

Marta Sanz Solé

$$\lim_{n \rightarrow \infty} \frac{1}{n} \log \mu_n(A) = \inf_{x \in A} \Lambda^*(x)$$

Marta Sanz-Solé grew up in Sabadell, Catalonia and obtained her PhD in 1978 from the University of Barcelona. She is currently professor at the University of Barcelona (UB), and head of the research group on stochastic processes. In 2011 Marta was elected Fellow of the Institute of Mathematical Statistics. Prior to taking up her post at the UB, she was associate professor at the University Autònoma of Barcelona. She was Dean of the Faculty of Mathematics UB (1993 – 1996), Vice-president of the Division of Experimental Sciences and Mathematics (2000 – 2003) and Director of the Barcelona Graduate School of Mathematics in (2018 – 2019). Marta was the President of the European Mathematical Society from 2011 until 2014. She is a member of several international committees overseeing the mathematical sciences. In 1998 she was awarded the Narcís Monturiol Medal of Scientific and Technological Excellence by the Generalitat of Catalonia. In November 2016 she was elected member of the Institute of Catalan Studies. In 2017 Marta was awarded the Real Sociedad Matemática Española Medal for her scientific contributions and international service. The same year she was elected honorary fellow of the Catalan College of Economists. In January 2019 she became Member of the Royal Academy of Sciences and Arts of Barcelona.

Research topics:

- Stochastic analysis
- Stochastic partial differential equations





How and when did you choose to do mathematics?

I was first attracted to mathematics when I was very young, I must have been thirteen years old. I liked solving logical problems and loved doing translations from and into Latin. At secondary school we had one year of Latin, and I liked the challenge of choosing the right tense. The same reason led me later on to study German for three years. I find it difficult to speak German, but I can read it well.

I like challenges and I view mathematics as a very difficult and challenging subject. When I look back, I was always motivated by challenges and I recall how I admired orchestra conductors and pilots, such as Saint Exupéry. I remember problems in geometry that were given to us at school, which were not easy to solve. I was a good student and did well in mathematics, so when I was 15 or 16 years old my teachers encouraged me to pursue mathematics. Up to the second year of mathematics I was able to study both mathematics and physics because the first year was common to all natural sciences. It was tough as I had to take exams in all subjects at the same time. I was actually very hesitant whether to choose mathematics or physics. I thought of doing both,

but I realized that this would be impossible in only five years of study.

I was in love with a philosophy student. Logic was a point of connection between him and me, so I studied logic on a private basis, after which I became interested in analysis. When I discovered analysis, I found it to be a wonderful subject: I liked to put all the epsilons together, through meticulous computations.

Were you then encouraged by your family, friends or other people around you?

I was born in 1952. After the Second World War and until the 70s, Spain was a very closed environment, to the extent that people were afraid of talking openly about politics. It was a challenge for my parents to send their daughters to university. Both my parents were well-educated and worked, but they had not been able to study at university and were very eager to give their two daughters access to university. So my parents were really supportive. My father went to war when he was only 17, after which, as a Republican, he was sent to prison where he remained for several years. He was a specialist in textile machines, an inventor at heart who was very good at cooperating with engineers. So when he discovered that I liked science, he

wanted me to become a textile engineer. My mother was the general secretary of the CEO of a textile company. Seeing my interests in pursuing a scientific career, she suggested to study pharmacy. In her opinion this seemed to be a very nice job for a women! My older sister, who was not quite as strong-willed as I was, specialised in French philology and later married a French citizen.

At that time, I was an idealist with a boyfriend who was a philosopher. I believed that technical work and science were incompatible and didn't want to dirty my hands with technical stuff.

I started studying in Barcelona, at a time of unrest, when the university was still marked by the events of May 68. So we were all more involved with politics than with science. My family and I were living in Sabadell, near Barcelona, the Manchester of Catalonia. To go to university, I would take the train every day. When I turned 20, I left home and chose to live in Barcelona. Since the university had closed down, many classes took place in churches, with the police all around. The professors were very collaborative and would deliver lectures in the only safe places available at the time, so churches or any place owned by the Catholic church. Police could not enter churches

without special permission from Franco, which explains why they felt safe. At the time, the Catholic church was split into two antagonistic groups, pro and contra Franco, so part of the church at least was very supportive of us students.

Did you come across obstacles in pursuing your career as a mathematician?

I am not really aware of any obstacle, and I had a quite pleasant career. Not everything went smoothly but I didn't come across obstacles because I was a woman. Looking back, there might be some attitudes that I would interpret differently now, but I didn't encounter any particular barriers. Political obstacles? Yes and no – I have always been involved in politics, but I have always preserved my independence and have never belonged to any party.

In retrospect, are you happy to have chosen mathematics or do you have some regrets?

What are for you the joys of mathematics? What are for you the hardships of mathematics?

