

Press release — September 4, 2025

Julio Parra-Martinez awarded an ERC Starting Grant to explore extreme gravitational waves

IHES is delighted to announce that Julio Parra-Martinez, Permanent Professor of Physics at the Institute since 2024, has been awarded a Starting Grant by the European Research Council (ERC). This prestigious grant will support the development of the GravitaS project (The Gravitational S-matrix: from theory to experiment), which aims to tackle one of the most formidable challenges in contemporary physics: understanding gravitational wave signals in extreme regimes.

Probing the heart of supermassive black holes

Gravitational waves—ripples in spacetime predicted by Einstein and first observed in 2015—have revolutionized our view of the Universe. Among the most intriguing sources of these waves are Extreme-Mass-Ratio Inspirals (EMRIs).

EMRIs involve a small astrophysical object, such as a compact star or an intermediate-mass black hole, spiraling into a supermassive black hole, like the one at the center of the Milky Way.

These extreme events produce gravitational wave signals of exceptional complexity and richness. They are expected to be a primary observational target for LISA (Laser Interferometer Space Antenna), the European Space Agency's upcoming space-based gravitational-wave observatory, set to launch within the next decade.

A formidable theoretical challenge

While Einstein's theory of general relativity provides, in principle, a framework to predict the signals emitted by EMRIs, solving the relevant equations remains a computational challenge. The extreme gravitational fields and near-light-speed dynamics involved are currently still beyond the reach of even the most advanced supercomputers.

This is precisely where GravitaS comes in. With this ERC Starting Grant, Julio Parra-Martinez will apply cutting-edge methods from particle physics, originally developed to calculate scattering amplitudes at high-energy particle colliders, to the modeling of gravitational wave signals. These techniques, which streamline complex calculations in quantum field theory, are now proving to be unexpectedly powerful tools in black hole and gravitational wave physics.

A Grant that opens new horizons

For Julio Parra-Martinez, receiving an ERC Starting Grant is both “an exciting opportunity and a personal achievement.”

In practical terms, the funding will allow him to recruit PhD students and postdoctoral researchers, build a strong research team around him, and strengthen international collaborations by hosting visiting scientists at IHES.

However, the impact of the grant will extend well beyond his own research group. Conferences, workshops, and thematic schools will be organized at IHES to foster a wider community working on related questions.

Reflecting on the application process, Julio Parra-Martinez underlines the role played by his colleagues and the IHES administrative staff:

“In preparing both the proposal and the interview, I greatly benefited from the help of friends and colleagues, notably Thibault Damour, Permanent Professor of Physics Emeritus at IHES, whose own research paved the way for the first detection of gravitational waves. Without their critical reading of my proposal and their tough questions during practice presentations, it would have been much harder to succeed. The staff at IHES was also incredibly helpful in preparing the non-scientific parts of the application. I am deeply grateful to all of them.”

“Dare to aim for the big questions”

Beyond the scientific challenge, studying extreme gravitational waves offers a unique window into the most mysterious regions of the Universe. With GravitaS, Julio Parra-Martinez seeks to push the boundaries of general relativity and prepare the ground for tomorrow’s astrophysical discoveries.

To young researchers considering an ERC grant application, his advice is clear: “Be ambitious and set your sights on the most important and challenging questions in your field.”



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L'Institut des Hautes Études Scientifiques (IHES)

A founding member of Université Paris-Saclay, IHES is a research center in mathematics, theoretical physics and all related disciplines. A private foundation recognized in the public interest, the Institute has only a restricted number of permanent faculty. Besides, it welcomes about 200 visitors from all over the world for research visits each year. Freedom of research, independence and interdisciplinarity are the values of IHES, which is also committed to promoting the diversity of talent in fundamental research.

Université Paris-Saclay

Université Paris-Saclay brings together ten constituent faculties and institutes, four Grandes Écoles, the Institut des Hautes Etudes Scientifiques, and two associate institutions and shared laboratories with national research organisations. With 48,000 students, 8,100 lecturers and 8,500 administrative and technical staff members, Université Paris-Saclay offers a comprehensive and varied range of undergraduate to doctorate level programs and engineering degrees, renowned for their quality thanks to the reputation and commitment of its academic staff. Located in the south of Paris on vast campuses that stretch across Paris, Orsay, Évry and Versailles, Université Paris-Saclay benefits from a strategic geographical and socio-economic position that is strengthened by its international visibility. A leading University, Université Paris-Saclay is recognized for its excellent Mathematics and Physics but also for its Life and Medical Sciences, Agriculture, Engineering, and its extensive Humanities and Social Sciences programs. Close to Paris, Université Paris-Saclay is nested in a protected natural area, at the very heart of a dynamic economic hub.