



Artur Avila is a franco-brazilian mathematician who was born in Rio de Janeiro, Brazil, in 1979.

He won the International Mathematical Olympic gold medal at the age of 16.

Even before finishing high school, he started studying at the Instituto Nacional de Matemática Pura e Aplicada (IMPA) of Rio de Janeiro where he began his PhD supervised by Wellington de Melo at 19 years old.

He is now senior researcher both at CNRS and IMPA.



The [Centre National de la Recherche Scientifique](http://www.cnrs.fr) (National Center for Scientific Research - CNRS) is a public organization under the French Ministry of Education and Research.

CNRS covers research in all fields of knowledge. It is the largest fundamental research organization in Europe.

International Joint Unit (*Unité Mixte Internationale - UMI*), is a single location Joint Lab with permanent CNRS staff. Its duration is 4 years, with two renewals possible. **UMI is the highest level of international cooperation.**

Meet the researcher

Interview with Artur Avila, Fields Medal Awardee and Brazilian ERC starting grant awardee

You are in the privileged position of being able to conduct research both in Brazil and in France. Since EURAXESS Links is an initiative to promote researcher mobility, we are particularly interested in finding out more about the stages of your research career so far. Could you tell us a little more about your experience? How did your cooperation with CNRS start?

I obtained my PhD at the age of 21 at the Institute for Pure and Applied Mathematics (IMPA) in Rio de Janeiro, before arriving in France in 2001, where I completed a two year post-doctoral degree at the College de France. After two unsuccessful attempts, I qualified for the competition held by the National Centre for Scientific Research (CNRS) - open to foreign researchers - in 2003, where I now hold a permanent position. After spending three years in Paris, I received a grant from the Clay Mathematics Institute, which allowed me to spend three years in Brazil, and in 2008, I was promoted director of research at CNRS.

I began to split my time between France and Brazil in 2009. My mobility has been facilitated by the fact that since 2006, IMPA has been part of the CNRS as an international joint research unit. When I am at IMPA in Brazil, somehow I'm also at the CNRS, although I officially still remain director of research at the Jussieu-Pairs Institute of Mathematics Rive Gauche (IMJ-PRG), in France.

Furthermore, I usually work on several projects simultaneously, some with partners in France, others in Brazil or elsewhere, and I can therefore easily switch from one project to the other.

You are also an ERC Starting Grantee. How did you find out about the ERC selection process? Could you tell us a little bit about the research you are conducting with this grant?

In 2010, the director of my laboratory encouraged me to submit a project to the ERC and helped me with the administrative procedures. It was the first time I asked for EU funding as a principal investigator (PI). As a result, I was awarded an ERC Starting grant for a period of five years.

The project, entitled "Quasiperiodic", covers several classes of dynamical systems which display a quasiperiodic component, while the second class consists of translation flows on higher genus surfaces.

Over this period, our research has sometimes taken an unexpected turn, as it has been influenced by the findings of the researchers who were recruited on the project. We ended up doing many things that were not originally planned. Without the ERC funds, I would not have been able to explore some of the themes we worked on.



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About the **European Research Council (ERC)**

Set up in 2007 by the EU, the [European Research Council](#) is the first pan-European funding organization for frontier research. It aims to stimulate scientific excellence in Europe by encouraging competition for funding between the very best, creative researchers of any nationality and age. The ERC also strives to attract top researchers from anywhere in the world to come to Europe. It funds young, early-career top researchers ([ERC Starting grants](#)), already independent excellent scientists ([ERC Consolidator Grants](#)), and senior research leaders ([ERC Advanced Grants](#)). The ERC operates according to an 'investigator-driven', or 'bottom-up', approach, allowing researchers to identify new opportunities in any field of research, without thematic priorities.

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How did your ERC grant influence your research career and your Fields award?

In mathematics, you do not need much equipment, and a good part of the grant can be directed towards funding mobility, be it for hiring post docs (regardless of their nationality or origin), or to participate in congresses and meeting partners.

The ERC grant allowed me to benefit from better working conditions and to continue my research in France more efficiently and comfortably for 5 years, by surrounding myself with competent researchers with whom we made major progress on several questions.

This particularly applies to problems that I looked at a few years ago but was not able to solve on my own. For example, back then I tried to solve the problems of low combination of billiards in regular polygons several times without success. Thanks to the ERC grant, we were able to recruit a post-doc who examined this problem and solved it.