In a second life, I don't know whether I would choose mathematics. I have always thought of mathematics as my job and not as my life. Yet I have devoted days and nights to mathematics and have worked very intensively on research. Lately, the time

I dedicate to research in mathematics has decreased, but I have devoted a lot of energy to societal commitments. I don't have regrets except maybe one, which is that I am interested in many things in life and find myself somewhat isolated in certain circles where I cannot explain to my friends what I am so busy with. This is an aspect of my life which I don't like so much, I cannot control my schedule 100 % – there is little space for one's private life. I am also very attracted by music and architecture. I play the piano and studied it at the conservatory for five years, up to my second year of university. I decided to stop when I reached a level for which I had to practice four hours every day and could not pursue my studies because of it. Like mathematics, music is an abstract language, and just as I like doing mathematics for the challenge, I feel that playing the piano is a challenge which I enjoy. There are lots of piano techniques that I haven't mastered, which leaves me with some frustration. Yet music gives me a lot of peace and I enjoy just being in the fantastic world of music. What I like about architecture is the distribution of spaces, how architects solve the light problem, in museums for example. The way geometry is taken into account to build amenable places, I find inter-

esting. I like the way art, civil engineering, and science merge in architecture. All my experiences in working for the community have been very positive, some of them very pleasant. I started by being Dean (1994–1997) of the Faculty of Mathematics in Barcelona and this was the first time that I had to deal with leadership in a serious way. I had a very pleasant time, and was luckily spared confrontation with serious problems. I then became Vice President (2001–2005) of the Division of Science at this same university, where I was responsible for research and postgraduate studies. This was interesting but very tough as I had to manage a huge budget involving many subjects. The third important job came with the Chair (2011–2014) of the EMS (European Mathematical Society). This was one of the most exciting experiences in my life. I saw the diversity of Europe; in the executive committee we had Italians and Finns forced to understand each other. I also liked the diversity of topics, some devoted to developing countries, others to gender, education and publications. It was very tough; I was travelling all the time and took the plane every week. I would go to Frankfurt just for a day to attend a meeting for example. Physically it was very demanding, it involved a lot of





mail and letters. Yet I learned a lot and met a lot of people from many countries. When I was elected president of the EMS, I was already senior with enough maturity and my son was already independent. So I didn't pay a high price on the family side. My visibility came with some commitments. Since 2018 I have been asked to be a

member of several committees, boards, and to collaborate with research councils. Since 2018, I have been the director of the Barcelona Graduate School of Mathematics, somewhat similar to the BMS (Berlin Mathematical School) in Berlin. I don't want to become rector of the university, which is a political position and no longer an aca-

demical position. A social council governs the university which exposes the rector to politics. Let me stress that the life of a researcher is very demanding, and it is a challenge to make it compatible with one's personal life. I only have one son and regret not having had more children. Raising my son has been the best part of my life.

I don't think having children and a career are incompatible. On the contrary, I think I was able to transfer some of my personal experience to my son. Many women think that they don't have the time to raise children, but I believe that they are missing something. It is an aspect of one's life that one should make compatible with a career.

What would you recommend a young woman in your country wanting to start a career in mathematics?

Mathematics has this very exciting feature that you don't necessarily need to focus on a useful problem, or work on a subject imposed by some trend. You are quite free to choose what you want to investigate, which can make you happier than being under the umbrella of someone giving you orders. Freedom is one aspect. There is also a very important creative component combined with a high level of abstraction. If you are gifted, give mathematics a serious go. If you have not discovered that you have some talent for mathematics, then don't go for it. Mathematics won't make you happy. Instead

you should look for a subject in which you are talented. There is always one thing one is talented in. Research in general is a very tough activity, with lots of ups and downs, and you have to be psychologically strong. I notice lots of ups and downs in students, maybe more than before. There is also the difficulty of getting a permanent position, again you need psychological strength. I don't feel we should systematically push young girls towards mathematics. It is better for us to tell them about our personal experience, about the good and the negative aspects of such a career.

Could you describe your favourite personal achievements in mathematics?

I was glad to find a characterization of the topological support of the law of the solution to a stochastic wave equation in spatial dimension one. This was an open problem in stochastic partial differential equations that we solved, in collaboration with A. Millet, with an approach due to S. Aida, S. Kusuoka and D. Stroock suggested to us by V. Bogachev. This led to further developments, in the

form of a solution to the same problem for the stochastic heat equation, in collaboration with V. Bally and A. Millet. I was also very excited about some findings obtained in collaboration with R. Dalang, in probabilistic potential theory applied to stochastic partial differential equations and, in particular, to wave equations.

Could you describe your research topics in mathematics to a non-expert?

I am a probabilist; probability is the field of mathematics that deals with randomness and uncertainty. Since these characteristics are present in many real life situations, probability is widely applicable, unlike other fields of mathematics. My field of expertise lies in the study of mathematical models for random evolutionary events. These can be financial markets or biological populations for example. I find it challenging and exciting to be able to express uncertainty and randomness in rigorous mathematical terms, to better understand phenomena and to make predictions about future tendencies.