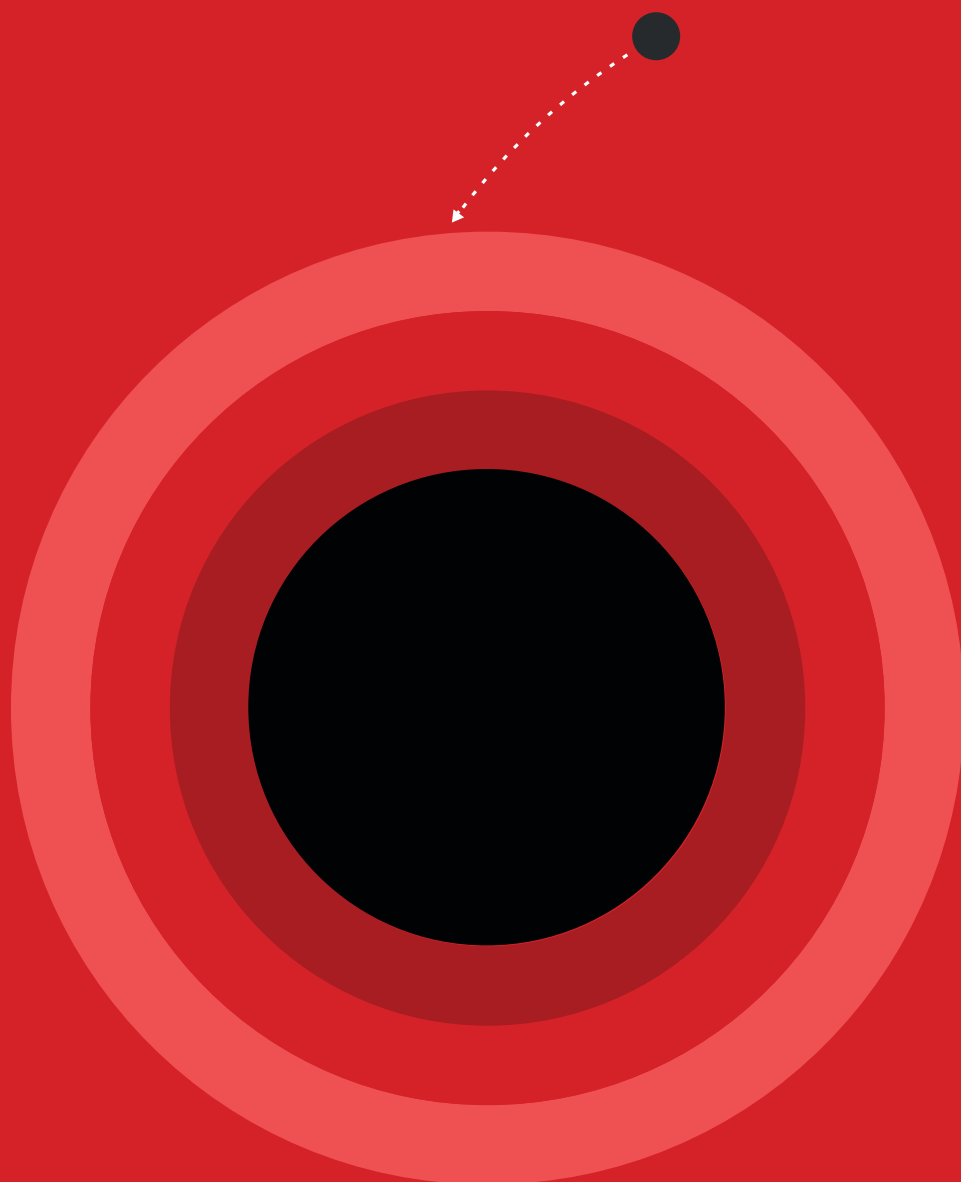


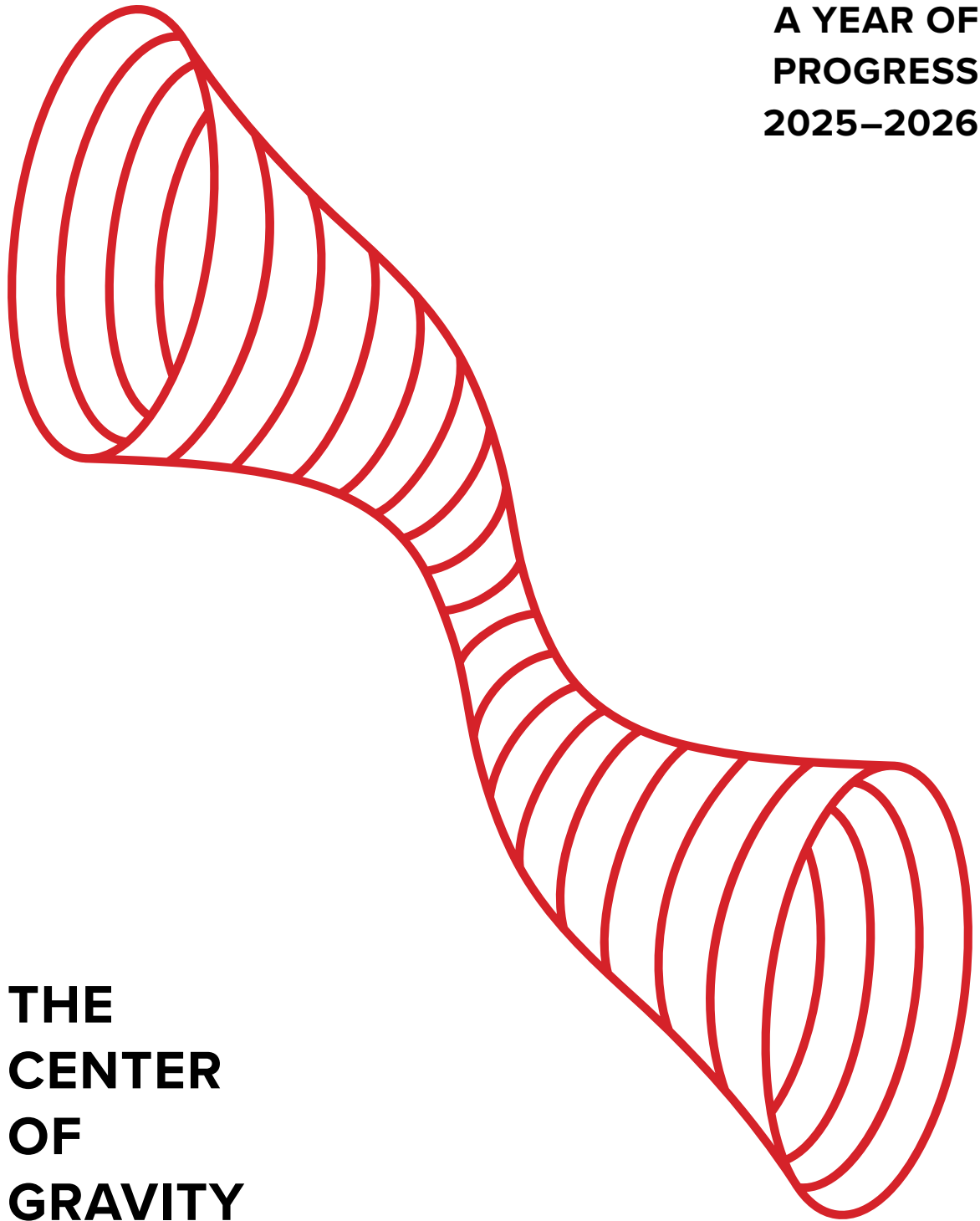
**A YEAR OF
PROGRESS
2025–2026**

**THE
CENTER
OF
GRAVITY**





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PROGRESS
2025–2026**

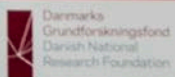


**THE
CENTER
OF
GRAVITY**



THE CENTER OF GRAVITY

<https://the-center-of-gravity.com>



A detail of the lovely staircase that leads up to the CoG's main spaces in the Niels Bohr Institute.



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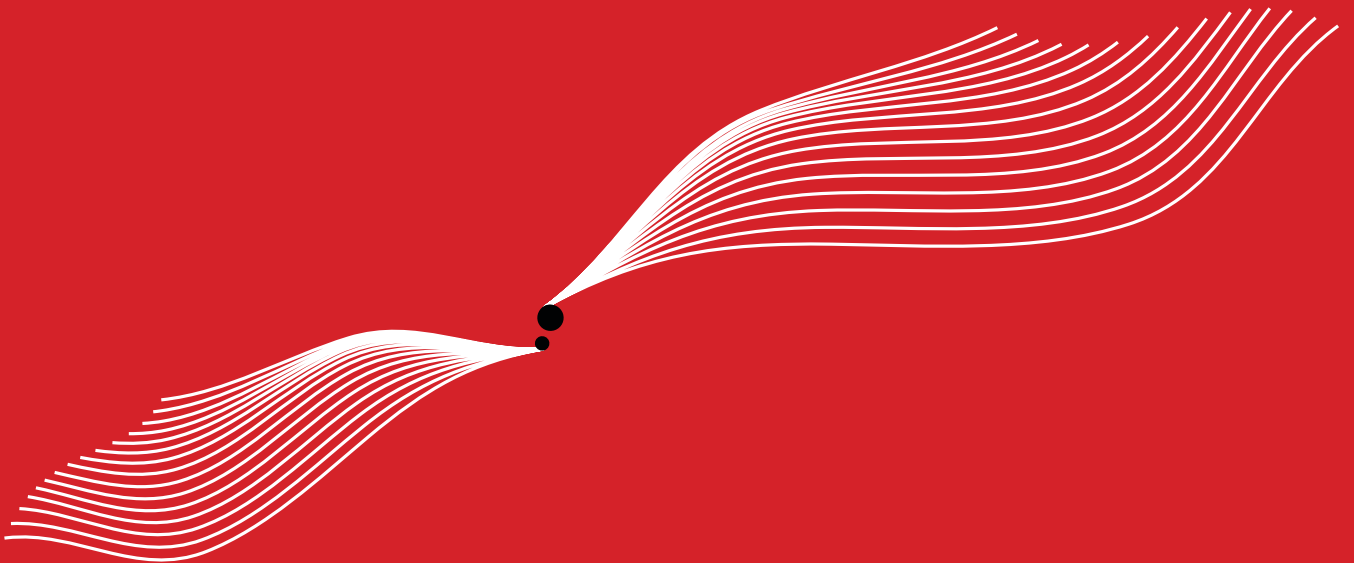
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*SoG members Brian Seymour,
Guangzi Xu and Luka Vujeva
in front of the Niels Bohr Institute.*

Introduction





Vitor Cardoso, Director of the Center of Gravity.

“A place where all questions are welcome.”

Eureka! Archimedes was one of the first to study the center of gravity, which was defined operationally: a specific point in a body where, if (when) suspended by a single string attached to that point, the object would remain perfectly level and balanced. No matter how complicated and distorted an object is, there's a center of gravity, a point of balance. In a way, we all know this, almost instinctively.

Nevertheless, for something so familiar, gravity remains deeply mysterious. And so it was that the Center of Gravity (we prefer CoG around these parts) at the Niels Bohr Institute was born with balance in mind. Or rather, with balanced excellence. We wanted to create a place where it would be possible to think about the gravitational interaction in massively different ways: from unexpected questions on how to build black holes from lasers, to the study of the mathematical content of Einstein's equations, to observations of spacetime ripples or of triple systems; from the equations governing the motion of stars and black holes, to quantum gravity effects or to communicating our work to children and grown-ups. A place where all questions are welcome.

Gravity is one of the four fundamental interactions of our universe. It makes things fall, it makes the Moon orbit the Earth, it causes tides in the oceans, and it is marked on our very bodies: the honorable wrinkles shaped by a fight against its constant pull. Gravity slows clocks down, creates stars, and collapses them into black holes. On the large scales of the universe, gravity is the dominant interaction and yet... there is so much to understand.

As you will see from this report, it is *indeed* a balanced excellence. The great Dane Hans Christian Ørsted believed that the use of reason to understand natural phenomena was the noblest act humankind could aspire to; it was a connection to the divine. At the Center of Gravity, we aim for an inspiring environment where it feels good to work, where our brains are stimulated, and our limits are constantly challenged. Because *we want to understand, we need to understand*.

Welcome to the Center of Gravity.

— Vitor Cardoso, Director of the Center of Gravity

*A tulip blooms in front of
the Niels Bohr Institute.*



“At the Center of Gravity there is no fear of flying.”

The center of mass plays an important role in physics, and it is one of the first concepts students are introduced to. With a tongue-in-cheek twist the name of the DNRF-funded Center of Gravity appeals to many meanings: to black holes, to the link between mass and gravity, to the central research themes surrounding gravity like satellites around our planet, and finally (I believe) to the high ambition of creating the Center of Excellence in this field, globally. As a curiosity, in physics the term “center of gravity” is sometimes used interchangeably with the notion of center of mass. In a uniform external gravitational field the two concepts coincide. If you could imagine the possibility of fixing one point inside an extended body so that it stays fixed in space, the center of gravity is the fixed point for which every orientation of the body is stable. For readers with fear of flying it may not be good to learn that in aviation such a center of gravity must be located in the neighborhood of a quite specific point of the aircraft, otherwise the plane can be difficult to stabilize in the air. Some may have experienced that passengers have been forced to move seats in order to redistribute the weight (especially in smaller airplanes where the problem is more acute), and here is one of the explanations for why airlines do not allow passengers to freely move to other seats, typically at the front of the plane.

At the Center of Gravity there is no fear of flying. The ambitions have been high from the beginning, and although the Advisory Board has not met yet, I believe that I write on behalf of the whole Board when I say that the center seems to have been off to a flying start. First post-docs and PhD-students will arrive shortly, and at the time of writing this, the historic Auditorium A is fully packed for a week for an international school “From Motion to Commotion”. The new series of Gravity Colloquia were inaugurated this past spring, and the last week of August we will see Copenhagen buzzing in “Black Hole Week” — taking research in gravity to the public. An on-going series of seminars by visitors as well as more local group meetings are already in place, and the level of activities is thus extraordinary.

Looking forward, expectations are high. The Board is looking much forward to its first formal meeting in 2027 where the first year of activities can be assessed, and ideas for potential realignments or new directions can be discussed. For the time being we note that there is wind in the sails, and the course is set. Data arrive from outer space at an increasing rate, and Center of Gravity scientists will be ready with new ideas and fresh calculations to confront and interpret the data. We congratulate again, and wish the center all the best.

Advisory Board

Katy Clough
(Queen Mary University London)

Poul Henrik Damgaard
(Chair, Niels Bohr Institute)

Reinhard Genzel
(Max Planck Institute for
Extraterrestrial Physics)

Scott Hughes
(Massachusetts Institute
of Technology)

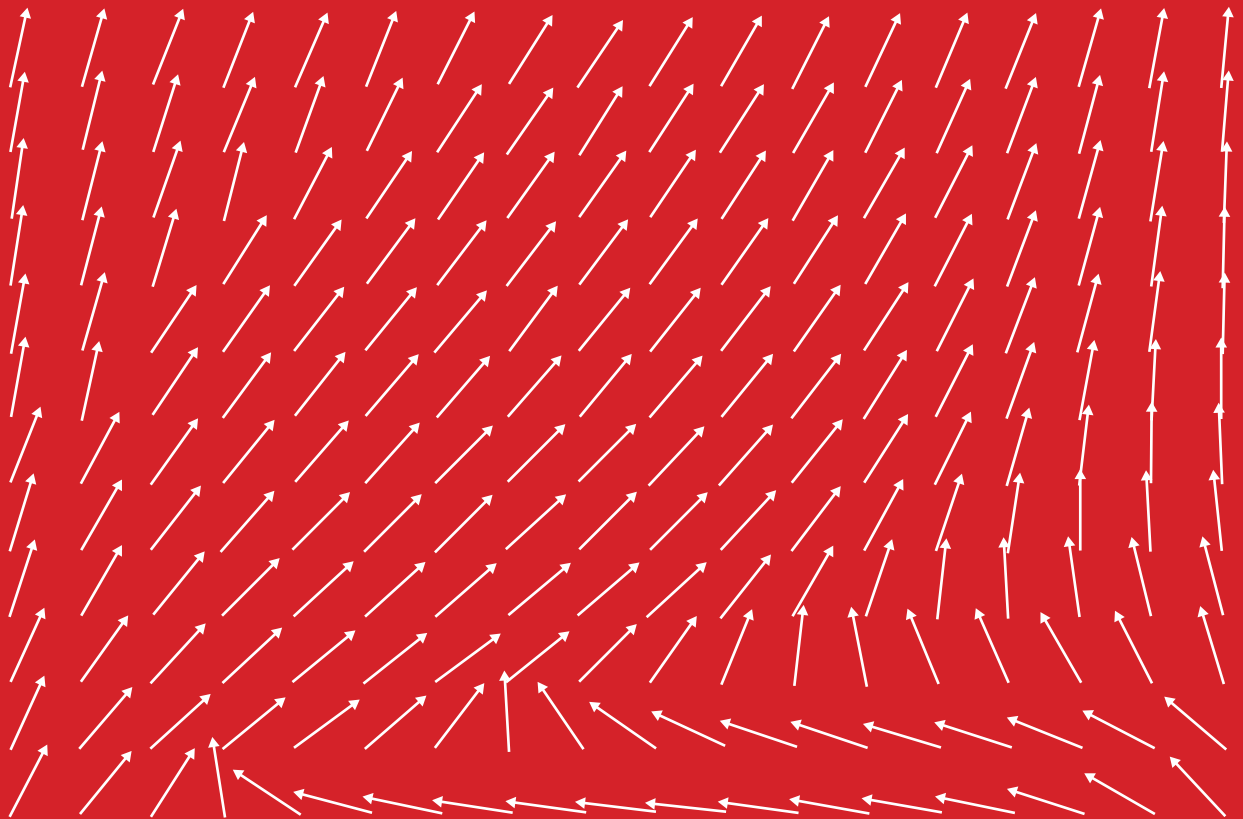
Aaron Zimmerman
(University Texas Austin)

— Poul H. Damgaard, Chair of Advisory Board, June 2026

*A moment of reflection
in front of a blackboard.*

*A moment of reflection
in front of a blackboard.*

Research Activities



Grants

The work of the Center of Gravity is generously supported by the following grants:

Danmarks Grundforskningsfond
Center of Excellence
01.09.2025–31.08.2031
Vitor Cardoso

Villum Foundation
01.01.2022–31.12.2027
Vitor Cardoso

Simon's Foundation
Collaborative Grant
01.09.2025–31.08.2029
Vitor Cardoso

European Research Council
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Vitor Cardoso

European Union,
Research and Innovation
Staff Exchange Grant
01.10.2023–30.09.2027
Vitor Cardoso

Danmarks Grundforskningsfond
01.10.2022–30.09.2025
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Horizon Europe MSCA
European Postdoctoral Fellows
01.04.2024–31.03.2026
Emil Bjerrum –Bohr

Villum Foundation,
Villum Young Investigator
01.03.2023–28.02.2028
Jose Maria Ezquiaga

European Research Council
Synergy Grant
01.04.2025–31.03.2031
Maarten van de Meent

European Research Council
01.09.2022–31.08.2027
Johan Georg Mulvad Samsing

Villum Foundation
Villum Young Investigator
01.06.2020–01.12.2027
Johan Georg Mulvad Samsing

Horizon Europe MSCA
European Postdoctoral Fellows
01.08.2024–31.07.2026
Marica Minucci

Villum Foundation,
Villum Young Investigator
01.02.2025–31.01.2030
Ziqi Yan

Villum Foundation,
Villum Young Investigator
01.02.2024–31.01.2029
Alessia Benedetta Platania

Carlsberg Foundation,
Carlsberg Mindelegat
01.08.2025–30.07.2027
Rodrigo Panosso Macedo

Danish Data Science
Academy (DDSA)
15.08.2026–15.08.2028
Lorena Magana Zertuche

*Giada Caneva Santoro and
Rodrigo Panosso Macedo discuss
black hole perturbation theory.*



Spotlight: Playing it Loud, Like Black Holes in the Sky

For the first time in history, an international team of researchers has brought together both theory and observations of black hole vibrations in a huge, comprehensive review on the field. One of the researchers behind it calls it “a new stage in astronomy.”