Similarly, there is a more complex version of the problem known as the "10 Martini" which clearly escaped the previously developed techniques. With the help of a Chinese post-doc recruited through the ERC grant, I was surprised to see that the ideas I had developed earlier could be applied in this project.. The issue has not been solved yet, but we are making good progress.

When I was awarded the Fields Medal, the selection committee mentioned my contribution "to the dynamical systems theory, which has changed the face of the field, using the powerful idea of renormalisation as a unifying principle... ". These are the comments the committee published on my work:" Avila leads and shapes the field of dynamical systems.... With his research team, he has made essential progress in many areas, including real and complex one-dimensional dynamics , spectral theory of the one- frequency Schrödinger operator , flat billiards and partially hyperbolic dynamics...."

So I have been recognised for the work I have done over all these years, but also for more recent developments, which were achieved through international cooperation, and partly funded by the ERC.

Can you share any tips with our readers to apply successfully for an ERC grant?

I am not well placed to give advice because the rules were a little different when I got my grant. My career was already well under way, I had completed my PhD almost 10 years before, and had been published several times . I was invited to international conferences, awarded European prizes such as the Michael Brin, the Jacques Herbrand, and the Salem Prizes, and the Early Career Award from the International Association of Mathematical Physics.

I would like to advise your readers that, unlike me, they should not wait to be an internationally recognised researcher to apply, especially for starting grants. The important thing is to have a good science project, detailed and consistent, and good colleagues.



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ERC grants are **open to researchers of any nationality** who may reside in any country in the world at the time of application.

To date, there are **402 principal investigators of non-ERA nationality** (nationals of countries other than the EU and the countries associated to the Framework Programme) among the over 5.000 ERC-funded researchers, representing 8% of all grantees (292 Starting and Consolidator Grants and 110 Advanced Grants). These grant holders are mainly nationals of the US (177), Canada (41), Russia (33), Australia (29), India (26), and Japan (18). Only 2 grantees are Brazilian: Artur Avila and [Aureo de Paula](#).

How important is the scientific cooperation between these two regions?

Cooperation between Brazil and France in mathematics is longstanding. Many young and excellent French researchers have, for example, carried out research at IMPA in the 80s as part of their French military service. This is the case of renowned researcher Jean -Christophe Yoccoz. He won the Fields Medal in '94 and completed his PhD at IMPA. Such collaborations have long-lasting and positive consequences since Jean-Christophe Yoccoz maintained his links with researchers at IMPA after his own experience, and it is also thanks to him that I came to Paris when I was recruited for a post- doc at the College de France!

In your opinion, how important is the mobility of international researchers between these two regions?

Scientific exchanges between Brazil and France are numerous and beneficial for both countries but also for mathematics. The advantage of scientific mobility is obvious to me.

For France, the presence of foreign researchers is beneficial. There are numerous foreign researchers here and we are always ready to welcome more. The language has never been a great obstacle for me. When I first arrived in France, I did not speak perfect French, but could still communicate without difficulty with my colleagues who spoke English or even Portuguese, thanks to the long tradition of international cooperation and their previous experiences abroad.

In the long term, I am convinced that Brazil will be attractive. The university system will develop and grow, and so will the recruitment needs. The potential for growth is larger than the one for developed countries.

Today, Brazil sends researchers abroad, but it should not be afraid of losing them. Once the researchers return, they will bring back a different type of knowledge and will contribute to the scientific development of the country. As for those who decided not to return, they will always be a reference for those who aim to follow their path. I also mention this to French researchers, and encourage young researchers to spend a few years in Brazil at the beginning of their careers.

I do not think we should be afraid of brain drain.

Having conducted research both in Brazil and in Europe, what are the main aspects of each of these countries' research landscape?

Being both Brazilian and French, it is important to me that conditions are favourable for mathematical research in both countries.

It is important not to let the researchers' careers deteriorate, not to put off talents. Some of these brilliant minds could indeed be discouraged by increased competition, difficult financial conditions and a lack of social recognition for researchers. As a consequence, they may turn away from this path. We must ensure that this does not happen.

For me it is different. I started my career very early and I am unable to do anything but maths. But we must also think of a more egalitarian research system, not only conducive to internationally recognised researchers. Ideas are universal and research is based on the work of many people, including also those who will unfortunately never be distinguished.