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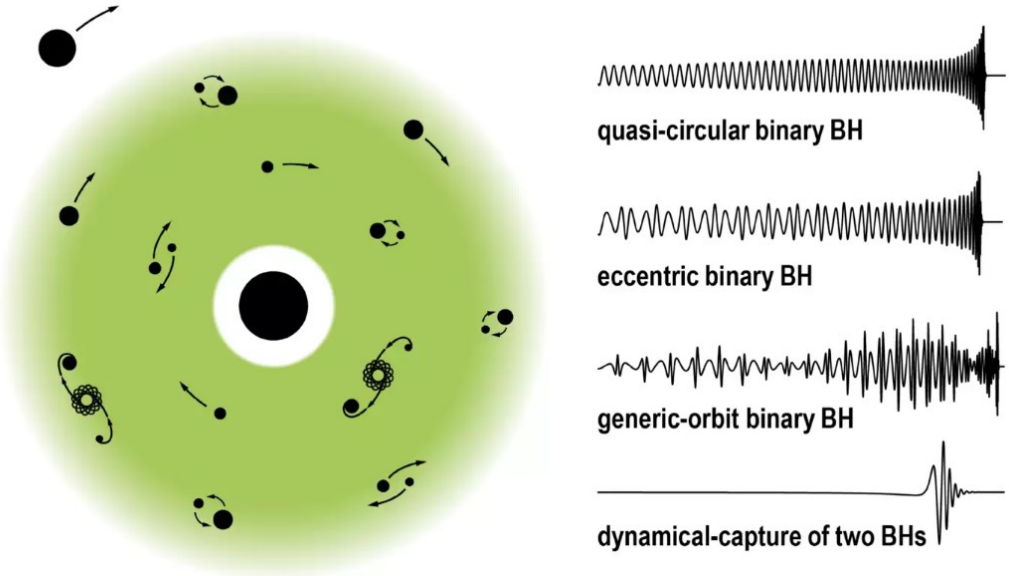
PRESS RELEASE

Three million euros to SISSA for precision astronomy

The School is among the partners of the international consortium GWSky, awarded with 12 million euros by the European Research Council to investigate gravitational waves.



Trieste, 5 November 2024

Existing and future gravitational-wave detectors will observe signals so precisely that they will be able to detect possible deviations from Einstein's theory of relativity and the standard model of particle physics. To fully exploit this unique instrumental capability, fundamental advances are needed in the theoretical description of black holes, the gravitational waves they emit, their cosmic environment and physics beyond the standard model. Providing the necessary theoretical framework is the aim of the project GWSky, awarded with 12 million euros over the next six years by the European Research Council (ERC). The ERC Synergy grant involves four nodes, SISSA (Trieste), the Niels Bohr Institute (Copenhagen), the University of California (Los Angeles), and the Max Planck Institute for Gravitational Physics (Potsdam).

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The aim of the project, called ‘Making Sense of the Unexpected in the Gravitational-Wave Sky’ (GWSky), is to use gravitational-wave measurements by existing and future observatories on Earth and in space as precision laboratories for fundamental physics, cosmology and astrophysics. This includes the current detectors of the LIGO-Virgo-KAGRA collaboration as well as the future ground-based observatories Cosmic Explorer and Einstein Telescope, and the space-based LISA detector.

“GWSky aims to develop innovative tools to interpret gravitational wave signals with great precision. The aim is to identify and understand possible anomalies in the signals, which could reveal new physical phenomena not predicted by Einstein's theory of General Relativity. These anomalies could result from unknown gravitational effects, the presence of the astrophysical environment, or inaccuracies in our solutions to the Einstein equations. The project will exploit the full potential of precision gravitational wave data to gain insight on astrophysical and cosmological phenomena,” says Enrico Barausse (SISSA), one of the four PIs of the project alongside Zvi Bern (University of California Los Angeles), Alessandra Buonanno (Max Planck Institute for Gravitational Physics) and Maarten Van de Meent (Niels Bohr Institute).

This is the first ERC Synergy Grant awarded to SISSA, which up to now has been managing 31 ERC projects, including the Consolidator grant awarded to Barausse in 2019 and ending in March 2025. Thanks to GWSky, the physicist will be able to investigate the effect of the astrophysical environment on gravitational waves, as well as explore and test alternatives to Einstein’s general relativity. The SISSA node will pursue these goals and explore their implications for the statistical analysis of gravitational wave data, both with classical techniques and machine learning.

“The upcoming flood of highly accurate gravitational wave data from both updates to current facilities and future detectors has the potential to revolutionize physics and astrophysics, but only if we have the right theoretical and statistical tools. GWsky will provide these tools and allow for decades of precision gravitational wave astronomy”, concludes Barausse.

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ERC Synergy Grants
The European Research Council awards Synergy Grants for scientifically excellent research projects through a complex and competitive selection process. Grants are awarded for a period of six years and are generally worth up to 10 million euros. Additional funding can be requested for large-scale equipment relevant to the project. Funding is available for projects involving two to four Principal Investigators (PIs). In the current selection round, the ERC is funding 57 projects out of 548 evaluated research proposals from all scientific disciplines. This corresponds to a success rate of 10.4 percent.

The GWSky project will receive a total of 11.98 million euros, of which 2.8 million euros will go to SISSA.

Besides Enrico Barausse, the other PIs of this ERC Synergy Grant are:

Zvi Bern from the University of California, Los Angeles, USA
Alessandra Buonanno, Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, DE
Maarten van de Meent from the Niels Bohr Institute, Copenhagen, Denmark

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IMAGE
Caption: "A schematic representation of binary black holes in different environment and the gravitational-wave signals they emit"
Credits Ana Carvalho

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