When researchers first detected gravitational waves in 2015, it fundamentally changed the way we can study black holes. What had been a field dominated by mathematical calculations suddenly became one in which it was possible to observe the signals directly.

“When I started my career, we were essentially deaf. We could study black holes theoretically, but we had almost no observations. Today we can listen to them,” says Vitor Cardoso, Professor of Physics at the Niels Bohr Institute at the University of Copenhagen.

Together with colleagues from Johns Hopkins University and the University of Birmingham, Vitor Cardoso has compiled the most comprehensive overview so far of the research on black holes and their vibrations.

The review, which has just been published in the journal *Classical and Quantum Gravity*, brings together and compares decades of theoretical work with the past ten years of observations from gravitational-wave astronomy.

From Theory to Experiment

For decades, researchers had only theory to work with. They knew that Einstein’s theory of relativity, that is, his mathematical equations, predicted gravitational waves and specific black hole vibrations, but they did not have the instruments needed to go out into the universe and investigate them directly.

When two black holes collide and merge, the newborn black hole vibrates before settling down. These vibrations send gravitational waves through the universe, and those are the signals researchers can measure. That is what Vitor Cardoso means when he says that we can now listen to black holes.

According to the professor, the signals can be compared to the sound of a musical instrument.

“Just like you can tell the difference between a guitar and a piano, we can use gravitational waves to identify what is vibrating.”

So black holes themselves do not make any sound?

“Correct. They need to be excited by something. In the same way as a church bell. It needs to be struck by something before you can hear it ring.”

And how does that become a sound?

“Think of it like throwing a stone into a well filled with water. There is an impact, and waves are produced. And they have a sound. Those waves, that sound, are what we can measure,” Cardoso explains.

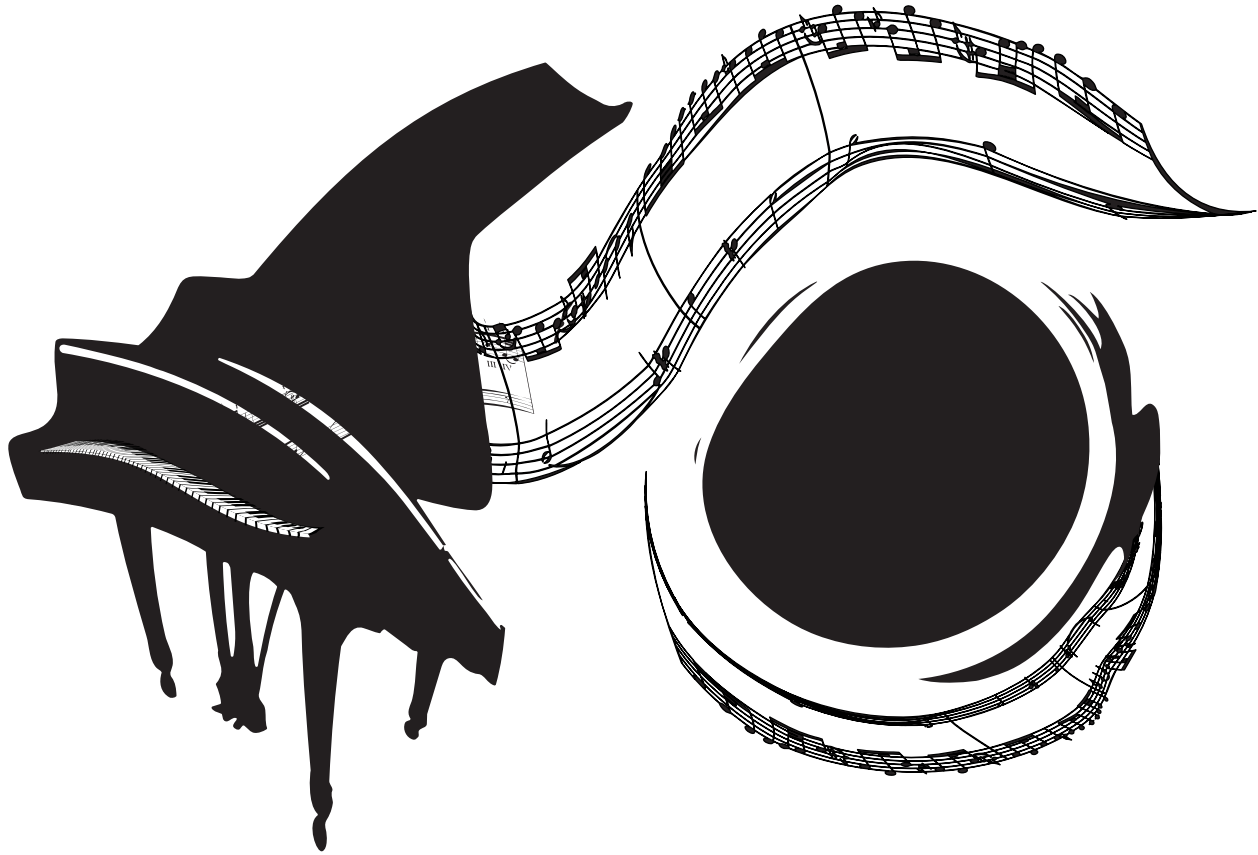
The field is known as *black hole spectroscopy* and is about using these vibrations to investigate the properties of black holes and thereby move even closer to understanding our universe.

A Field that has Grown Explosively

According to Cardoso, one of the reasons they set out to create this overview was that research in the field has grown extremely rapidly, with the result that a lot of work has become highly fragmented across topics and across the world. The second motivation was that there had also been considerable disagreements within the community about what the research was actually telling us.

“We realized that we really needed to bring everybody together and we needed to write this and agree. And when we don’t agree, we need to work towards understanding what the source of this disagreement was. And that’s what we did,” he says.

Artistic synesthesia between music tones and spacetime-deforming black hole vibrations.



Einstein was Right, at Least for Now

One of the questions physicists are always trying to answer is whether the calculations and observations they make are consistent with Albert Einstein's general theory of relativity from 1916. The same is true of this monumental review, which Cardoso and 70 other researchers have now published.

"This is what has happened for centuries with all the fundamental laws of nature. And at some point, they all turned out to have limitations. And so, we're looking for that in relation to Einstein's theory," Cardoso explains.

"And so far, we found no signals that nature goes elsewhere." The same conclusion is reflected in the new review. "Einstein so far is correct. Everything we see is consistent with Einstein's predictions," says Cardoso.

The Search Continues

However, this does not mean the matter is settled. The final word is still far from being written when it comes to whether the observations are truly consistent with Einstein's theory.

"We know that Einstein's theory is incomplete. Neither Einstein nor any of us know what happens inside black holes. Right now, there is simply nothing. You could say that inside black holes, mathematics breaks down. The question is whether nature will eventually show us where the theory ceases to work," says Vitor Cardoso.

The review article also points toward the next generation of observatories, including the European space mission LISA, which is expected to provide researchers with even deeper insights into the mysterious black holes of our universe.

"There *has* to be a better theory than Einstein's," says the professor.

Will it happen in your lifetime that you are able to seriously challenge him, you think?

"I certainly hope so! I'm going to live till I'm 200," Vitor Cardoso concludes with a big laugh.

— Interview by Johanne Digebjerg Tougaard
UCPH Press Department



Emil Bjerrum-Bohr and Leart Sabani during a discussion with students.

Black Hole Dynamics from Particle Physics

An important question for the Center's research is how massive objects such as stars and black holes interact gravitationally across a range of physical parameters. This knowledge is important for quantitatively analyzing observational data relative to theoretical predictions.

Traditionally, Einstein's equations are solved through extensive numerical simulations on supercomputers. The Center leverages this computational power to model gravitational interactions across diverse scenarios. In specific regimes, however, a powerful analytic alternative is to compute quantum-mechanical scattering amplitudes using the Feynman Path Integral.

This approach encapsulates both classical and quantum scattering information, mapping it to classical processes, and enabling precise theoretical predictions for observables. We apply amplitude-based methods to

problems such as gravitational-wave emission, orbital motion, and precession in black hole inspirals, enhancing analytic accuracy. Since the spin dynamics of astrophysical black holes are crucial, we adapt our formalism to include these effects.

A major achievement this year was developing a new theoretical model for spinning black holes, offering novel ways to analyze their scattering at higher perturbative orders. Additionally, we calculated the gravitational Compton amplitude up to third post-Minkowskian order using a curved-space formalism that incorporates recoil effects from massive-source deflection, boosting computational efficiency. These advances support improved computations of classical dynamics in binary mergers and deepen the connection between Black Hole Perturbation Theory and modern amplitude techniques.

Did you know that you can live forever
close to the horizon of a black hole?





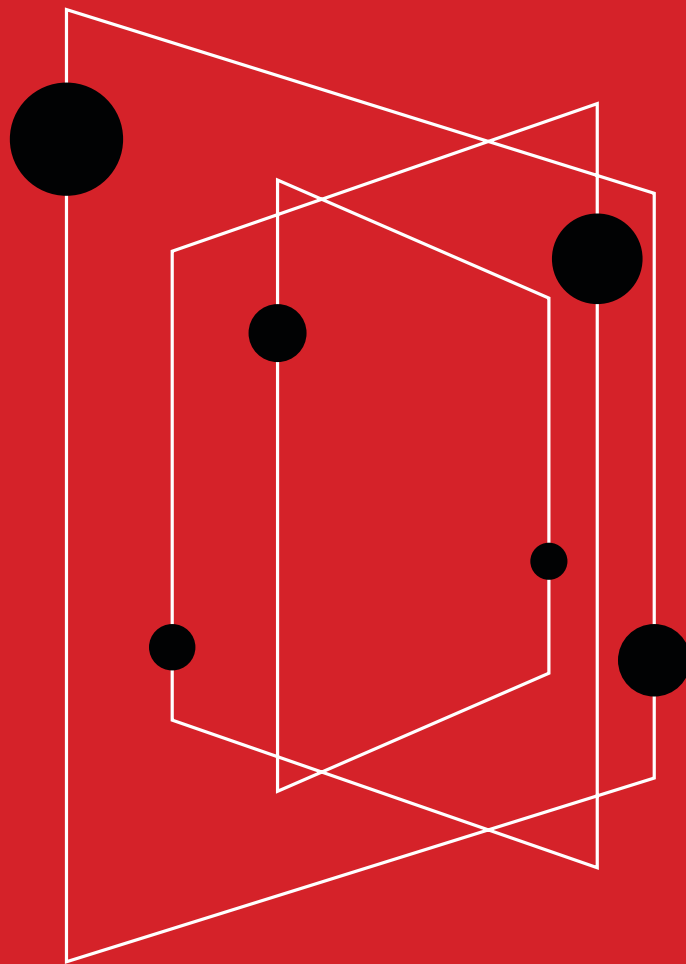
Niels Obers and Luka Vujeva during a moment of relaxation in the NBI library.

Quantum Physics and Gravity

The detection of gravitational waves, rooted in particle/wave duality, has renewed interest in the quantum nature of space-time and gravity. Center of Gravity members are addressing fundamental questions about time, space, gravity, and their relationship to quantum physics, including the composition of black holes, quantum manifestations of spacetime, holographic realizations, and gravity in strong-coupling regimes.

We also explore the potential for direct quantum gravity detections and their implications for black hole spectroscopy and gravitational-wave physics. This year, we investigated controlled limits of the gauge/gravity duality, which simplify microscopic dynamics while

preserving key gravitational parameters such as entropy, horizons, and information. Additionally, we focused on extending the theoretical formalism to asymptotically flat spacetimes, which are directly relevant to astrophysical gravitational wave science. Another highlight was research on improving the connection between microscopic theoretical dynamics and macroscopic gravitational behavior. Such results provide benchmarks for testing microscopic quantum models and support broader scientific objectives to investigate how gravitational thermodynamics can arise from the underlying quantum degrees of freedom.



If the Earth was compressed into
a black hole, it would have a size
of approximately 2 cm.



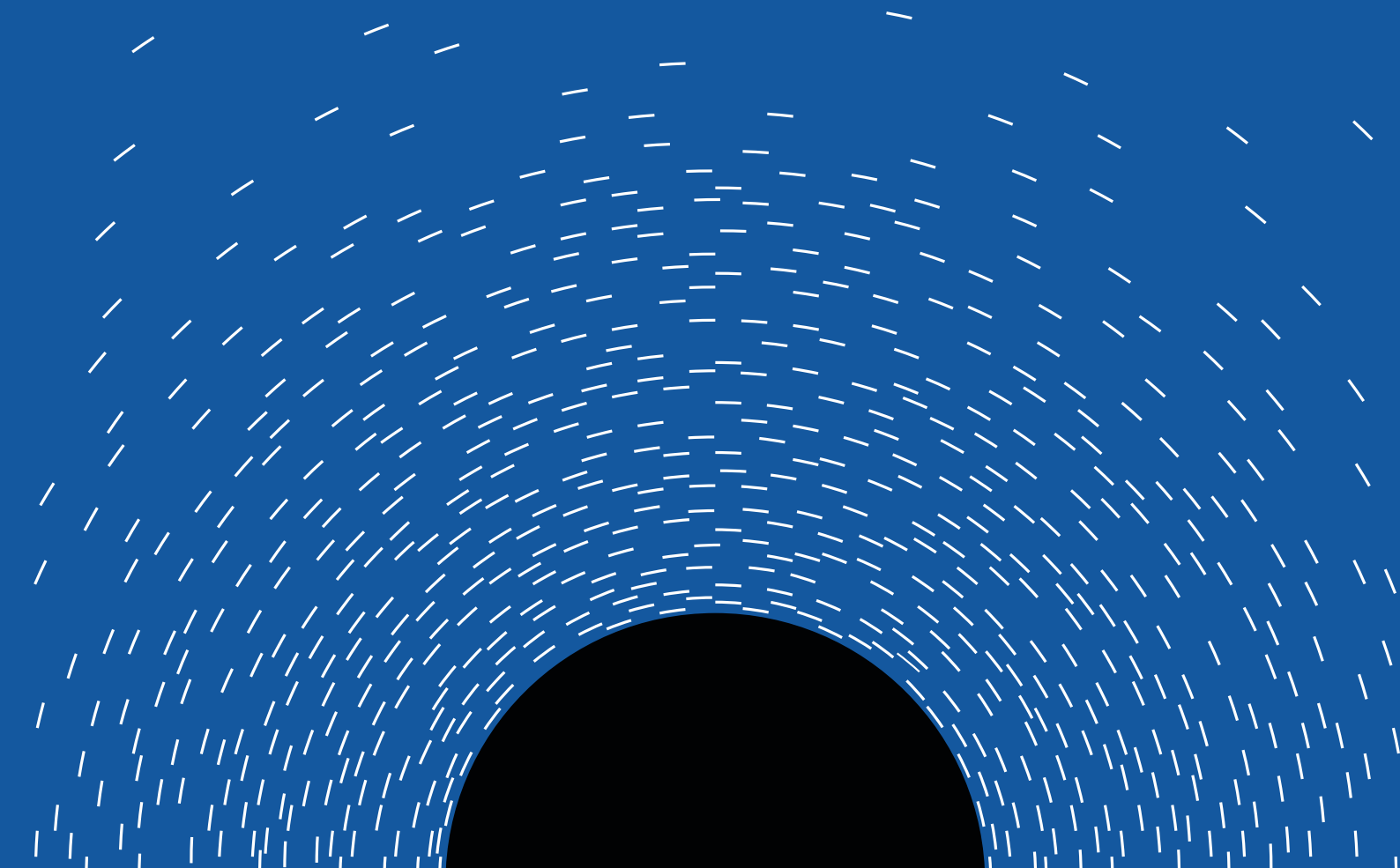
Vitor Cardoso speaks during the inauguration ceremony of the CoG, which took place in the legendary Auditorium A of the Niels Bohr Institute. Friday, September 5, 2025.

