´, in which the winners of a competition held beforehand saw their ideas on the behaviour of fluids take shape on a mural representing ocean currents, tornados and volcanic eruptions. A series of explanatory posters showing the mathematics involved in graffiti, and a wall on which the public could try out their efforts completed the exhibition.

A Season of Music and Mathematics opens the ICMAT Initiative for Mathematics and the Arts

Music and mathematics were the protagonists on the 25th, 26th and 29th of last month in the season of activities that kicked off the Iniciativa por las Matemáticas y las Artes (IMA – Initiative for Mathematics and the Arts). This new Institute of Mathematical Sciences (ICMAT) outreach program is aimed at exploring the mathematics of art and the art of mathematics, showing how science forms an integral part of life and culture. On this inaugural occasion, the initiative demonstrated the links between mathematics and music, perhaps the most abstract of all the arts. The inaugural talk was given by David Wright, professor of Mathematics at the University of Washington, who participated in conducting an international award-winning male voice choir. Furthermore, a round-table discussion on the special relationship between mathematics and music was held at the CSIC Residencia de Estudiantes, in which musicians who are also researchers in the mathematical sciences and computation also took part, as well as two further researchers who gave a concert of lyrical music.

For Daniel Azagra, a researcher at the Complutense University of Madrid (UCM), a member of the ICMAT and one of the organizers of the activity, "of all the arts, mathematics and music are the closest". According to this scientist, who also happens to be a pianist, both "use abstract languages and are probably the only disciplines that have done so since the beginning of their existence". It was Pythagoras who created the different harmonic scales on the basis of arithmetic relations, and furthermore mathematics constitutes a fundamental resource in artistic creativity.

As ICMAT researcher and co-organizer of the initiative, Óscar García-Prada, says: "Many people are drawn to both disciplines from a very early age, and many mathematicians are practicing musicians. Both appear to complement each other, while at the same time satisfying different needs. Musical performances are frequently given by the people attending mathematical events, and many mathematical research institutes around the world have pianos on their premises".

Fefferman, Vilani and Daubechies to attend the

The 10th AIMS (American Institute of Mathematical Sciences) Conference on Dyanamical Systems, Differential Equations and Applications will be held at the ICMAT in Madrid from July 7th to July 11th, 2014. Together with the AIMS, the conference is organized by the ICMAT in collaboration with the Autonomous University of Madrid, the Carlos III University, the Complutense University, the Polytechnic University and the Rey Juan Carlos University, all likewise from Madrid, as well as with the Spanish Society of Applied Mathematics (SEMA). A dozen main speakers will attend the conference, among whom we may mention two Fields Medal winners, Charles L. Fefferman and Cédric Vilani, and the recent award-winner of the BBVA Frontiers of Knowledge Prize and current Chairperson of the International Mathematical Union, Ingrid Daubechies. The conference has aroused great international expectation, and 120 special sessions have been approved, which have raised the expected number of participants to some two thousand. This will make AIMS 2014 the second largest mathematical conference to be held in Spain in terms of participants, surpassed only by the 2006 International Congress of Mathematicians (ICM), also held in Madrid.

The Institute of Mathematical Sciences and the Ymedia Company Sign a Collaboration Agreement

On September 20th of this year, the Institute of Mathematical Sciences and the marketing and publicity agency Ymedia signed a collaboration agreement to carry out a joint research project for studying and developing new techniques applied to modeling the impact of publicity on business metrics. This work will be supervised by the director of the ICMAT, Professor Manuel de León, and the director of Ymedia Business Intelligence, Alfonso Salafranca.

The ICMAT thereby extends its links with society at large, with contributions to the development of theoretical and applied knowledge and involving front-rank mathematical research more closely with problems of immediate application to the business world. This forms part of the ICMAT project for the transfer of knowledge, which it intends to pursue over the coming years.

In its turn, Ymedia hopes to extend its own competitive advantage in a field to which it has always given priority and where it is already a leader in the market, thanks to its advanced planning, measurement and modeling tools, developed in collaboration with companies such as Accenture and Bayes Marketing Science.

ICMAT

Quarterly newsletter
Instituto de Ciencias Matemáticas
Number 4. III Trimester 2013
Editing:
ICMAT
C/ Nicolás Cabrera, nº 13-15
Campus de Cantoblanco, UAM
28049 Madrid SPAIN

Editorial comittee:
Manuel de León
Ágata A. Timón
Carlos Vinuesa
Kurusch Ebrahimi Fard

Production:
Divulga S. L.
C/ Diana 16 - 1º C
28022 Madrid

Coordination:
Ignacio F. Bayo
Andrea Jiménez
Ágata Timón

Design:
Andrea Jiménez

Contribution:
Lorena Cabeza
Juan José López
Marco Antonio Fontelos
María Vela Pérez

Photography:
ICMAT
Space des Sciencies

Translation: Jeff Palmer

Students and researchers during a visit to the ICMAT.

ICMAT

ICMAT

Instituto de Ciencias Matemáticas

www.icmat.es

Campus Cantoblanco UAM
Madrid (España)

Síguenos en:

Instituto de Ciencias Matemáticas ICMAT

@_ICMAT

MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

excelencia Campus Internacional UAM CSIC+

EXCELENCIA SEVERO OCHOA

CSIC