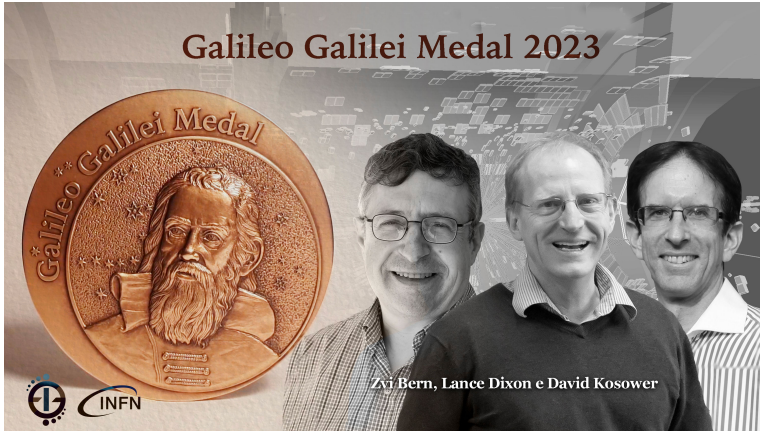


Press Release 2021

THE 2023 GALILEO GALILEI MEDAL GOES TO ZVI BERN, LANCE DIXON AND DAVID KOSOWER



The prize is awarded for the development of powerful theoretical computational methods for collision processes at large particle accelerators. These methods have been essential for comparing theoretical predictions with experimental results obtained at CERN's Large Hadron Collider.

The physicists Zvi Bern, Lance Dixon and David Kosower are the winners of the Galileo Galilei Medal 2023, a prize awarded every two years, by the National Institute for Nuclear Physics (INFN) with the Galileo

Galilei Institute (GGI), its National Center for Advanced Studies in partnership with the University of Florence, to scientists who have made outstanding and seminal contributions to the advancement of research in theoretical physics.

The Prize, announced today, February 15, on the anniversary of the birthday of the great scientist Galileo Galilei, was awarded to Zvi Bern, Lance Dixon and David Kosower “for the development of powerful methods for high-order perturbative calculations in quantum field theory”.

“There was a problem in the early nineties: try to make the most use of colliders that were under construction, like the LHC at CERN. A collider is a very complicated environment to try to learn the secrets of nature: it collides protons that are made up out of quarks and gluons, which interact with each other through a force called the strong force. Particle theorists call it QCD, which stands for Quantum chromodynamics, where chromo stands for the colors of the quarks and the gluons exchanged in the collisions,” explains **Lance Dixon**. “We were able to convert a property of QCD, known as unitarity, into a tool for doing more precise calculations, both for processes at the LHC but also in other theories.”

“At the beginning, our goal was to refine and improve the theoretical tools that were available to experimenters in particle physics. So, we developed new and more efficient methods for doing the theoretical calculations. These new methods allowed us to do many more calculations and to reach much higher precision than was possible before,” adds **David Kosower**. “These developments allowed a new generation of researchers to continue to develop new techniques and new calculations for the LHC, but also to make connections to many other branches of physics: they revealed very intriguing connections between theories like Quantum chromodynamics and gravity.”

“When David Kosower, Lance Dixon and I started thinking about the so-called scattering amplitudes, it seemed to most people that all the important ideas had already been worked out. In the 1950s and 1960s, the topic was not of much interest, but the three of us had a different viewpoint inspired by various results,” says **Zvi Bern**. “The path to convince the community that there was something deep and interesting in scattering amplitudes was not an easy one: when we started, you could fit everyone interested in the subject in a small broom closet. But now, the problem is to find lecture halls large enough for the conferences and workshops. I always marvel at the fact that we are no longer the only ones who find joy in studying this topic.”

“I’d like to sincerely congratulate the winners of the Galileo Galilei Medal 2023 who are also great friends of the GGI. The three of them have been contributing a lot to the GGI activities with their participations to several research programs and conferences,” comments **Stefania De Curtis**, director of GGI. “The work of Bern, Dixon and Kosower, really played a central role in enhancing our ability to compare theory and experiment at particle colliders but also to extract information from gravitational wave observatories. Physicists often expect that outstanding results come from new theories arising from new principles. However, sometimes they arise from a careful reinterpretation of already known principles. This is indeed the case for the exceptional results obtained by Bern, Dixon and Kosower: a revolution in our understanding of the processes involved in particle collisions, greatly improving our ability to discover the underlying physical phenomena.”

