Mathematical Work of Carlos Gustavo Moreira

Carlos Gustavo Moreira is one of the most brilliant young research mathematicians in the world scenario: very creative, audacious and most enthusiastic about facing important difficult questions to the development of branches of mathematics, most specially dynamical systems.

Early on, he caught the attention of well-established mathematicians for his intelligence in addressing problems that were totally new to him. Indeed, frequently he had the best performance in a class of graduate students at the National Institute for Pure and Applied Mathematics – IMPA in Rio de Janeiro, while he was still engaged in secondary school classes. He concluded his Master`s Degree at IMPA before becoming an undergraduate student at the Federal University of Rio de Janeiro.

His Ph.D. thesis, concluded when he was 20 years old, was quite striking, showing the existence of stable intersections of Cantor sets in the context of Poincare`s homoclinic tangencies and their bifurcations on surfaces. It was published in the excellent journal Annales de l'Institut Henri Poincaré-Analyse Non Lineaire. Following that, he produced with the Fields Medal Winner - 1994, J.- C. Yoccoz, a remarkable piece of work in the same context, that has great impact in dynamics: a pair of regular Cantor sets with large fractal dimensions, meaning that their sum is bigger than one, generally have stable intersections when one of them is translated across the other. The work has been published in the famous journal Annals of Mathematics. The authors exhibited a great skill in blending the theories of dynamics, probability and combinatorics. An extension of this theory is being achieved in higher dimensions in an ongoing work of Moreira with Palis and Viana.

Another absolutely major contribution of Moreira corresponds to a series of papers with Artur Avila and concerns the typical dynamical behavior of maps of the interval with only one critical point, the so-called unimodal maps: for general parameterized families of such maps, for a typical parameter value the corresponding map either has a hyperbolic sink attracting almost all orbits or else it displays an absolute continuous invariant probability measure. This kind of result is a dream achievement in dynamics. The authors assumed the maps to be twice differentiable, while before the pioneer work of Lyubich assumed the maps to be quadratic. Their papers appeared again in the Annals of Mathematics and in Astérisque and Contemporary Mathematics. Concerning the eingenvalues of periodic orbits, Avila and Moreira also published a beautiful combinatorial formula in the outstanding journal Publications Mathématiques – Institut de Hautes Études Scientifiques.

There are other important contributions of Moreira in the area of combinatorics, with a number of authors such as Y. Kohayakawa, C. Mauduit, V. Rödl and N. Alon. Besides the results mentioned above, he has a number of other relevant ones in dynamics with many authors, like R. Bamón, S. Plaza, J. Vera, R. Labarca, E. Muñoz and J. Rivera.