Fundamental Science with Quantum Computers and Simulators

14.Sep - 17.Sep 2026

Cód. Z66-26

Mod.:
Presencial

Edición
2026

Tipo de actividad
Workshop

Fecha
14.Sep - 17.Sep 2026

Ubicación
Palacio Miramar

Idiomas
Inglés

Validez académica
40 horas

DIRECCIÓN

Enrique Rico Ortega, UPV/EHU - Ikerbasque

Juan José García Ripoll

Comité Organizador

Descripción

La **Escuela de Verano de la UIK, «Ciencia fundamental con ordenadores y simuladores cuánticos»**, que se celebrará en **San Sebastián/Donostia del 14 al 17 de septiembre de 2026**, ofrecerá formación avanzada sobre cómo los dispositivos cuánticos programables facilitan nuevos enfoques para los problemas fundamentales de la física. La escuela hará hincapié tanto en las perspectivas teóricas como en las experimentales, mostrando cómo se pueden utilizar los ordenadores y simuladores cuánticos para explorar la física de muchos cuerpos, el procesamiento de información cuántica y los fenómenos emergentes más allá de las capacidades de la computación clásica. Uno de los objetivos principales es fomentar la interacción y el intercambio de conocimientos entre estudiantes de posgrado, investigadores noveles y expertos internacionales destacados en el campo.

El programa cuenta con importantes plataformas experimentales, como circuitos superconductores, iones atrapados, átomos de Rydberg y sistemas atómicos ultrafríos, junto con los marcos teóricos que conectan estas plataformas con cuestiones fundamentales de la física cuántica. Los temas abarcan la simulación cuántica de sistemas fuertemente correlacionados, la mitigación y el control de errores cuánticos, los algoritmos cuánticos variacionales e híbridos, y el uso de dispositivos cuánticos a corto plazo para estudiar la dinámica de no equilibrio, el entrelazamiento y las transiciones de fase cuánticas. Los ponentes y conferenciantes confirmados, como David Hayes, Antoine Browaeys, Andreas Wallraff, Francesca Ferlaino, Luca Tagliacozzo, Pedram Roushan, Antonio Acín, Kristan Temme, Markus Müller y Hans Peter Büchler, garantizan que el programa abarque tanto las fronteras experimentales como las teóricas.

Objetivos

- Ofrecer una formación sólida, pedagógica y estructurada sobre las principales plataformas cuánticas experimentales y sus aplicaciones a la ciencia fundamental.
- Crear un espacio de interacción entre estudiantes, jóvenes investigadores y grupos punteros en átomos de Rydberg, redes ópticas, iones atrapados, circuitos superconductores y simulación cuántica en HEP.
- Promover la colaboración entre instituciones españolas e internacionales en computación y simulación cuántica.

Colaboradores específicos del curso

Dirigido por:

Enrique Rico Ortega

UPV/EHU - Ikerbasque

He estado trabajando en el campo de la física cuántica teórica en una amplia gama de temas que van desde la preparación de estados topológicos exóticos en sistemas abiertos hasta implementaciones de teorías de gauge en el retículo utilizando átomos ultrafríos. He hecho contribuciones clave a una gran cantidad de proyectos y las ideas de mi investigación con mis colaboradores han abierto nuevas direcciones en varios temas de actualidad de física cuántica en materia condensada, física atómico-molecular-óptica cuántica. Para dar un ejemplo, en mi trabajo reciente sobre la simulación cuántica de las teorías gauge en el retículo, con mis colaboradores, hemos presentado un nuevo enfoque para problemas fundamentales de la física de altas energías. En 2015 me trasladé a Bilbao con el prestigioso y competitivo puesto de investigador Ikerbasque. Actualmente tengo un puesto fijo en la UPV / EHU con un puesto de investigador asociado Ikerbasque.

Juan José García Ripoll

Juanjo García Ripoll completed a PhD in ultracold atoms and 5 years of postdoctoral work at the Max Planck Institute for Quantum Optics, in which he contributed to the early developments of quantum simulation and quantum computing. In 2008 he joined CSIC as researcher, leading investigation in quantum hardware and quantum software to operate it. He coordinates the CSIC Platform for Quantum Technologies and the Spanish Network for Quantum Information and Quantum Technologies, and has contributed to the creation of two masters programas in quantum technologies in which CSIC collaborates.