Black Hole Spectroscopy

Black holes have a characteristic “sound”, just like a bell or a piano. They emit gravitational waves when they relax, some of which fall onto the black hole, forever lost. But some waves travel over large distances where we can study them to probe black holes and Einstein’s theory. This is called black hole spectroscopy. The Center of Gravity members pioneered many tools and concepts in the field and are now pushing the frontiers of spectros-

copy: what happens if black holes don’t exist after all? With what precision can we study General Relativity? If time stops at the black hole horizon, what implications does it have for their sound? Can we access black hole interiors? This year, the previously established perturbation theory for black holes in nontrivial environments was further explored and applied to a range of new contexts.

Black holes also have
a “characteristic sound”
just like a piano or a guitar.





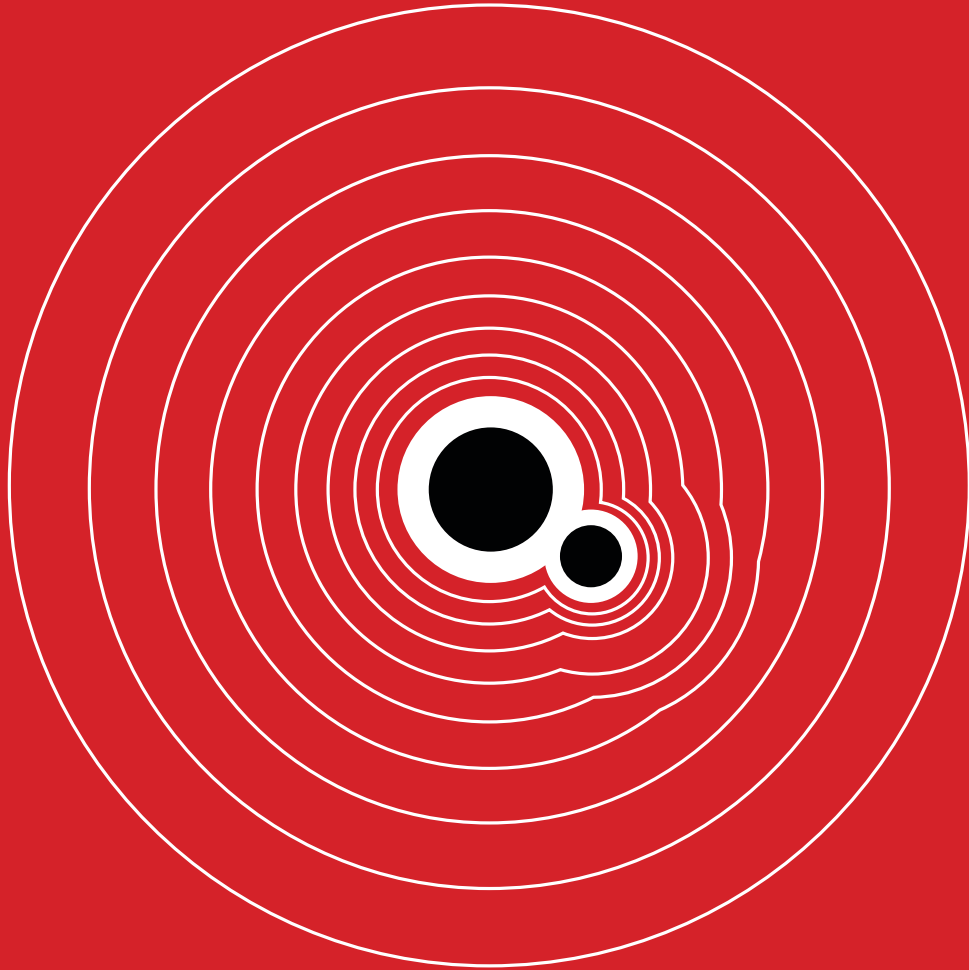
Marina De Amicis, Jose Ezquiaga and Thomas Spieksma during the reception celebrating the inauguration of the CoG.

Gravitational Waves Across the Cosmos

When two black holes merge, they produce ripples in spacetime that travel billions of years before arriving at Earth. Despite the long trip, gravitational waves travel unaltered, except for the stretching caused by the Universe's expansion and their interaction with cosmic structures. Just as a magnifying glass bends light, any clump of matter may act as a giant lens to magnify faraway gravitational waves.

Gravitational waves are thus the perfect cosmic messengers to investigate the elusive dark matter that holds galaxies together and for unveiling the nature of the dark energy driving the accelerated expansion of the Universe. At the Center of Gravity, we are leading global

efforts to discover gravitational-wave lensing, explore the properties of the most distant black holes ever observed, and unlock the mysteries of the Universe's fundamental components. Highlights of this year's research include the development of new deep-learning algorithms that reduced the time required to evaluate lensed gravitational-wave parameters from days to minutes. This technical breakthrough was necessary for computing the statistical significance of the current highest-ranked lensing-candidate gravitational-wave emission event. Moreover, important progress was made in understanding the effect of dark-matter substructures on gravitational-wave lensing.



When you smash two black holes
together at the speed of light,
14% of their energy gets converted
into gravitational waves.



Johan Samsing explains astrophysics.

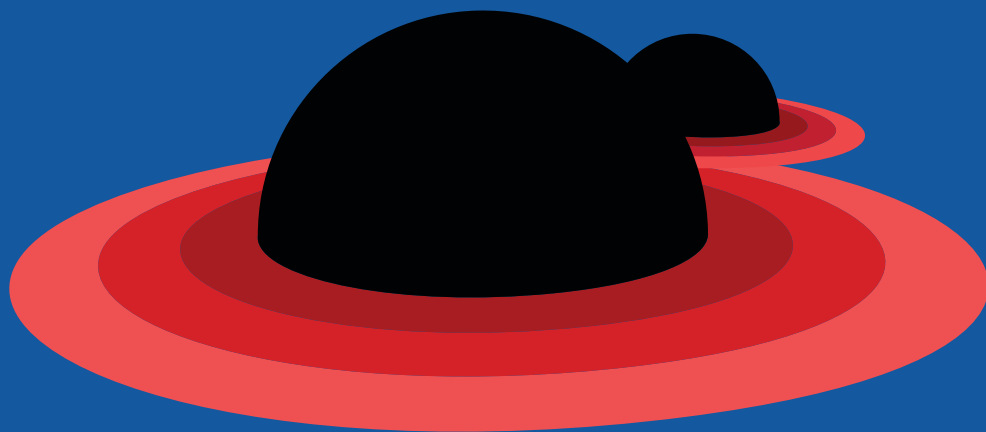
Black Holes in Environments

Black holes in close orbits generate gravitational waves that travel at the speed of light throughout the Universe. The tune and fine modulations of these waves carry imprints of the environment in which the orbiting black holes live, much like how a string that vibrates on a guitar, violin, or Japanese shamisen will sound different.

Members of the Center of Gravity are advancing new techniques to link these wave modulations to outstanding questions such as how and where binary black holes merge. Can one use black hole binaries to detect the presence of other black holes? Is Einstein's theory correct at all scales? Do new states of particles cluster around black holes? What is the nature of dark matter? We are training our ears to learn from the sound of gravity. This year's highlighted research examined how external tidal

effects influence black-hole dynamics. For instance, using metric reconstruction approaches, the spacetime metric of a Kerr black hole in an external tidal field was obtained in a fully analytic framework. This work has direct applications to gravitational-wave modeling and tests of gravity in the strong-field regime. Tidal effects are also central in hierarchical triple systems, where a compact binary orbits a supermassive black hole.

Another highlight was the investigation of precession resonances between the binary's periastron precession and its orbital motion around the supermassive black hole, which identified magnetic tidal coupling as a novel strong-gravity effect and demonstrated its role in shaping the resonant dynamics of compact binaries near supermassive black holes.



Every 5 minutes,
two stellar-mass black holes
merge somewhere in the Universe.



CoG members engage in a lively scientific discussion.

Precision Gravitational Wave Observations

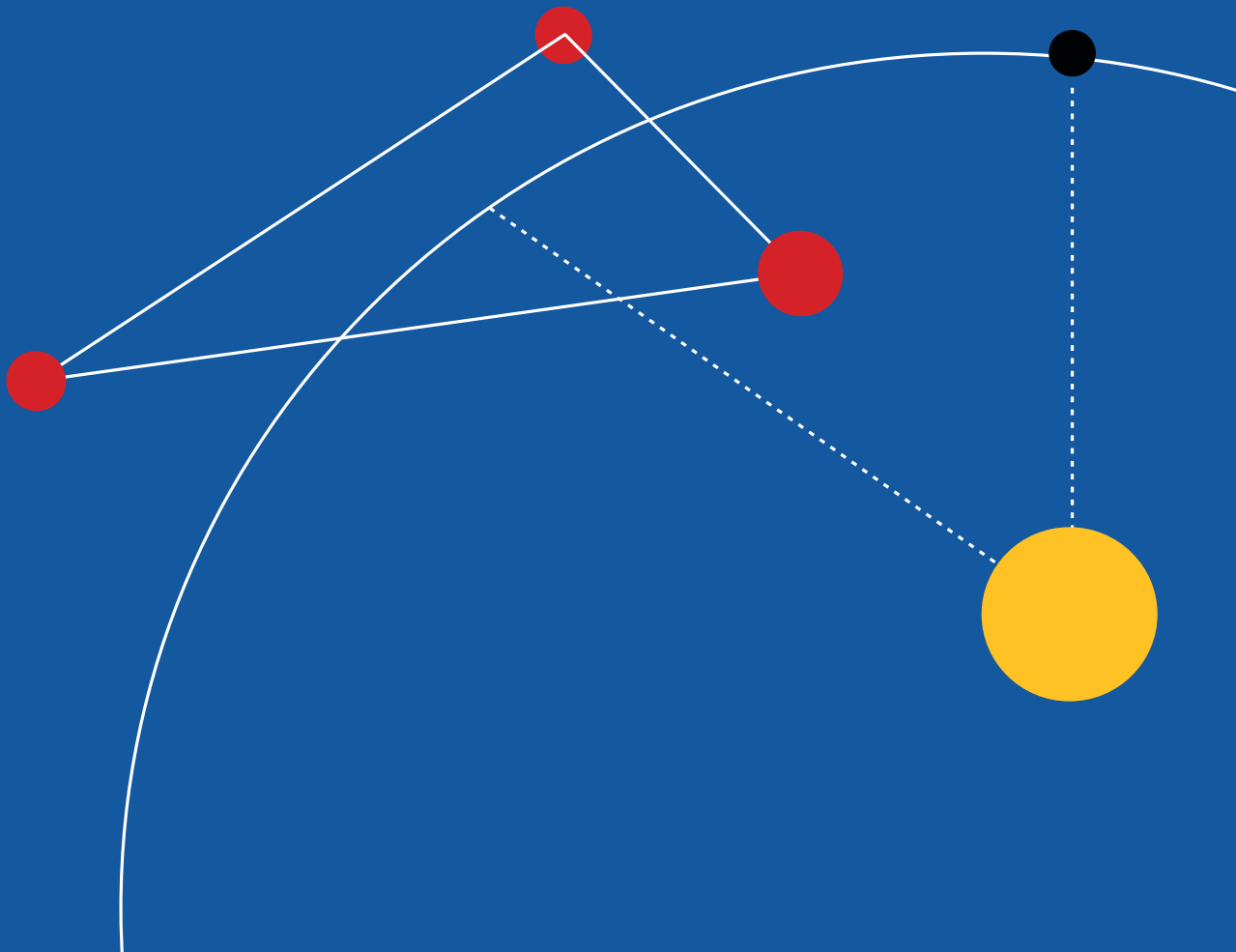
To extract science from gravitational-wave observations, instrumental data is compared with predicted theoretical models known as gravitational waveforms. The more faithfully these theoretical waveforms represent reality, the more precise the scientific inferences from the observations are. Conversely, gravitational wave observations are mostly deaf to effects not included in the waveforms. To integrate all the newest predictions from the Center of Gravity with waveform models used in ongoing observations, the Center of Gravity partners with the Max Planck Institute for Gravitational Physics in Potsdam, Germany.

Together, we develop waveforms that allow us to distinguish new physics from astrophysical environments or gravitational lensing. This year, we investigated ways to reduce systematic errors in fast-relativistic waveforms for

extreme-mass-ratio inspirals. This work on systematic errors supports dependable modeling. It permits accurate data collection from forthcoming space-based gravitational-wave detectors. One key revelation is the potential to integrate post-adiabatic self-force information into waveform models.

In conclusion, the first year at the Center has been scientifically very successful. The continued growth of the Center, spurred by upcoming new hires, a strong visitor program, our partnership with the Max Planck Institute, and a stimulating atmosphere, places us well for the years to come. Together, these developments will not only strengthen our scientific output but also intensify the connections across our various research directions as the Center continues to grow.

Our gravitational wave detectors
measure changes in space which
are a thousand times smaller
than the nucleus of an atom.



Spotlight: Shockwaves Through the Universe

Right: Two black holes collide and merge, releasing gravitational waves as they spiral inward.

Gravitational waves shake the very fabric of the universe when black holes collide. Today we measure these events and use them to understand the cosmos. Now University of Copenhagen researchers and their international collaborators have published a treasure trove of new gravitational waves that may challenge our fundamental understanding of black holes, gravity, and the universe itself. Among them the strongest signal and the largest collision ever recorded.

For millions upon millions of years, they orbited each other, bound by gravity. The distance between them grew shorter until, in a fraction of a second, they collided with velocity nearing the speed of light.

When the most compact and heavy objects in existence—black holes—merge, the forces involved are so immense that they ripple through the universe, sending waves that distort space and time.

“These are waves in spacetime itself—like ripples in water—that travel at the speed of light. They don’t move through space; they are waves of space: a rhythmic stretching and compression of the very structure of the universe,” explains Jose Maria Ezquiaga from the Niels Bohr Institute, who leads NBI’s LIGO–Virgo–KAGRA (LVK) group and contributed to the new scientific publications and observations.

Exactly ten years ago, Einstein’s prediction of gravitational waves was confirmed with the first measurement. Now, an almost identical black hole collision has provided gravitational wave researchers with a stronger and clearer signal than ever before: The measurement reveals two black holes, each having around 30 times the mass of the Sun.

“The properties of this merger are a type we know well from previous measurements. What makes this discovery truly exceptional is the very strong signal. It opens entirely new possibilities for testing our fundamental understanding of gravity and the nature of black holes,” says Jose Maria Ezquiaga.

Already, the observation has confirmed—at more than 99% certainty—a longstanding theory by the renowned physicist Stephen Hawking, which states that a black hole formed from merging black holes must have a larger area than the combined area of its progenitors. Because gravitational waves fade quickly after a merger, it has previously been difficult to confirm the theory through observations. But the strength and clarity of the new record signal has made it possible.

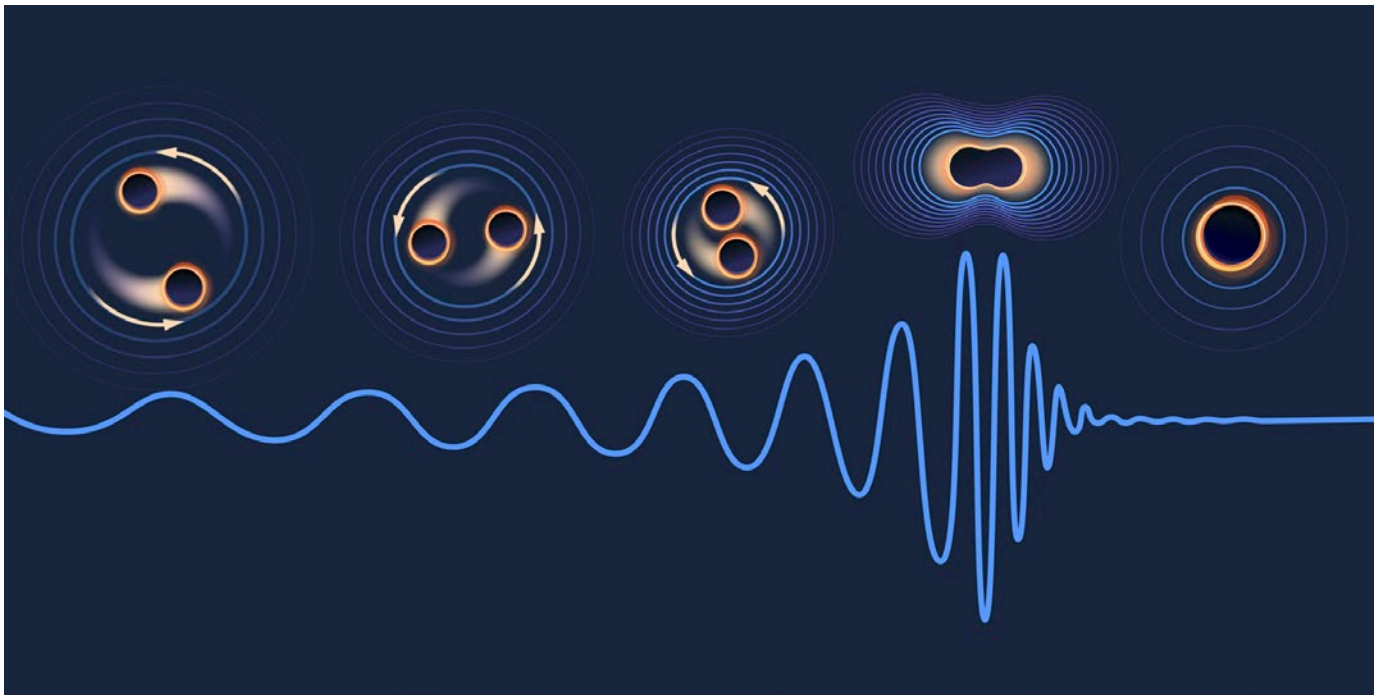
The spacetime disturbances caused by gravitational waves are extremely small. To detect them, researchers must measure changes that are 700 trillion times smaller than the thickness of a human hair.

