Fields Medal awarded to Artur Avila

The Fields Medal, the world's most prestigious distinction in mathematics, is being awarded today to Artur Avila, a CNRS senior researcher at the Institut de Mathématiques de Jussieu-Paris Rive Gauche (CNRS/Université Paris Diderot/UPMC). The presentation is part of the program of the International Congress of Mathematicians, which is being held this year in Seoul, South Korea. The 35-year-old Franco-Brazilian mathematician, who also works at the National Institute for Pure and Applied Mathematics in Rio de Janeiro, is being recognized for outstanding work in his specialty fields, primarily concerning dynamical systems and analysis. Three other mathematicians are receiving Fields Medals this year: Martin Hairer from Austria, the Canadian-American number theorist Manjul Bhargava and the prize's first female laureate, Maryam Mirzakhani from Iran. The 2014 awards strengthen France's position as number two in the world in mathematical research.

Once every four years, the International Congress of Mathematicians unites some 3,000 mathematicians from all over the world. This year it is being held in Seoul, South Korea, on August 13-21. As part of the opening ceremony of this scientific event, four Fields Medals are being awarded to outstanding mathematicians under the age of 40, each of whom also receives a financial endowment of €10,000. One of the four winners for 2014 is a 35-year-old CNRS researcher: Artur Avila of the Institut de Mathématiques de Jussieu-Paris Rive Gauche.

Born on June 29, 1979 in Rio de Janeiro, Brazil, this Franco-Brazilian researcher decided to devote himself to mathematics at the age of 16 after winning a gold medal at the 1995 International Mathematical Olympiad in Toronto. Since then, his progress in his field has been impressive: while finishing secondary school, he also studied at the Brazilian National Institute for Pure and Applied Mathematics (IMPA) in Rio de Janeiro, where, at age 19, he began a dissertation on one-dimensional dynamics under the supervision of Welington de Melo. During this time, he traveled to the United States on several occasions to work with Mikhail Lyubich, marking the beginning of a longstanding collaboration and equally lasting friendship between the two men. Three years later, in 2001, he entered the Collège de France for postdoctoral work with Jean-Christophe Yoccoz, another mathematician with whom he has maintained close relations. Recruited by CNRS in 2003, Avila joined the Laboratoire de Probabilités et Modèles Aléatoires (CNRS/Université Paris Diderot/UPMC). In 2006 he won a three-year fellowship from the Clay Mathematics Institute, which offered him the possibility of working at any laboratory in the world. He decided to return to IMPA, as part of the CNRS-IMPA joint unit. In 2008, at age 29, he became CNRS's youngest senior researcher and went to work at the Institut de Mathématiques de Jussieu-Paris Rive Gauche. Today, he continues to divide his time between Paris and Rio, two cities where he enjoys the company and contributions of his students and colleagues.

Blessed with an inquiring mind, Avila is the author of more than 50 scientific publications. His focus of interest is dynamical systems, i.e. systems that evolve over time, with a specialty in determining the probability of a given system evolving toward one type of behavior or another. After studying transformations of a real interval[1] for his dissertation, he turned his attention to the dynamics of complex plane applications, an aspect linked to certain fractal objects, like the Mandelbrot set. Taking an interest in "unimodal" analytical systems with non-regular behavior, Avila succeeded in demonstrating, with Lyubich, de Melo and Carlos Gustavo Moreira, that their dynamics are highly chaotic and seem to behave as an aleatory object.

Another area of inquiry for the new Fields laureate is one-dimensional Schrödinger operators associated with a dynamical system (to describe in mathematical terms certain simple quantum systems governed in physics by the Schrödinger equation). More precisely, Avila became fascinated with the "almost Mathieu operator," a type of Schrödinger operator that describes the evolution of an electron in a specific magnetic field. He was thus able to solve, in cooperation with researchers like Raphaël Krikorian, Svetlana Jitomirskaya and David Damanik, three problems concerning this specific operator from the list complied by Barry Simon in 2000 of 15 problems on Schrödinger operators that remained open in the 21st century.

Since 2003, Avila has also taken an interest in interval exchanges. If the interval is represented by playing cards, this branch of mathematics studies the order resulting from the way the cards are cut. With Giovanni Forni, he succeeded in proving that when the interval is cut in several parts in a non-cyclic (and thus, in a sense, aleatory) manner, the interval exchange is almost certain to be "weak mixing." Taking the notion even further, he also studied a transformation acting upon a set of mathematical objects linked to these interval exchanges, the Teichmuller flow. With Yoccoz and Sébastien Gouzel, he has demonstrated the highly chaotic nature of this flow.

Artur Avila is the recipient of numerous other prestigious distinctions, in particular the CNRS Bronze Medal and the Salem Prize in 2006, the European Mathematical Society Prize in 2008 and, one year later, the Jacques Herbrand Prize of the Académie des Sciences, which is awarded every two years to talented young mathematicians under the age of 35.

This latest award brings to 12 the number of French winners of the 56 Fields Medals presented since 1936, confirming the success and reputation of French mathematics in the international arena. France thus retains its rank as second in the world for number of Fields laureates, after the United States (13) and before the USSR/Russia (9).

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[1] If A and B are two real numbers such that A < B, the real interval [A,B] is the set of real numbers comprised between A and B.

Artur Avila
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Contact

CNRS press officer I Priscilla Dacher I **T +33 (0)1 44 96 46 06 / 51 51** I priscilla.dacher@cnrs-dir.fr