Zvi Bern is a distinguished professor and the director of the Mani L. Bhaumik Institute for Theoretical Physics at the University of California, Los Angeles. Together with his co-recipients, he is a founder of the modern field of scattering amplitudes in quantum field theories. He contributed to various topics including supergravity, supersymmetric gauge theory, physics of the Large Hadron Collider, and most recently to gravitational-wave physics.

Lance Dixon is a professor in the Particle Theory Group at the SLAC National Accelerator Laboratory of Stanford University and a member of the U.S. National Academy of Sciences. He has held visiting positions at the University of Cambridge, Durham University, Ecole Normale Supérieure, CERN, Perimeter Institute, Caltech, ETH Zurich, and the University of Zurich. He was awarded the Sakurai Prize of the American Physical Society for his scattering amplitudes research (2014), together with Zvi Bern and David Kosower, and received the Humboldt Research Award in 2017.

David A. Kosower is researcher at the Institut de Physique Théorique of the CEA at Saclay, in France. After graduating and completing his PhD at the Harvard University, he held postdoctoral positions at Columbia University, the Fermi National Accelerator Laboratory, and CERN. He held visiting appointments at the University of Zurich, the Weizmann Institute, the California Institute of Technology, the Institute for Advanced Study, the Chinese Academy of Sciences (Beijing), and CERN. His research has been supported over the years by NATO and EGIDE collaborative grants, by the French National Research Agency (ANR), and especially by the European Research Council.

“Galileo Galilei Medal” award

INFN founded the “Galileo Galilei Medal” award in honor of the father of the scientific method and of modern physics. The award was created in 2018 when the GGI was established as an INFN National Centre for Advanced Studies, in partnership with the University of Florence. Starting from 2019, the Galileo Galilei Medal is assigned every two years by an international selection committee appointed by INFN. The medal is awarded to scientists (three at most) who, in the 25 years before the date of the award, have achieved outstanding results in the areas of theoretical physics of interest to INFN, such as fundamental interactions among elementary particles, including gravity and nuclear phenomena.

The members of the selection committee for the Galileo Galilei Medal 2023 are Eliezer Rabinovici (Hebrew University - chair), Graciela Gelmini (UCLA), Juan Martin Maldacena (Institute for Advanced Study), Michael E. Peskin (SLAC/Stanford University), Mikhail Shifman (University of Minnesota).

The Galileo Galilei Medal 2021 was awarded to Alessandra Buonanno, Thibault Damour and Frans Pretorius “for the fundamental understanding of sources of gravitational radiation by complementary analytic and numerical techniques, enabling predictions that have been confirmed by gravitational wave observations and are now key tools in this new branch of astronomy”.

While the Galileo Galilei Medal 2019 was assigned to Juan Martin Maldacena “for his ground-breaking ideas in theoretical physics, and especially for the discovery of duality between gravity and ordinary quantum field theory, with far-reaching implications.”

The Medal

The Galileo Galilei Medal was crafted by a famous Florentine workshop, Picchiani&Barlacchi, with over a century of tradition of artistic and commemorative medals, plaques and trophies.

In the laboratory the processing of the products follows traditional methods, such as the design, the creation of the plaster model, the casting and finishing of the model, the pantograph reduction, the production of the punchcutting and the coining.

The GGI

The Galileo Galilei Institute (GGI) of Florence is the first European Institute dedicated to organising and hosting advanced long term research programs dedicated to the highlights of the theoretical physics of fundamental interactions. The GGI is on the hill of Arcetri, a historically significant site for physics and astronomy, where Galileo Galilei spent the last eleven years of his life. At the GGI, which is the National Center for Advanced Studies of INFN, several PhD schools dedicated to string theory, theoretical physics of elementary particles, theoretical nuclear physics, statistical field theory, astroparticle physics and cosmology take place every year.

Galileo Galilei Medal 2023 - the video (<https://youtu.be/bqG2g1T9zrw>)

Galileo Galilei Medal 2023 - video interviews to the winners (<https://www.youtube.com/watch?v=bqG2g1T9zrw&list=PLbsqUzxZlcP6jMb4QDE9YciFF35pd3m9G>)

Press Kit with videos and images (<https://pandora.infn.it/public/46388e>)