The reason the signal from GW250114—the name given to the collision—was so strong is largely due to the advancements in measurement equipment made by the LVK collaboration. This development continues and promises a bright future for the field.

The Strongest Measurement vs. the Biggest Clash

The record-breaking measurement is part of a massive package of gravitational wave observations now released by the research coalition. Not only does it double the number of gravitational wave measurements available for study, but thanks to several remarkable observations, it marks a significant leap forward for the field.

GW250114 is not the only record among the group’s new observations. They also include a measurement of



the merger of two black holes weighing approximately 100 and 140 solar masses, forming a black hole of at least 225 solar masses: the largest black hole merger ever observed.

Until now, researchers have seen that binary systems—where black holes orbit each other—typically have masses up to 50 solar masses. Beyond this, the number of observations drops significantly.

GW231123, the name of this collision, breaks that pattern. The resulting black hole may weigh up to 260 solar masses, placing it outside the normal classification of “stellar” black holes formed from stars, and instead into the range known as intermediate-mass black holes—between 150 and 100,000 solar masses. This size is extremely rare and puzzling to scientists.

“The observation challenges our understanding of how black holes form. Black holes of such large mass shouldn’t arise through ordinary stellar collapse. One possibility is that the two black holes in this system were themselves formed by previous mergers of smaller black holes, but in truth, we don’t know. It’s also possible that the signal was distorted as it traveled through the universe,” says Jose Maria Ezquiaga.

In addition to their extreme masses, both black holes rotate at unusually high speeds, making the observation even more remarkable. The downside, however, is that this signal is very short and weak compared to GW250114, which makes analysis and interpretations much harder.

A Research Field Driving Innovation

Einstein predicted gravitational waves nearly 100 years ago as an inevitable aspect of his famous theory of relativity. Ten years ago, the theory became empirical reality when the first gravitational waves were measured. Now, the decade is marked by a wealth of new observations, including these two spectacular ones. Both studies are milestones that demonstrate we can not only hear the universe’s deepest resonances—we can begin to decode its structure.

As often happens in physics, the fundamental research driving these discoveries can also lead to new technologies. Already, the extremely sensitive instruments used to measure gravitational waves have led to new types of lasers and optical systems in quantum computers and atomic clocks, and AI techniques are used to reduce noise and much more.

The development is expected to continue. Future waves of observations are anticipated to eventually include all gravitational wave signals from black hole collisions that the universe has to offer. This will be achieved by expanding the LVK collaboration with a new observatory in India and through planned new instruments.

“We expect this research field to be crucial for our fundamental understanding of the universe. We’ve only just reached the end of the beginning,” says Jose Ezquiaga.

— Kristian Bjørn-Hansen
UCPH Press and Communications Officer



*CoG's coordinator Fanny Töpper speaks
with NBI librarian Kader Ahmad.*

Team



Board Members

From left: Emil Bjerrum-Bohr, Vitor Cardoso, Fanny Töpper, Troels Harmark, Maarten van de Meent, and Niels Obers, pose in front of the Niels Bohr Institute.



Alessandra Buonanno is Director at the Max Planck Institute for Gravitational Physics and leads the Astrophysical and Cosmological Relativity department. She is also a research professor at the University of Maryland and an honorary professor at Humboldt University and the University of Potsdam. A prominent member of the LIGO Scientific Collaboration, Buonanno contributed to the first detection of gravitational waves in 2015. Her research focuses on modeling gravitational waves from binary black holes and neutron stars to explore fundamental questions in astrophysics and gravity.



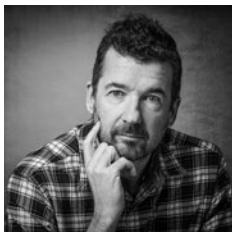
N. Emil J. Bjerrum-Bohr is a Professor at the Niels Bohr Institute. After his PhD in Copenhagen (2004), he held postdoctoral positions in Swansea and at the Institute for Advanced Study, Princeton. He became a Knud Højgaard Assistant Professor at NBIA in 2010, received Steno and Lundbeck grants, and became permanent faculty in 2015. He is currently leading the Theoretical High Energy, Astroparticle, and Gravitational Physics section. His research, supported by DFF and Carlsberg grants, focuses on perturbative expansions of scattering amplitudes in gravity for studying black hole binaries.



Maarten van de Meent is an Associate Professor at the Niels Bohr Institute. He joined the Niels Bohr Institute in 2022 as an Assistant Professor. After obtaining his PhD from Utrecht University under supervision of Gerard 't Hooft, Maarten held an NWO Rubicon Fellowship at the University of Southampton and a Marie Skłodowska–Curie Fellowship at the Max Planck Institute for Gravitational Physics in Potsdam. Maarten's interested in the relativistic 2-body problem describing the inspiral and merger of black hole binaries. He is an expert on gravitational self-force formalism.



Niels Obers is a Professor at the Niels Bohr Institute with a PhD earned at UC Berkeley, in 1991, after undergraduate studies at Nijmegen University. He held postdoctoral positions at Bonn, École Polytechnique, CERN, and Nordita. Obers was an Assistant Professor at Utrecht University (2000–2002) before joining NBI as an Associate Professor in 2002 and becoming a Professor in 2012. He has served as Deputy and acting Head of Department at NBI and as Director of Nordita. His research explores the quantum nature of gravity and black holes using string theory and holography.



Troels Harmark is an Associate Professor at the Niels Bohr Institute. He earned his PhD from NBI in 2001 and was a postdoctoral researcher at Harvard. After research grants from DFF and Carlsberg, he became an Assistant Professor at Nordita in 2009. Harmark returned to the Niels Bohr Institute in 2012, becoming permanent staff in 2015. He held a major DFF project grant from 2017 with N. Obers and led the Theoretical High Energy, Astroparticle, and Gravitational Physics section (2018–2023). His research focuses on quantum gravity, holographic models, and analytical techniques for strong gravity phenomena.



Vitor Cardoso is a Professor at the Niels Bohr Institute. He is a member of the Royal Danish Academy of Sciences and of the Lisbon Academy of Sciences. He has been recognized with the “Ordem de Sant’Iago da Espada” presidential title and the “ULisboa Award” for his “extraordinary contribution to the development of theoretical physics and the progress of science at a global level”. He is an “Honourable Citizen” of Póvoa de Varzim. His research uses black holes to explore the universe’s dark content and to test General Relativity.



NIELS BOHR INSTITUTET
1920

Left: A view of the Niels Bohr Institute, the Center of Gravity's beautiful home, at Blegdamsvej 17.



Managerial Committee



Fanny Töpper is the Center of Gravity Coordinator, managing events, outreach, and administrative processes. She ensures that people, ideas, and projects move smoothly across the Center's community.



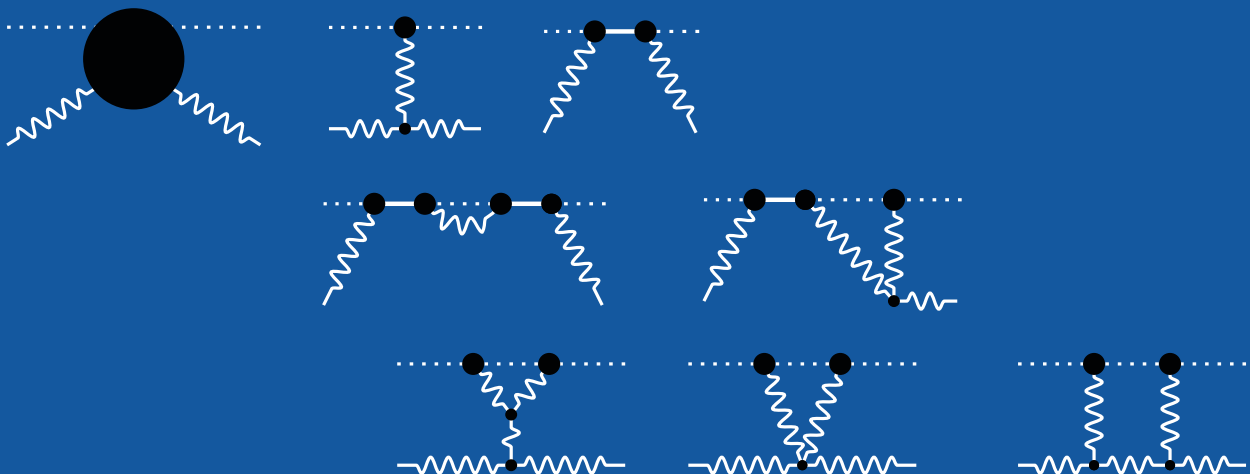
Emily Kate Mansfield is a Center of Gravity student assistant working to facilitate the daily life of the center, with a particular emphasis on event planning, visitor processes, website updates and communication.



Marie Rosenkrands is a Center of Gravity student assistant working to facilitate the daily life of the center, with a particular emphasis on event planning, visitor processes, website updates and communication.

Stellar-mass black holes dominate the total black-hole mass budget, rather than supermassive black holes.

Recent estimates suggest that the mass contained in stellar-mass black holes is two orders of magnitude greater than that contained in supermassive black holes.



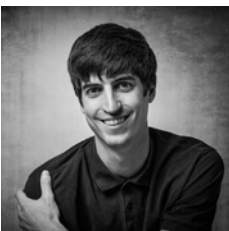
Group Leaders



Alessia Benedetta Platania is an Associate Professor and Villum Young Investigator at the Niels Bohr Institute and a Professor at the University of Graz (with a FWF grant). She also leads a working group within the COST Action BridgeQG, holds a Double PhD from Radboud and Catania Universities, and has held prestigious fellowships at Heidelberg University and Perimeter Institute. Alessia studies quantum gravity through the lens of effective field theory, testing and comparing theories using the renormalization group to connect and constrain physics across scales.



Johan Samsing is a Louis-Hansen Assistant Professor at the Niels Bohr Institute and is leading the GW astrophysics group. He joined in 2019, after which he first received a Villum Young Investigator Grant in 2020 and then the ERC Starting Grant in 2022. Before moving to the Niels Bohr Institute, Johan was an Einstein and later a Spitzer Fellow at Princeton University. His research centers on the astrophysical formation and origins of gravitational-wave sources and black hole mergers. He uses gravitational-wave observations to probe the origins and environments of binary black hole mergers across the universe.



Jose M. Ezquiaga is an Associate Professor at the Niels Bohr Institute and PI of the NBI LIGO group. He joined the institute in 2022. Previously, he was a NASA Einstein Fellow at the University of Chicago. He obtained his PhD from Universidad Autonoma de Madrid in 2019. Jose is a Villum Young Investigator. His research leverages gravitational-wave observations to drive new discoveries at the intersection of fundamental physics, cosmology, and astrophysics.



Marta Orselli joined the Strong Gravity group at the Niels Bohr Institute in 2023. She is an Associate Professor at the University of Perugia and Affiliate Professor at NBI. She earned her PhD from the University of Parma and has held postdoctoral appointments at both Nordita and NBI. Marta has received grants from the Carlsberg Foundation, the European Community, and the Danish Research Council DFF. Her research focuses on how strong-gravity environments affect black hole dynamics and gravitational wave signals.



Ziqi Yan joined as an Associate Professor in 2025. He has a PhD from UC Berkeley and has held postdoctoral appointments at the Perimeter Institute and Nordita before joining the Niels Bohr Institute in 2025 as a Villum Young Investigator. Ziqi's current research focuses on how gravity emerges from quantum systems in string theory and M-theory, and its implications for cosmology.

Research Staff



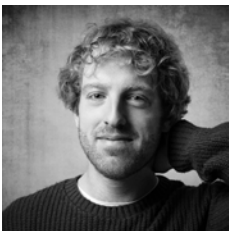
Ariadna Ribes Metidieri is a postdoctoral researcher at the Niels Bohr Institute with a PhD from Radboud University. Ariadna's research focuses on the dynamics of black hole horizons, developing new tools to probe their geometry through gravitational waves.



Brian Seymour is a postdoctoral researcher and a Marie Skłodowska-Curie fellow at the Niels Bohr Institute with a PhD from Caltech. Brian investigates how gravitational wave observations can probe the environments around compact objects and test general relativity under extreme conditions.



Emil Have is a Carlsberg Internationalization Fellowship postdoctoral researcher at Oxford University and a Marie Skłodowska-Curie fellow at the Niels Bohr Institute, with a PhD from the University of Edinburgh. Emil studies geometric aspects of physical theories ranging from strings to gravity to fluids.



Francesco Del Porro is a postdoctoral researcher at the Niels Bohr Institute with a PhD from SISSA. Francesco studies the quantum aspects of gravity and their implications for black holes using various models, including Hořava gravity and asymptotic-safety gravity.



Gang Chen is an Associate Professor at the Niels Bohr Institute. He earned his PhD at Nanjing University, then held faculty and postdoctoral positions at Nanjing, Uppsala, and Queen Mary University. Gang works on scattering amplitude and black hole physics, focusing on setting up the fundamental action of black holes and its applications to gravitational waves and black hole deformation in binary systems.



Giada Caneva Santoro is a postdoctoral researcher at the Niels Bohr Institute with a PhD from Barcelona, IFAE. Giada's work focuses on black hole ringdown, where she tries to extrapolate the different modes in its spectrum from real data. She also characterizes the astrophysical environments around merging black holes.



Jann Zosso is an SNF Postdoctoral Research Fellow at the Niels Bohr Institute, with a PhD from ETH Zürich. Jann is interested in the fundamental properties of gravity theories and their implications for observational tests via gravitational wave signals and gravitational memory.



Lorena Magaña Zertuche is a Danish Data Science Academy postdoctoral fellow at the Niels Bohr Institute with a PhD from the University of Mississippi. Lorena's work focuses on testing General Relativity and improving ringdown waveform modeling, mainly through black hole spectroscopy.



Lorenz Zwick is a postdoctoral researcher at the Niels Bohr Institute and a Marie Skłodowska-Curie fellow at the Niels Bohr Institute, developing new methods to extract astrophysical information from gravitational waves to study extreme gravitational dynamics and gas physics in the vicinity of black holes.



Marica Minucci is a Marie Skłodowska-Curie Postdoctoral fellow at the Niels Bohr Institute. After obtaining a PhD in Mathematical Sciences from Queen Mary University of London, she held a position as Lecturer in Mathematics at Northeastern University London. Marica's research uses mathematical methods to model binary black hole ringdown. She also explores the large-scale behavior of expanding spacetimes.



Nabha Shah joined the Niels Bohr Institute and the Niels Bohr International Academy as a postdoctoral researcher after receiving her PhD from Caltech in 2024. Nabha works on the application of tools from quantum field theory to study the gravitational dynamics of macroscopic classical systems such as black hole binaries.



Pankaj Saini joined the Niels Bohr Institute as a postdoctoral researcher after receiving his PhD from Chennai Mathematical Institute. Pankaj's research uses gravitational waves to probe the astrophysical environments of eccentric compact binaries and to develop new methods to test the strong-field regime of gravity.



Rico Lo is a postdoctoral researcher with a PhD from Caltech. Rico studies gravitational waves, gravitational lensing, black holes, and exotic compact objects using novel and efficient data analysis and computational methods.



Rodrigo Panosso Macedo is an Assistant Professor who earned his PhD from the University of São Paulo, followed by a postdoc at the Max Planck Institute for Gravitational Physics. His research advances black-hole perturbation theory with a geometrical focus, establishing frameworks for black-hole spectroscopy, extreme-mass-ratio inspirals, and gravitational-wave modeling.



Simon Maenaut is a postdoctoral researcher with a PhD from KU Leuven. Simon studies the ringdown of black holes to explore the nature of their spacetime. These gravitational wave signals can serve as a probe of the strong-field regime of gravity.



Zhengwen Liu received his Doctorate from the Université Catholique de Louvain in 2019. Before joining us as an Assistant Professor in the fall of 2022, Zhengwen was a postdoctoral fellow at DESY in Hamburg. Zhengwen is interested in quantum field theory, ranging from its mathematical structures to its applications to the gravitational two-body problem and collider physics. In April 2026 he moved to China to take up a new permanent position.

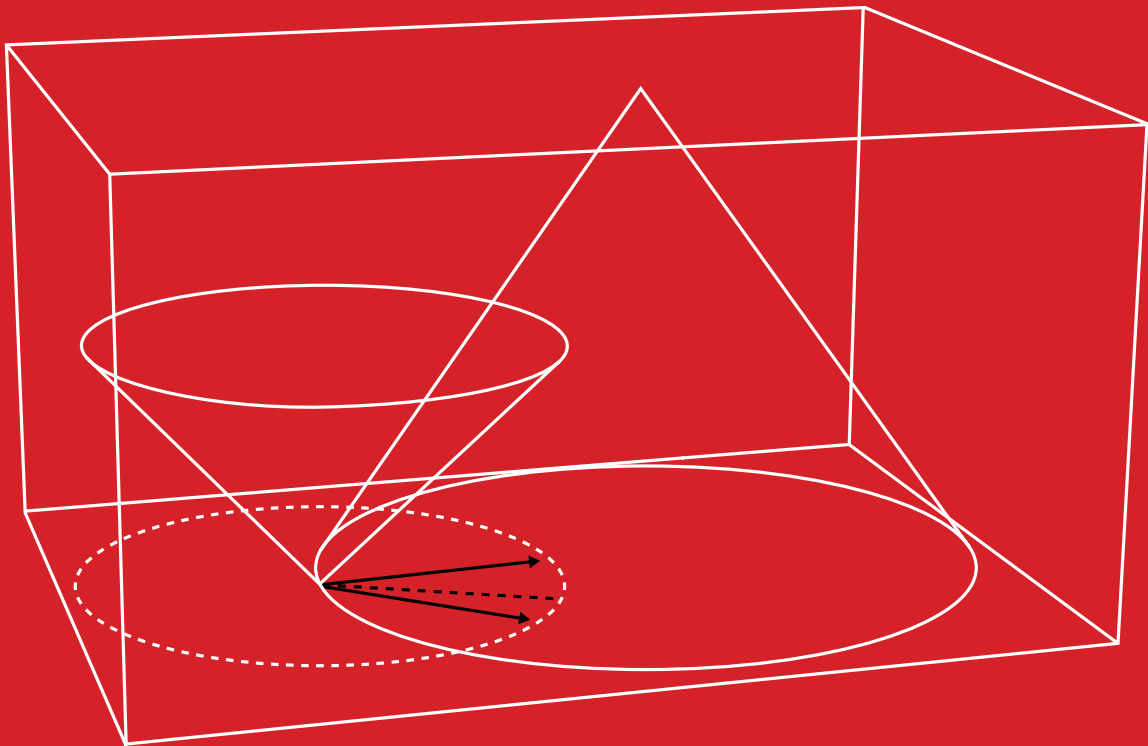


Yifan Chen joined us as a postdoc after a PhD at Sorbonne. His research lies at the intersection of particle physics, black holes, and various detection methods, with a particular focus on using black holes as particle detectors. In September 2025, he moved to China to take up a new position at the prestigious Tsung-Dao Lee Institute.



*Maddalena Reggio and
Guangzi Xu discuss
results of their work.*

About a tenth of a percent
of the Universe's total energy
is in black holes, and
corresponds in size to about
one percent of baryonic matter.



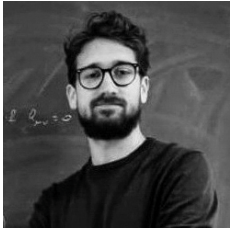
PhD Students



Conor Dyson works on the gravitational self-force formalism to model extreme-mass-ratio inspirals, focusing on higher-order effects and the matter fields around super-massive black holes.



Guangzi Xu works on developing and applying the second-order gravitational self-force formalism at second order to model extreme-mass-ratio inspirals.



Davide Panella studies tidal perturbations to binary black hole dynamics in a strong gravity regime, investigating relativistic signatures in the gravitational wave emission.



Jaime Redondo-Yuste studies the nonlinear interaction of gravitational waves with themselves and with astrophysical matter. Jaime is now a postdoctoral fellow at Princeton University.



Elisa Grilli studies the inspiral phase of compact binary coalescence, focusing on systems involving electrically charged black holes.



Juno Chan explores gravitational waves and relativistic astrophysics and probes how matter and gravity interact in astrophysical events.



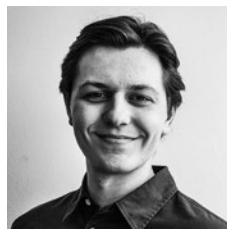
Evelyn-Andreea Ester researches quantum effects in the strong gravity regime by investigating the backreaction of quantum processes on classical black hole geometries.



Kai Hendriks studies how gravitational wave sources interact with their astrophysical environments and how these interactions are imprinted onto their gravitational wave signals.



Francesco Ferrarin's research lies at the interface of quantum gravity and effective field theory, focusing on asymptotically safe gravity and its connections to other approaches to quantum gravity.



Luka Vujeva studies the effects of gravitational wave lensing by complex large-scale structures and how these signals can teach us about cosmology and the nature of dark matter.



Marta Cocco studies strong-gravity tidal interactions in hierarchical black hole triples, probing their complex dynamics and resonant behaviors in the framework of General Relativity.



János Takátsy studies the composition of neutron stars through their tidal dynamics, as well as fundamental aspects of phase shifts in gravitational-wave signals due to environmental effects.



Thomas Spieksma works on characterizing the observational signatures of the environment surrounding black holes. After completing his PhD at the CoG, he is now a postdoctoral fellow at Oxford University.



Gaia Fabj is a researcher examining how environmental effects in AGN accretion disks shape the evolution of stars and stellar remnants, black hole mergers, and three-body interactions.



Marina De Amicis is interested in the ringdown signal emitted by binary black hole coalescences. After earning her PhD with us, Marina is now a postdoctoral fellow at the Perimeter Institute.



Carmen Lopez is a research assistant, collaborating on a project about studying the gravitational waves of extreme mass ratio inspirals according to the Modified Gravity theory “Higher-Derivative Gravity”.



João Sieiro dos Santos is interested in understanding how gravitational waves can probe the environments around black holes, currently with a focus on hierarchical triple systems.

Master Students



Álvaro Fernández Madrid studies Asymptotically Safe Quantum Gravity and its link to particle physics, focusing on how its scale impacts the asymptotic-safety predictions for the top/Higgs mass ratio.



David Johansen's research focuses on the non-relativistic limit of superstring theory and examines how the holographic principle extends to this non-relativistic regime.



Dávur á Høgabóli studies heterotic nonrelativistic string theory, investigating renormalization group flow in newly proposed sigma models.



Lila Esther Wolfe uses modern techniques from quantum field theory and scattering amplitudes to study the classical two-body problem in general relativity.



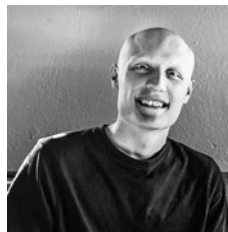
Emily Henningsen investigates effective field theories from asymptotically safe gravity with a scalar field, testing the scalar potential against swampland and black hole instability conditions.



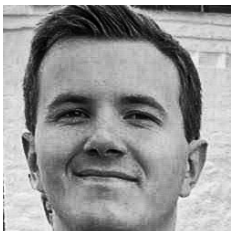
Joey Bowman studies distortions of the gravitational wave signal due to gravitational lensing or modifications to Einstein's gravity using neural posterior estimation to accelerate the analysis.



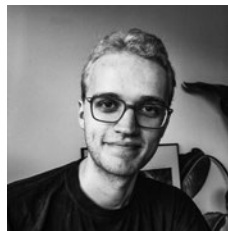
Francesca Campani studies Starobinsky inflation, focusing on how embedding it in a quantum-gravity framework affects its predictions and its consistency with cosmological data.



Leart Sabani studies the interplay between gravity and matter, with a focus on the dynamics of self-gravitating systems and the interaction of gravitational waves with astrophysical objects.



Gustav Gudmandsen is an MSc student who wrote a BSc Project on determining the presence of complex chemistry in the formation of stars using spectroscopy.



Liam Pflughaupt studies BPS limits of superstring theory, focusing on the resulting non-Lorentzian supergravity theories and their duality relations.



Jens Emil Lautrop Buemann uses modern techniques from quantum field theory and scattering amplitudes to study the classical two-body problem in general relativity.



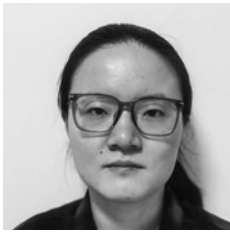
Lucía Vélez Tartajo studies black holes from different perspectives and is now working with Maarten on the self-force formalism and with Vitor on black hole spectroscopy.



Jens Peter Andersen explores the applicability of Spin Matrix Theory to $N=6$ super conformal Chern–Simons-matter theory (ABJM), seeking exact, non-relativistic limits of the associated AdS/CFT correspondence.



Manon Johansson is a master's student in Quantum Physics at NBI, working on the relativistic two body problem.



Menglei Tian studies the dualities between 3d $N=2$ supersymmetric gauge theories and is interested in the 3-manifold invariants associated with these theories via the compactification of $6d(2,0)$ theory.



Sashvat Iyer is an MSc student at the Niels Bohr Institute and is studying the ringdown of black holes by understanding their quasinormal modes.



Michal Ksawery Przybylski is interested in the mathematical structure of general relativity and is currently studying perturbations of the Reissner–Nordström family of spacetimes.



Zhifeng Du is an MSc student at the Niels Bohr Institute studying black hole observations and imaging, focusing on ray tracing from the POV of an observer orbiting a spinning black hole.



Polyxeni Rafaela Tsigdinou's research focuses on quasinormal mode analysis of gravitational waves in post-merger black holes.

Incoming Members

Assistant Professors



Andrew Svesko is an Assistant Professor at the Niels Bohr Institute with a PhD from Arizona State University, previously at King's College London. He studies quantum and semiclassical black holes to advance understanding of quantum gravity.



Nils Siemonsen is an Assistant Professor with a PhD from Perimeter Institute, joining Copenhagen after a postdoctoral position at Princeton University. Nils studies compact objects in extreme astrophysical environments to search for new physics, understand black holes, and explore the fundamentals of gravity.

Postdoctoral Researchers



Dogan Akpınar has a PhD from Edinburgh University. His research uses scattering amplitudes to study the dynamics and symmetries of spinning black holes, gravitational waves, and thermal radiation from macroscopic objects.



Raj Patil has a PhD from the Albert Einstein Institute and Humboldt University. Raj works on studying astrophysical compact objects and gravitational waves emitted by them using the techniques of quantum field theories and scattering amplitudes.



Jury Radkovski constructs methods for large scale phenomenology, explores small scale quantum models and connects descriptions of gravity on different scales using Renormalization Group techniques.



Davide Perrone studies black hole perturbations at linear and non-linear order, developing techniques to calculate the gravitational waves emitted from those objects and their properties.

PhD Students



Fabian Gunnink works on the theory of orbiting black holes and the gravitational waves they emit, accounting for how surrounding matter fields affect their motion.



Serdar Yildiz studies the non-linear dynamics of near-extremal black holes using analytical and numerical techniques to uncover new phenomena in the strong-gravity regime.



Hannah Kingham studies gravitational dynamics, including the relativistic two-body problem, using modern quantum field theory methods and scattering amplitudes.



Shibashis Mukhopadhyay studies precise modelling of gravitational dynamics and radiation. His research focuses on studying the inspiral and ringdown of binary mergers using scattering amplitude.



Nikesh Lilani studies quantum gravity, particularly holography, focusing on Carrollian flat space holography via both bottom-up methods and top-down matrix-model-based constructions.



Vita Movrin studies quantum gravity and black holes, with a focus on holography, including its extensions beyond AdS, along with analytical approaches to strong gravity.

Development and Design



Ana Carvalho is on a not-so-secret mission to bring the center's extraordinary ideas to life through bold illustration and design.



João Vasconcelos keeps CoG's servers running and its ideas live on the web. Linux apologist. Backend-first. Unapologetically opinionated about frontend bloat.



The hallway adjacent to the historic Auditorium A where many of the Center of Gravity's events take place.

Visitors

September 2025

Enrico Cannizzaro
Técnico Lisboa

Yang Lei
Soochow University

Gregorio Carullo
University of Birmingham

Paolo Pani
Sapienza University of Rome

Katy Clough
Queen Mary

Scott Hughes
MIT

Luis Lehner
Perimeter Institute

Stephen Taylor
Vanderbilt University

Rita Teixeira da Costa
Cambridge

October 2025

Yucheng Yin
Peking University

Florian Niedermann
Nordita

Cecil Castelluci
Visiting Writer

Utku Zorba
Istanbul University-Cerrahpaşa

Etevaldo Costa
Universidade de Aveiro

Aaron Held
Ecole Normale Supérieure

November 2025

Antonia Micol Frassino
SISSA, Trieste

Vasco Gennari
Laboratoire des 2 Infinis

Sarp Akcay
UCD, Dublin

Giulia Fumagalli
Caltech

Marc Schneider
University of the
Basque Country

Paolo Di Vecchia
CoG Fellow

Jean-Baptiste Bayle
CEA Paris-Saclay

Huiyu Zhu
IBS CTPU-CGA

Jonas Neuser
SDU Odense

Emil Have
Oxford University

Michele Mancarella
Aix-Marseille University

Andrea Guerrieri
London City University

Patricia Ribes Metidieri
University of York

December 2025

Johanna Borissova
Imperial College London

Jung-Wook Kim
CERN

Manuel Reichert
University of Sussex

Francesco Marzocco
University of Perugia

Giacomo Finocchi
University of Perugia

January 2026

Pedro Fernandes
University of Heidelberg

Héctor Villarrubia Rojo
Madrid University

Daniele Oriti
Universidad Complutense
de Madrid

Shalabh Gautam
BIMSA

Marina David
KU Leuven

Paolo Di Vecchia
CoG Fellow

Mariana Carrillo Gonzalez
Imperial College London

February 2026

Maddalena Reggio
Maastricht University

Thomas Van Riet
KU Leuven

Bruno Bucciotti
Arizona State University

Adrien Kuntz
Técnico Lisboa

Zhen Zhong
Sapienza University of Rome

Marta Cocco
University of Perugia

Alessandra Buonanno
Max Planck Institute
for Gravitational Physics

Fay Dowker
Imperial College London

Cecil Castellucci
Visiting writer

Serena Giardino
Imperial College London

Benjamin Knorr
Heidelberg University

João Santos
Técnico Lisboa

Miguel Montero
IFT Madrid

David Keitel
University de les Iles Balears

Arthur Suvorov
University of Tübingen

March 2026

Diogo Esteves
Técnico Lisboa

Filipe Santos
Técnico Lisboa

Giuseppe Ficarra
Università della Calabri

Licia Verde
Universitat de Barcelona

Elias Roland Most
Caltech

Béatrice Bonga
Radboud University

Caio Filipe Bezerra Macedo
Federal University of Pará

Guanru Li
CAPES

Samuel Upton
University of Southampton

Julian Westerweck
Max Planck Institute,
Hannover

Patricia Ribes Metidieri
University of York

Paolo Di Vecchia
CoG Fellow

Witse Sybesma
Nordita

Samson Leong
Chinese University of Hong Kong

April 2026

Marek Szczepanczyk
University of Warsaw

Fabiano Feleppa
Salerno University

Andrew Svesko
Kings College London

Stef Husken
KU Leuven

Joaquim Gomis
University of Barcelona

Siddarth Bhat
Copenhagen International School

Xavier Kervyn
Max Planck Institute

James Alvey
University of Cambridge

May 2026

Jorge Expósito Patiño
Técnico Lisboa

Giacomo Finocchi
Perugia University

Matteo Nanni
Perugia University

Leonardo Rossetti
Perugia University

Javier Matulich
Instituto de Fisica Teorica,
Madrid

Thomas Spieksma
Oxford University

Jun Liu
University of Cambridge

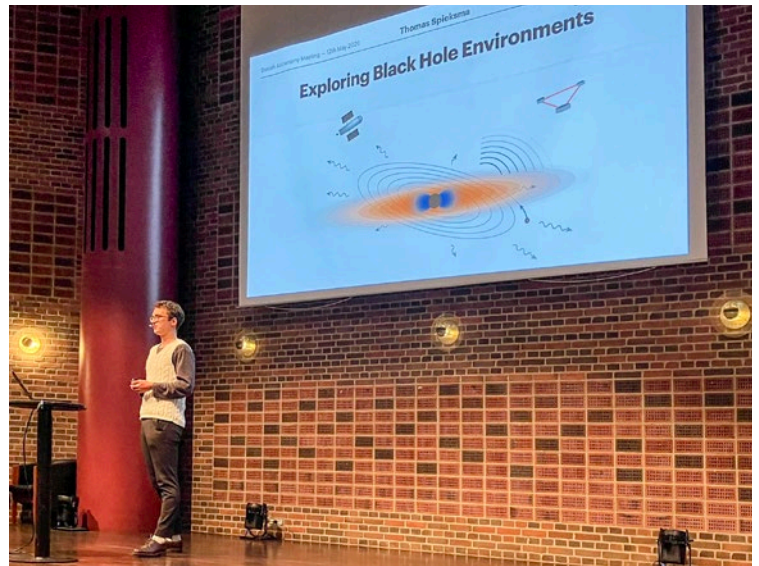
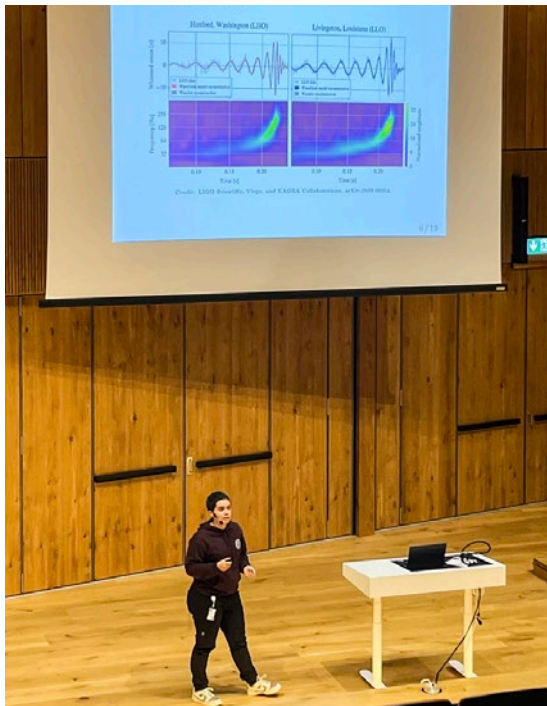
Job Feldbrugge
University of Edinburgh

Paolo Di Vecchia
CoG Fellow

Juan Camilo Henao
University of Strasbourg

June 2026

João Santos
Técnico Lisboa



Left: Lucía Vélez Tartajo during her presentation which earned her the Best Oral Presentation diploma. Top: Thomas Spielsma presenting his work during the IDA PhD Prize ceremony.

Richard Brito
Técnico Lisboa

Qixuan Xu
Técnico Lisboa

Renato Renner
ETH Zürich

Nicola Borghi
University of Bologna

Lieke van Son
Radboud University

Julio Parra Martinez
IHES

Joaquin Turiaci
U. Washington, Seattle

Laura Sberna
Nottingham University

Giulia Campailla
Università di Genova

July 2026

David Becker
MIT

Shruti Paranjape
Brown University

Kevin Grosvenor
University of the Philippines

Maddalena Reggio
Maastricht University

Kara Nelson
uMass Boston

Dimitris Theocharis
Visiting Artist

Taillte May
Técnico Lisboa

Nicola Franchini
Técnico Lisboa

Hooman Neshat
SISSA

Bruno Bucciotti
Arizona State University

Diogo Currito Ribeiro
Max Plank Institute
for Extraterrestrial Physics

Noa Zilberman
Princeton University

August 2026

Gabriel Maia Leão
UFABC

Nils Siemonsen
Princeton University

Maxence Corman
Max Plank Institute

Wayne Hu
University of Chicago



Top: Lars Kann-Rasmussen and Jose M. Ezquiaga pose in the Auditorium A of the Niels Bohr Institute, February 24, 2026. Right: Vitor Cardoso, Distinguished Bearden Lecturer, at the Bloomberg Center for Physics and Astronomy, Johns Hopkins University, December 13, 2025.



Honors and Awards

Vitor Cardoso joined Johns Hopkins University's William H. Miller III Department of Physics & Astronomy as a *Bearden Distinguished Lecturer* in 2025.

The International Society on General Relativity and Gravitation elected Vitor Cardoso for President during the 2028–2031 triennium.

Vitor was honored with the Póvoa de Varzim city medal for his outstanding scientific contributions

Jose Ezquiaga received the 2025 *Lars Kann-Rasmussen Prize*. The prize is awarded annually to an exceptionally talented young individual who has already had a very high impact on research and who has or has had close connections to the Niels Bohr Institute.

The International Union of Pure and Applied Physics awarded the 2025 *IUPAP General Relativity and Gravitation Early Career Prize* to Jose “for his groundbreaking work on gravitational physics”.

Johan Samsing received the 2025 MERAC prize for “Best Early Career Researcher in Theoretical Astrophysics” awarded by the European Astronomical Society “for his seminal contributions how binary black holes merge in our Universe”.

Thomas Spieksma has been awarded the *Instrument Centre for Danish Astrophysics (IDA) PhD Prize*. The prize is awarded annually to the most scientifically outstanding PhD thesis defended at a Danish university within the fields of astronomy and astrophysics.

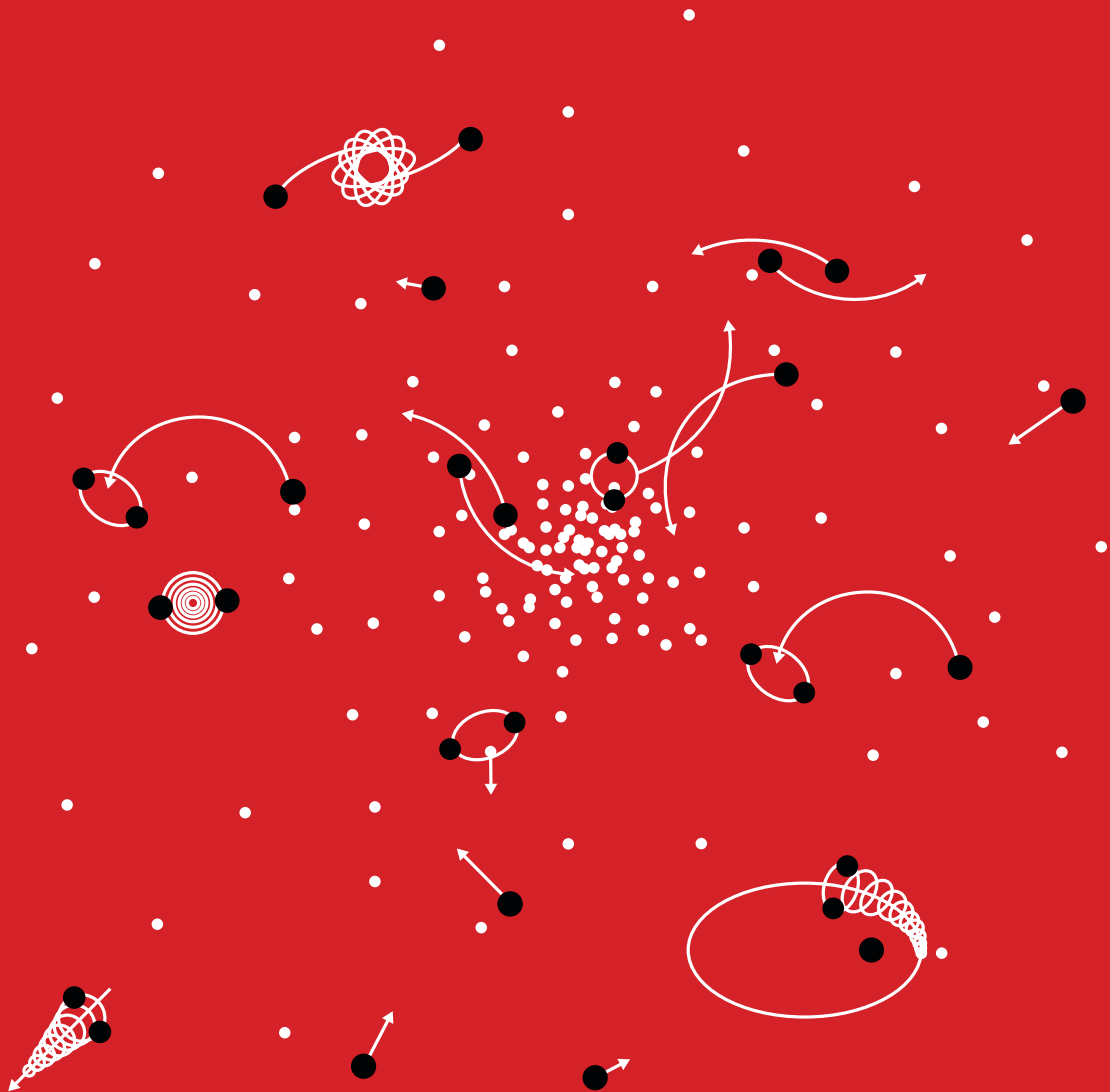
Lucía Vélez Tartajo, a MSc Student and member of the Center of Gravity, was awarded the *Best Oral Presentation diploma* at the Niels Bohr Institute MSc Student Symposium for the presentation “How to play a black hole.”

In December 2025, the CoG website, designed by **Ana Carvalho** and developed by **João Vasconcelos** was featured in “Fonts in Use”, a prestigious archive showcasing the best practices of typographic use in design.



Students in the Auditorium A during the School on Gravity, which took place from June 22 through June 26, 2026.

Events



NIELS BOHR INSTITUTET 1920



Left: Participants in the School on Gravity pose for the group photo in front of the Niels Bohr Institute.

Schools and Meetings

The School on Gravity

22–26 June, 2026

This international PhD school introduced junior scientists—graduate students and advanced undergraduates in general relativity—to key topics in gravitational wave physics and featured lectures by Lieke van Son, Julio Parra, Gustavo Turiaci and Laura Sberna. Subjects included motion theory, quantum-physics challenges, black-hole astrophysics, and source modeling for detectors.

5th Meeting on Gravitational Wave Science in Scandinavia

15–16 May, 2025

The gravitational physics landscape has been evolving rapidly, driven in good part by our ability to study strong-field regions, in particular black holes, with gravitational waves. Gravitational-wave astronomy celebrated a decade of existence in 2025, and with it, we celebrated a revolution in physics. The Scandinavian community has been producing extraordinary results in the field and met for the 5th Meeting on Gravitational Wave Science in Scandinavia, organized by the CoG.



Colloquia

With the new Center of Gravity Colloquia series, we aim to showcase the future of gravity research across a broad spectrum. The series is designed to highlight exciting scientific advances, explore the foundations of the field's most pressing open questions, and share the fascination and wonder of fundamental physics with a wide and diverse audience. Each colloquium is followed by a reception. And everyone is welcome.

A Tale of Many H_0 .
Professor Licia Verde
03.03.2026

Professor Verde discussed “A Tale of Many H_0 ,” examining the conflicting measurements of the Hubble constant, H_0 , and the potential need for new physics to explain the universe's evolution.

Evidence for Black Holes and Cosmic Evolution
Professor and Nobel Laureate Reinhard Genzel
21.04.2026

Despite unforeseen issues, Genzel joined remotely and presented evidence for black holes, especially at the Milky Way's center, and their growth, interaction with galaxies, and remaining questions. He ended with a humorous film on black holes, followed by discussions and a reception.

Wigner's Friend and Quantum Gravity Paradoxes
Professor Renato Renner
02.06.2026

Renner explored observation in quantum physics via the Wigner's Friend experiment, showing how differing observer perspectives can lead to contradictions, which is relevant to black hole physics and quantum foundations.



Top: Jann Zosso introduces Nobel Laureate Reinhard Genzel's colloquium, April 21, 2025.
 Right: The audience listens to Professor Genzel's lecture in a packed Auditorium A.



Seminars

Our Seminar Series iterates between internal meetings where Center of Gravity members present their latest work and seminar meetings with external speakers.

21.10.2025

CoG Seminar

Florian Niedermann, Nordita
The Hubble tension as a signature of a new phase transition

28.10.2025

Internal Seminar

Ziqi Yan
Exotic Braneworlds?

04.11.2025

CoG Seminar

Cumrun Vafa, Harvard
String theory and the fading dark sector

11.11.2025

Internal Seminar

Jose Ezquiaga
Getting ready for the discovery of lensed gravitational waves

18.11.2025

CoG Seminar

Jean-Baptiste Bayle, CEA Saclay
Status, challenges and perspectives for LISA

25.11.2025

Internal Seminar

Lorena M. Zertuche
Building accurate ringdown waveform models

02.12.2025

CoG Seminar

Jung-Wook Kim, CERN
Magnusian: An integrated approach to gravitational dynamics

13.01.2026

CoG Seminar

Héctor Villarrubia-Rojo, Madrid
Gravitational wave lensing: Wave optics and GW231123

20.01.2026

Internal Seminar

Niels Obers
Gravity and string theory at the edges of relativity

27.01.2026

CoG Seminar

Marina David, KU Leuven
Amplification of new physics in the quasinormal mode spectrum of near-extremal black holes

03.02.2026

Internal Seminar

Jaime Redondo-Yuste
Scattering waves off compact objects

24.02.2026

CoG Seminar

Serena Giardino, Imperial College
Testing modified gravity with gravitational wave lensing

03.03.2026

Internal Seminar

Gang Chen
Kerr black hole dynamics from hyper-surface model, Compton amplitude and black hole perturbation theory

10.03.2026

CoG Seminar

Elias Most, Caltech
Spacetime in turmoil: insights into merging black holes and neutron stars from computational relativistic astrophysics

24.03.2026

CoG Seminar

Witse Sybesma, Nordita
Exploring quantum features of de Sitter space from an observer's perspective

07.04.2026

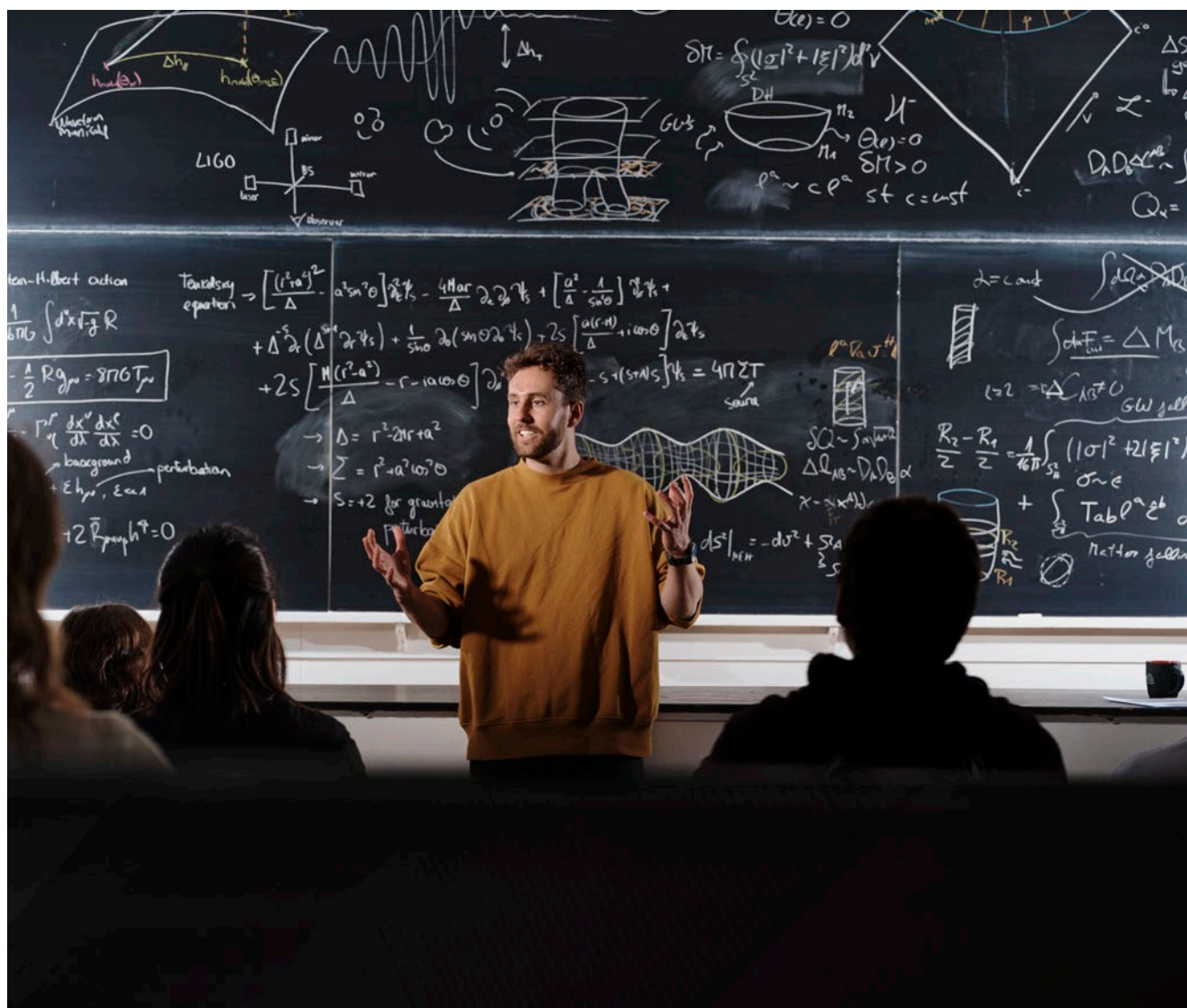
CoG Seminar

Marke Szczepanczyk, Warsaw
The quest to detect (exceptional) gravitational-wave sources

14.04.2026

Internal Seminar

Lorenz Zwick
Little Red Dots (LRDs): An overview of the Physics



Jann Zosso explains what a memory effect is.

28.04.2026

Internal Seminar

Brian Seymour

Gravitational waves as a probe of the quantum structure of black holes

19.05.2026

Internal Seminar

Clara Ferreira Cores and team

Brainstorm on Black Hole Week performance with artists group

19.05.2026

CoG Seminar

Job Leon Feldbrugge, Edinburgh

Real-time path integrals, caustics and interference in cosmology

26.05.2026

Internal Seminar

Alessia Benedetta Platania

Quantum gravity at the crossroads

09.06.2026

Internal Seminar

Ariadna Ribes Metidieri

Universality at the threshold of black hole capture

28.07.2026

CoG Seminar

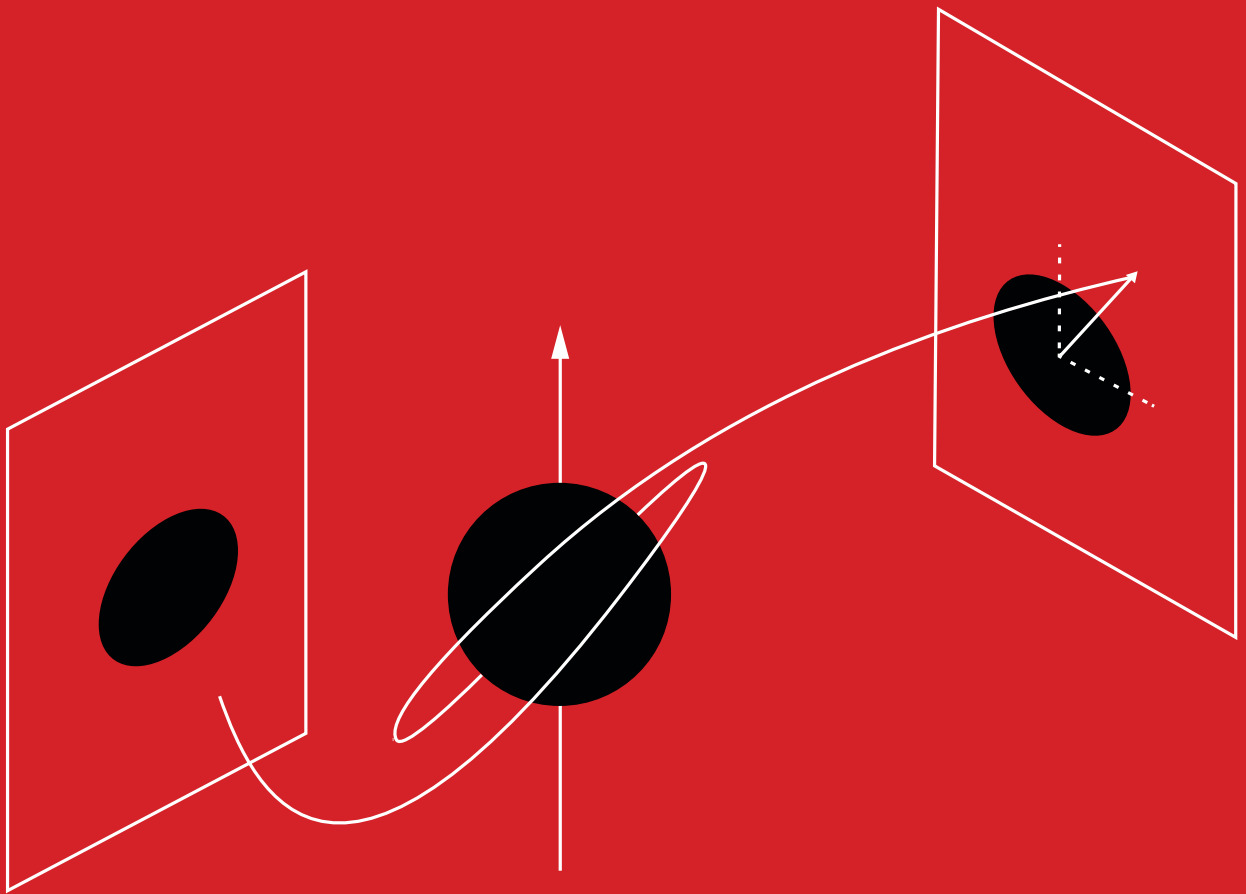
Noa Zilbermann, Princeton

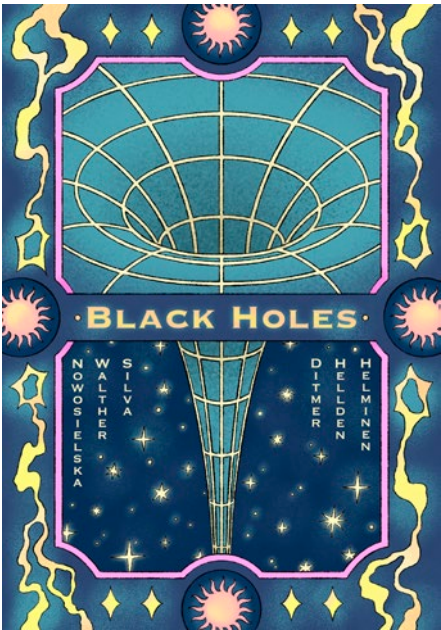
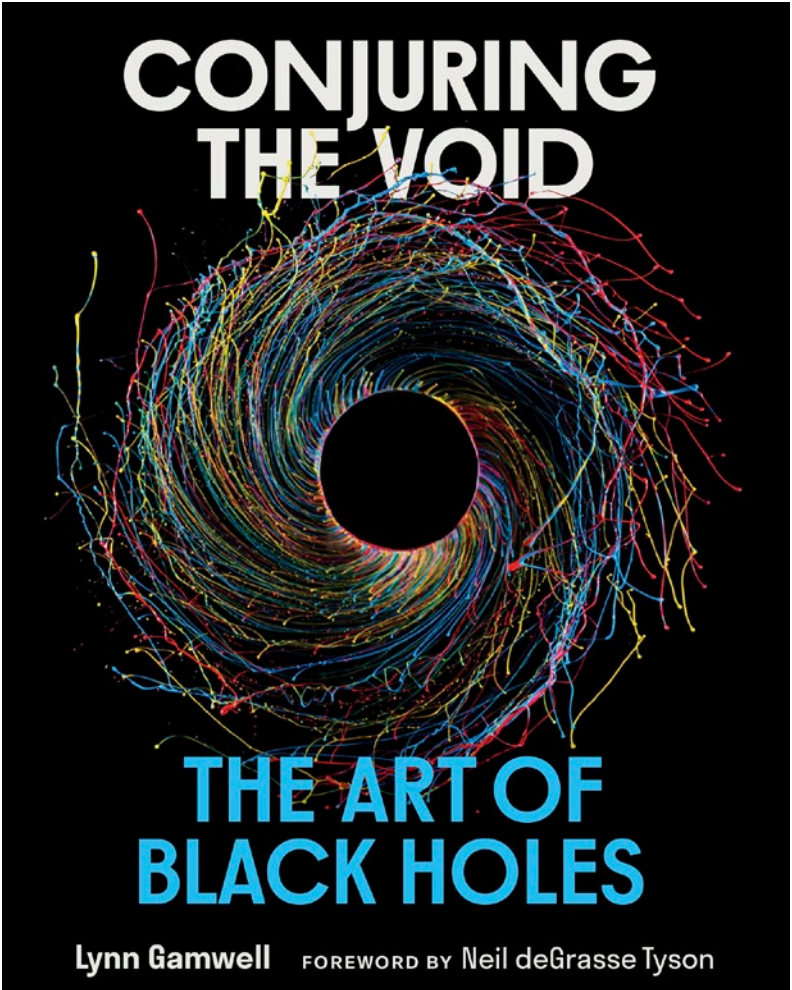
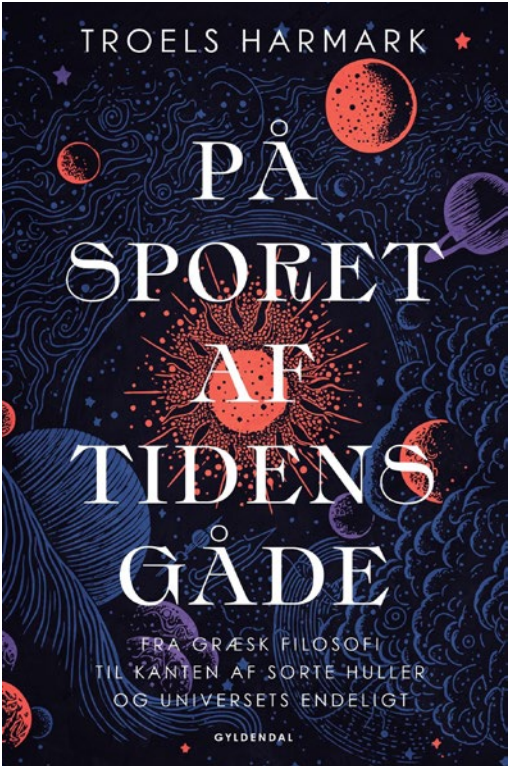
The semiclassical energy outflux emerging from a collapsing shell



*Lorena Magaña Zertuche introducing the film
"Interstellar" at Cinemateket. May 6, 2026.*

Outreach





Clockwise from top left: Troels Harmark's book "På sporet af tidens gåde"; "The Art of Black Holes" which featured a work by Johan Samsing; The book "Assim Nasce Uma Ideia", co-organized by Vitor Cardoso and Ana Carvalho; The comic book "Black Holes", a collaboration between Rodrigo Panosso, Jose Ezquiaga, Cecil Castellucci, and VIA University College.

Outreach Highlights

The Center of Gravity is full of committed and passionate scientists. We are deeply aware of the importance of the knowledge we are pursuing. We take science seriously. At times, a bit too much. Because we recognize the importance of the work we do, we want to share it with everyone. Our members are involved with outreach in a variety of ways: public speaking, school visits, arts exchanges, media engagements, and a myriad of other educational activities. Our wish with these efforts is to foster a deeper appreciation for science and to make it welcoming for everyone. As we take stock of the year behind us, we are happy to realise that our efforts have reached tens of thousands of people in Denmark and abroad. Below are some of the highlights of these efforts.

10 Years of Gravitational Waves

The center and the Niels Bohr Institute LIGO GROUP marked the first decade of gravitational wave astronomy in 2025.

Unraveling the Mystery of Time

Troels Harmark's new book "På Sporet af Tidens Gåde: Fra græsk filosofi til kanten af sorte huller og universets endeligt" (in English, "Unraveling the Mystery of Time: From Greek philosophy to the edge of black holes and the end of the universe") was published by Gyldendal in 2025. In addition, Troels gave several talks on quantum physics and gravity at Folkeuniversitetet and festivals in Odense, Copenhagen, and Ørestad.

On the Birth of an Idea

Vitor Cardoso collaborated with Ana Carvalho to edit the book "Assim Nasce uma Ideia". The book is a collection of texts selected from their joint project "The Birth of Idea", an online archive featuring hundreds of essays about the origin of ideas in science.

Kultur Salonen Talk

Emil Bjerrum-Bohr discussed gravity and the binary merger problem at Kultur Salonen in Viby.

Fundamental Forces at Folkeuniversitetet

Niels Obers spoke at Folkeuniversitetet on gravity as part of a series on fundamental forces.

CoG Arts & Science Residency

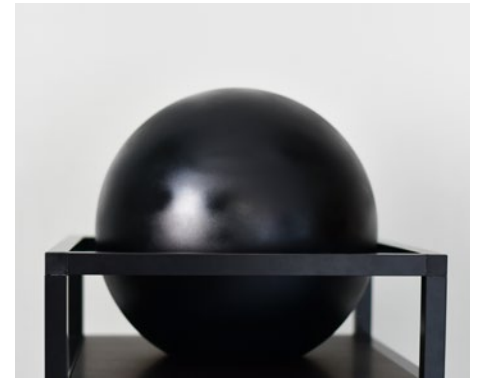
Art offers a unique and inspiring lens on knowledge. The Center of Gravity's flagship art residency brings artists and scientists together to create new works, enhancing science communication and introducing scientists to innovative outreach methods. A highlight was when former residency artist Dimitris Theocharis won the Inspire Prize in 2025.

Collaboration with VIA University College

Rodrigo Panosso and Jose Ezquiaga collaborated with writer Cecil Castelluci and VIA University College students to create comics about black holes.

Women in Orbit

Center of Gravity member Lorena Magaña Zertuche introduced the film *Interstellar* at Cinemateket on May 6 as part of the "Women in Orbit" series by Kvinder i Fysik and High5-Girls, in collaboration with Cinemateket. The event highlighted how cinema can spark curiosity about physics and the universe beyond our planet.



Left: Cecilie Waagner Falkenstrøm's artwork "A Black Hole Calling Us"; Top: The artwork "Resonance" by visiting artist Dimitris Theocharis.

The CoG Does Theater

PhD student Jaime Redondo-Yuste co-wrote the play "A quantum of hope," which premiered in Waterloo, Canada, in September 2025.

A Black Hole Calling Us: An Art Installation

Artist Cecilie Falkenstrøm debuted her interactive art installation "A black hole calling us" at ARoS art museum in Aarhus in 2026. The opening featured the artist discussing black holes, her work, and the art–science connection with Troels Harmark.

Science Stories Interview

Interviewed by Jens Degett from Science Stories, Niels Obers talked about the science behind the Einstein Telescope.

A Christmas Tale of Gravity

More than 400 people of all ages filled the Teatro Aberto auditorium to hear Vitor Cardoso discuss black holes and gravitational waves. The occasion was the popular Christmas Conference organized annually by Ciência Viva, inspired by the British Royal Institution's Christmas Lectures.

"No Stupid Questions" Podcast

In the Radio IIII podcast "No Stupid Questions", the hosts Esben Pretzmann and Jonas Kuld Rathje discussed with Troels Harmark about what time is and why it may not last forever.

Planetarium Public Talk

Center of Gravity members Ariadna Ribes Metidieri, Leart Sabani, and Lucía Vélez Tartajo participated in a public talk at the Tycho Brahe Planetarium. The two-hour event, attended by 200 people, took the audience on a journey through the cosmos to explore the physics of black holes.

Black Hole Week

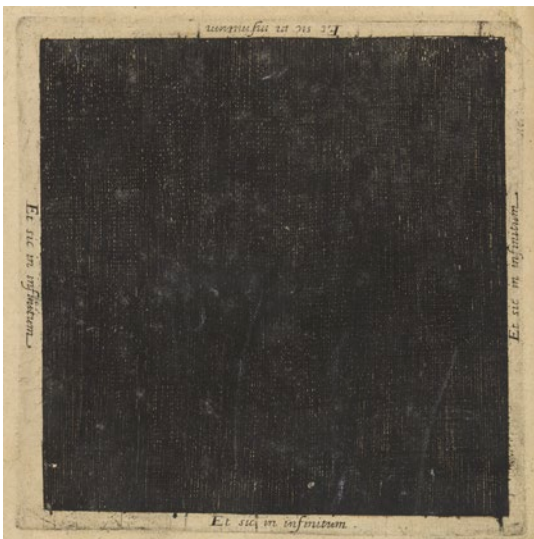
The Center of Gravity, together with the Niels Bohr Institute and other partners, is organizing the Black Hole Week, during which we will invite Copenhagen to join us in sharing and celebrating the wonders of black hole physics. A full and exciting program featuring many different events around the city and to which all are welcome.

Bugbox

The Bugbox is a little cabinet of wonders nested in a corner of the Center of Gravity's website. It is a place open to unknown treasures, exquisite finds, beautiful theories, sublime art, and remarkable lives. All suggested by our members, for everyone.

Burrowing Holes in the Sky

An art project, borne out of a collaboration between Vitor Cardoso and Ana Carvalho, exploring the poetics of the embedding diagrams commonly used to represent black holes.



Clockwise from top left: A scene from the play "A Quantum of Hope", co-written by Jaime Redondo-Yuste; Leart Sabani, Lucía Vélez Tartajo and Ariadna Ribes Metidieri during a public talk at the Tycho Brahe Planetarium; Vitor Cardoso performing Galileo's falling bodies experiment with a group of children; Robert Fludd's work, "Utriusque cosmi maioris scilicet et minoris metaphysica, physica atque technica historia" which inaugurated the CoG project Bugbox; A panel by artist Freja Ytting Helldén, from the comic book "Black Holes".

Spotlight: Black Hole Week

The poster advertising this year's edition of the "Black Hole Week".

In the last week of August, we celebrate black holes in Copenhagen. There are many reasons to be excited. The LIGO–Virgo–Kagra collaboration has seen hundreds of black hole collisions and hundreds more will be seen over the next decade. Europe is preparing the launch of LISA, the greatest detector ever built, and is currently discussing an Einstein telescope. Both GRAVITY and the Event Horizon Telescope are, as we speak, studying in ever increasing detail the black hole at the very center of our galaxy. This has changed everything since now the conundrums associated with quantum physics and gravity can be discussed in the light of observations.

In the meantime, our Center of Gravity has been interpreting all these observations and making predictions for how black holes should behave according to the theory of Einstein. In these fascinating times, gravity exerts an even stronger pull!

We want Copenhagen to fully participate in this celebration and to share the wonders of black hole physics. For this reason the Center of Gravity, together with the Niels Bohr Institute and other partners, is organizing the Black Hole Week with different exciting events around the city.

For 2026, the program features the following events:

Paint Black Holes with Light!

The Round Tower, 22.08.2026

Painting, exploration, and many hands-on activities, live demos, as well as a pop-up exhibition led by scientists from the Center of Gravity at the Niels Bohr Institute.

Discover Black Holes Through Comic Books!

Book launch at Comic Garden and public display at Kongens Nytorv, August 20–31.08.2026

This is a collaboration with artists from Graphic Storytelling at TAW VIA in Viborg.

Your Borrowed Stardust

KoncertKirken, 26.08.2026

A performance which is also an invitation to journey playfully into how we generate meaning as part of our cosmos — a recalibration of perception and praxis, embodying the stardust we borrow and will return to.

Black Holes: When Light Falls In

The Round Tower, 26.08.2026

We welcome everyone to join us at the Round Tower for an exciting journey to explore black holes and discover how physicists uncover the secrets of these mysterious objects.

Between Science and Fiction

Gloria Biograf, 27.08.2026

Where does science end and science fiction begin? Physicists of the Center of Gravity will introduce a movie and explain the real science of gravity, exploring how these scientific ideas, together with our understanding of the universe around us, inspire the worlds we imagine on the screen.

Science & Cocktails

DR Koncerthuset, 29.08.2026

Over cocktails, some of the world-leading figures in science explain what black holes are, how we see them and why we want to know them.

Satellite Events Include:

Black Hole Aria: A Lyrical Micro Opera Creation

Aveny-T, August 17.08.2026

Resonance, an Art Installation

Planetarium, August, 2026

BLACK HOLE WEEK 2026

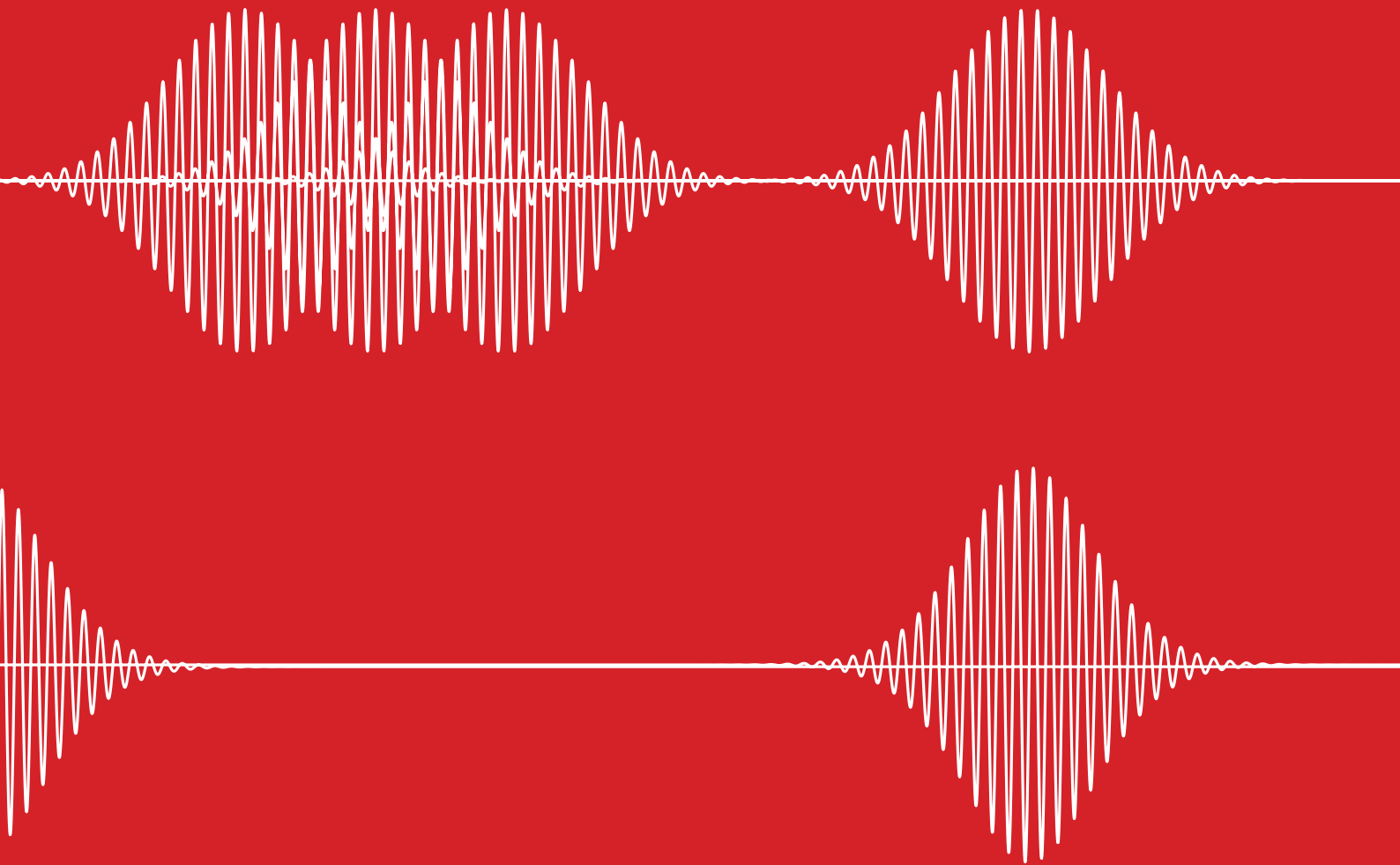


COPENHAGEN • AUGUST 22-29

*Davide Panella, Lucía Vélez Tartajo
and Lorena Magaña Zertuche
during a group meeting.*



Appendix



Research Publications

Abac et al.

All-sky searches for continuous gravitational waves from isolated neutron stars in the data from the first part of the fourth LIGO–Virgo–KAGRA observing run

arXiv:2603.14168 (2026)

Abac et al.

Black hole spectroscopy and tests of general relativity with GW250114
Phys. Rev. Lett 136, 041403 (2026)

Abac et al.

GWTC-5.0: An introduction to version 5.0 of the gravitational-wave transient catalog

arXiv:2605.27223 (2026)

Abac et al.

All-sky search for continuous gravitational-wave signals from unknown neutron stars in binary systems in the first part of the fourth LIGO–Virgo–KAGRA observing run

arXiv:2511.16863 (2025)

Abac et al.

Direct multi-model dark-matter search with gravitational-wave interferometers using data from the first part of the fourth LIGO–Virgo–KAGRA observing run

arXiv:2510.27022 (2025)

Abac et al.

All-sky search for long-duration gravitational-wave transients in the first part of the fourth LIGO–Virgo–KAGRA observing run
Phys. Rev. D 113, 082004 (2026)

Abac et al.

All-sky search for short gravitational-wave bursts in the first part of the fourth LIGO–Virgo–KAGRA observing run
Phys. Rev. D 112, 102005 (2025)

Abac et al.

Sub-torque-balance upper limits on continuous gravitational waves from Scorpius X-1

arXiv:2607.07765 (2026)

Abac et al.

GWTC-4.0: Population properties of merging compact binaries
Astrophys. J. Lett 1005, L51 (2026)

Abac et al.

GW240925 and GW250207: Astrophysical calibration of gravitational-wave detectors
Phys. Rev. Lett (2026)

Abac et al.

GWTC-4.0: Updating the gravitational-wave transient catalog with observations from the first part of the fourth LIGO–Virgo–KAGRA observing run
Astrophys. J. Lett 1004, L22 (2026)

Abac et al.

Narrowband searches for continuous gravitational waves from known pulsars in the first two parts of the fourth LIGO–Virgo–KAGRA observing run

Astrophys. J., 1005:221, (2026)

Abac et al.

The Science of the Einstein Telescope
JCAP03(2026)081

Abac et al.

Cosmological and high energy physics implications from gravitational-wave background searches in LIGO–Virgo–KAGRA's O1–O4a runs
arXiv:2510.26848 (2025)

Abac et al.

GWTC-4.0: Tests of general relativity. I. Overview and general tests
arXiv:2603.19019 (2026)

Abac et al.

GW241011 and GW241110: Exploring binary formation and fundamental physics with asymmetric, high-spin black hole coalescences

Astrophys. J. Lett , L21 (2025)

Abac et al.

GWTC-4.0: Population properties of merging compact binaries
arXiv:2508.18083 (2025)

Abac et al.

Search for planetary-mass ultra-compact binaries using data from the first part of the LIGO–Virgo–KAGRA fourth observing run

arXiv:2511.19911 (2025)

Abac et al.

GWTC-4.0: Methods for identifying and characterizing gravitational-wave transients
Astrophys. J. Lett 1004, L21 (2026)

Abac et al.

Directed searches for gravitational waves from ultralight vector boson clouds around merger remnant and

galactic black holes during the first part of the fourth LIGO–Virgo–KAGRA observing run
arXiv:2509.07352 (2025)

Abac et al.
GW231123: A binary black hole merger with total mass 190–265 $M_{\odot}$
Astrophys. J. Lett 993, L25 (2025)

Abac et al.
Constraints on gravitational waves from the 2024 vela pulsar glitch
Astrophys. J 1005, 12 (2026)

Abac et al.
Open data from LIGO, Virgo, and KAGRA through the first part of the fourth observing run
Astrophys. J 1004, 232 (2026)

Abac et al.
Upper limits on the isotropic gravitational-wave background from the first part of LIGO, Virgo, and KAGRA's fourth observing run
arXiv:2508.20721 (2025)

Abac et al.
GW250114: Testing Hawking's area law and the Kerr nature of black holes
Phys. Rev. Lett 135, 111403 (2025)

Abac et al.
Searches for continuous gravitational waves from supernova remnants in the first part of the LIGO–Virgo–KAGRA fourth observing run
Astrophys. J 1004, 204 (2026)

Abac et al.
GWTC-4.0: Tests of general relativity. III. Tests of the remnants
arXiv:2603.19021 (2026)

Abac et al.
GWTC-4.0: Methods for identifying and characterizing gravitational-wave transients
arXiv:2508.18081 (2025)

Abac et al.
Open data from LIGO, Virgo, and KAGRA through the second part of the fourth observing run
arXiv:2605.27090 (2026)

Abac et al.
GWTC-5.0: Observations from the second part of the fourth LIGO–Virgo–KAGRA observing run and updates to the gravitational-wave transient catalog
arXiv:2605.27225 (2026)

Abac et al.
GWTC-4.0: Searches for gravitational-wave lensing signatures
arXiv:2512.16347 (2025)

Abac et al.
GWTC-5.0: Population properties of merging compact binaries
arXiv:2605.27226 (2026)

Abac et al.
GWTC-4.0: Tests of general relativity. II. Parameterized tests
arXiv:2603.19020 (2026)

Abac et al.
GWTC-4.0: An introduction to version 4.0 of the gravitational-wave transient catalog
Astrophys. J. Lett 995, L18 (2025)

Abac et al.
Searches for binary mergers with sub-solar mass components in data from the first part of LIGO–Virgo–KAGRA's fourth observing run
arXiv:2605.05444 (2026)

Abac et al.
GW230814: Investigation of a loud gravitational-wave signal observed with a single detector
Astrophys. J. Lett 1004, L23 (2026)

Abac et al.
GWTC-5.0: Methods for identifying

and characterizing gravitational-wave transients
arXiv:2605.27224 (2026)

Abac et al.
Directional search for persistent gravitational waves: Results from the first part of LIGO–Virgo–KAGRA's fourth observing run
Phys.Rev.D 114 (2026) 2, 022001

Abac et al.
GWTC-4.0: Constraints on the cosmic expansion rate and modified gravitational-wave propagation
arXiv:2509.04348 (2025)

Abac et al.
GWTC-4.0: Updating the gravitational-wave transient catalog with observations from the first part of the fourth LIGO–Virgo–KAGRA observing run
Astrophys. J. Lett 1004, L22 (2026)

Abbasi et al.
Deep search for joint sources of gravitational waves and high-energy neutrinos with IceCube during the third observing run of LIGO and Virgo
Astrophys. J 1003, 41 (2026)

Abbott et al.
Tests of general relativity with GWTC-3
Phys. Rev. D 112, 084080 (2025)

Abd El Dayem et al.
Exploring the presence of a fifth force at the Galactic Center
Astron. Astrophys 698, L15 (2025)

Acernese et al.
Advanced Virgo Plus for O5 — Design report overview
arXiv:2603.20342 (2026)

Acernese et al.
Optical characterization of the Advanced Virgo gravitational wave detector for the O4 observing run
Appl. Opt 64, 4710 (2025)

Afshordi et al.
Waveform modelling for the Laser Interferometer Space Antenna
 Living Rev. Rel 28, 9 (2025)

Akama et al.
Testing gravitational wave polarizations with LISA
 arXiv:2603.03165 (2026)

Almeida et al.
Conservative binary dynamics to third post-Minkowskian order beyond general relativity
 arXiv:2602.08876 (2026)

Alnasheet et al.
Gravitational-wave tails and memory effect for mergers in astrophysical environments
 Phys. Rev. D 112, 044066 (2025)

Andrés-Carcasona & Caneva Santoro
No Love for black holes: Tightest constraints on tidal Love numbers of black holes from GW250114
 arXiv:2512.01918 (2025)

Armas et al.
Null matter and the ultrarelativistic origin of hydrodynamics at zero temperature
 arXiv:2509.25320 (2025)

Armas et al.
Null fluid/gravity correspondence
 arXiv:2602.20268 (2026)

Arrechea et al.
Effective geometrostatics of spherical stars beyond general relativity
 arXiv:2603.24269 (2026)

Arrechea et al.
Physical and theoretical challenges to integrable singularities
 Phys. Rev. D 112, 044024 (2025)

Arrechea et al.
From de Sitter to anti-de Sitter singularity regularization:

Theory and phenomenology
 Phys. Rev. D 112, 124029 (2025)

Assaad & Panosso Macedo
Quasinormal modes in Kerr spacetime as a 2D eigenvalue problem
 Class. Quant. Grav 42, 245008 (2025)

Auzzi et al.
Finite scalar field theory with $SU(1,1)$ spacetime symmetry from near-BPS limits of $\mathcal{N}=4$ SYM
 arXiv:2605.24085 (2026)

Ayzenberg et al.
Fundamental physics opportunities with future ground-based mm/sub-mm VLBI arrays
 Living Rev. Rel 28, 4 (2025)

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Probing axions via spectroscopic measurements of S-stars at the galactic center
 arXiv:2507.07482 (2025)

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Stellar superradiance and low-energy absorption in dense nuclear media
 JCAP 04, 029 (2026)

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Lectures in quantum gravity
 SciPost Phys. Lect. Notes 98, 1 (2025)

Basile et al.
Asymptotic safety, quantum gravity, and the swampland: A conceptual assessment
 SciPost Phys 20, 027 (2026)

Bergshoeff et al.
Heterotic string sigma models: Discrete light cone quantization and its current-current deformation
 JHEP 09, 021 (2025)

Berti et al.
Black hole spectroscopy:

From theory to experiment
 Class. Quant. Grav 43, 123001 (2026)

Bjerrum-Bohr et al.
Kerr black hole dynamics from an extended Polyakov action
 Phys. Rev. Lett 136, 071601 (2026)

Bjerrum-Bohr et al.
The gravitational Compton amplitude from flat and curved spacetimes at second post-Minkowskian order
 JHEP 10, 235 (2025)

Bjerrum-Bohr et al.
Resumming spinning black hole dynamics at third post-Minkowskian order
 arXiv:2603.04214 (2026)

Bjerrum-Bohr et al.
The gravitational Compton amplitude at third post-Minkowskian order
 arXiv:2602.06947 (2026)

Blair et al.
Carroll geometry meets de Sitter space via holography
 Phys. Lett. B 879, 140641 (2025)

Blas et al.
Quantizing nonprojectable Hořava gravity with Lagrangian path integral
 Phys. Rev. D 113, 106022 (2026)

Borissova & Carballo-Rubio
Regular black holes from pure gravity in four dimensions
 Phys. Rev. D 113, 124004 (2026)

Borissova & Carballo-Rubio
Effective geometrodynamics for renormalization-group improved black hole spacetimes in spherical symmetry
 JCAP 05, 023 (2026)

Bourg et al.
Quadratic quasinormal modes at null infinity on a Schwarzschild spacetime
 Phys. Rev. D 112, 044049 (2025)

Boyanov & Carballo-Rubio
Regular Vaidya solutions of effective gravitational theories
Phys. Rev. Lett 136, 171403 (2026)

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Dynamical response of viscous objects to gravitational waves
Phys. Rev. Lett 135, 151402 (2025)

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Higher derivatives in quantum gravity: theory, tests, phenomenology
Eur. Phys. J. Plus 140, 772 (2025)

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Visions in quantum gravity
SciPost Phys. Comm. Rep. 11 (2025)

Bussi eres et al.
Axial oscillations of viscous neutron stars
arXiv:2604.13208 (2026)

Cacciapaglia et al.
When black holes can wear pants
arXiv:2606.24642 (2026)

Campailla et al.
Machine learning assisted parameter-space searches for lensed gravitational waves
Phys. Rev. D 113, 083510 (2026)

Capelo et al.
Multi-messenger and multi-band studies of massive black holes: The synergies between LISA and SKAO
arXiv:2606.25020 (2026)

Carballo-Rubio
Master field equations for spherically symmetric gravitational fields beyond general relativity
Nature Commun 17, 1399 (2026)

Carballo-Rubio et al.
Imprints of quantum vacuum fluctuations on the gravitational field of a spherical mass
JHEP 02, 129 (2026)

Carballo-Rubio et al.
Macroscopic backreaction of the trace anomaly on classical vacuum backgrounds
Phys. Rev. D 113, 124005 (2026)

Carballo-Rubio et al.
Nonminimal light-curvature couplings and black-hole imaging
Phys. Rev. D 112, 103016 (2025)

Carballo-Rubio et al.
Semiclassical regularity of compact trapped regions: From dynamical horizons to inner extremality
arXiv:2607.03916 (2026)

Carballo-Rubio et al.
Charging up regular black holes
arXiv:2607.07831 (2026)

Cardoso & Nat rio
An exact solution describing a scalar counterpart to the Schwarzschild-Melvin Universe
Gen. Rel. Grav 57, 138 (2025)

Cardoso et al.
The physics of black holes and their environments: Consequences for gravitational wave science
arXiv:2511.14841 (2025)

Cardoso et al.
Nonlinear dynamics in general relativity
arXiv:2603.04501 (2026)

Cardoso et al.
The third wheel: Ringdown and lensing of triple systems
arXiv:2605.20320 (2026)

Chan et al.
Lensing and wave optics in the strong field of a black hole
Phys. Rev. D 112, 064009 (2025)

Chan et al.
Discovering gravitational waveform distortions from lensing: A deep dive into GW231123
arXiv:2512.16916 (2025)

Chan et al.
Identification and characterization of distorted gravitational waves by lensing using deep learning
Phys. Rev. D 113, 024041 (2026)

Chen et al.
Identifying the quadrupolar nature of gravitational wave background through space-based missions
JCAP 08, 063 (2025)

Chen et al.
Illuminating black hole shadows with dark matter annihilation
Phys. Rev. Lett 135, 121001 (2025)

Cocco et al.
Strong-gravity precession resonances for binary systems orbiting a Schwarzschild black hole
Phys. Rev. D 112, 044010 (2025)

Cocco et al.
Observable signature of magnetic tidal coupling in hierarchical triple systems
arXiv:2510.24897 (2025)

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with a portrait of Niels Bohr,
seen here on the left.

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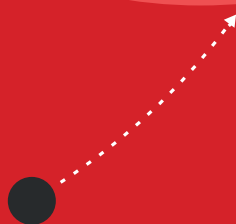
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