Profesorado

Antonio Acin

Antonio Acín Dal Maschio is a Spanish theoretical physicist and ICREA Research Professor at ICFO – The Institute of Photonic Sciences, where he leads the Quantum Information Theory group. He holds degrees in Physics (University of Barcelona) and Telecommunication Engineering (Polytechnic University of Catalonia), and earned his PhD in Theoretical Physics in 2001 from the University of Barcelona, followed by a postdoctoral stint at the University of Geneva. His research focuses on quantum information theory, quantum cryptography, quantum communication protocols, certification of quantum technologies, and foundational aspects of quantum physics, including quantum optics, quantum thermodynamics, and many-body physics. Acín has published extensively in high-impact journals, delivered numerous invited talks, and has been awarded multiple European Research Council grants (Starting, Proof of Concept, Consolidator, and Advanced) as well as an AXA Chair in Quantum Information Science and the Rei Jaume I Prize for Basic Research. He is recognized for pioneering work in device-independent quantum information processing and the characterization of quantum correlations.

Wallraff Andreas Joachim

ETH Zurich

Andreas J. Wallraff is a German physicist and Full Professor of Solid State Physics at ETH Zurich, where he has led research on superconducting quantum circuits and quantum information science since 2006. He holds physics degrees from Imperial College London and RWTH Aachen University and received his Ph.D. from the University of Erlangen-Nuremberg for pioneering work on vortex quantum dynamics in superconductors. As a postdoctoral researcher at Yale University, he contributed to foundational experiments demonstrating coherent interactions between single photons and quantum electronic circuits. At ETH Zurich, Wallraff’s research focuses on experimental circuit quantum electrodynamics (cQED), development of superconducting qubits, hybrid quantum systems integrating superconducting circuits with semiconductor quantum dots and Rydberg atoms, and strategies for quantum error correction. He has received numerous awards, including the Nicholas Kurti European Science Prize, an ERC Starting Grant and an ERC Advanced Grant, the ETH Zurich Max Rössler Prize, and the Helmholtz International Fellow Award. Wallraff also serves as Founding Director of the ETH Quantum Center.

Antoine Browaeys

Laboratoire Charles Fabry (UMR 8501 CNRS) - Institut d’Optique Graduate School

Antoine Browaeys is a French experimental physicist and CNRS Research Director at the Laboratoire Charles Fabry, Institut d’Optique Graduate School / Université Paris-Saclay / CNRS, where he leads the Quantum Optics – Atoms group studying many-body quantum physics with neutral atoms. He obtained his PhD in physics in 2000 at the Institut d’Optique under Alain Aspect, followed by a postdoctoral fellowship at the National Institute of Standards and Technology (USA) in the Laser Cooling group of W. D. Phillips. Browaeys’ research focuses on cooling, trapping, manipulating and observing individual cold atoms in optical tweezers to build synthetic quantum systems for exploring quantum many-body phenomena and advancing quantum information science, including scalable quantum simulators and computing platforms based on neutral atoms. His contributions have been recognized with the CNRS Silver Medal (2021), the Aimé Cotton Prize (2007), the Alfred-Verdaguer Prize, an ERC Advanced Grant, and his election to the French Academy of Sciences. He is also co-founder and scientific adviser of Pasqal, a quantum technology start-up.

Hans Peter Buechler

Prof. Dr. sc. nat. Hans Peter Büchler is a Swiss theoretical physicist and Professor of Physics at the Institute for Theoretical Physics III, University of Stuttgart, Germany, where he leads a research group on quantum many-body phenomena in cold atomic, molecular, and photonic systems. He studied physics at ETH Zürich (Diplom 1999) and completed his Ph.D. in theoretical physics under Gianni Blatter (2003) with a dissertation on phase transitions in quantum condensed matter, awarded the ETH silver medal. Following a postdoctoral fellowship with Peter Zoller at the University of Innsbruck, he joined the University of Stuttgart as a professor in 2007. His research spans quantum simulation with Rydberg atoms, topological phases, quantum error correction, and strongly correlated quantum matter, with extensive high-impact publications in Nature Physics, Phys. Rev. Lett., PRX Quantum, and other leading journals. He has secured significant funding, including ERC support, and actively collaborates on quantum technologies at the theoretical–experimental interface.

Francesca Ferlaino

Francesca Ferlaino is an Italian experimental physicist specializing in ultracold quantum matter and dipolar quantum gases. Born in Naples in 1977, she received her diploma in physics at the University of Federico II (magna cum laude) and completed her Ph.D. in 2004 at the University of Florence and the European Laboratory for Non-linear Spectroscopy (LENS) in Italy. After postdoctoral research in Innsbruck, she established the Dipolar Quantum Gases Group, achieving milestones including the world's first Bose–Einstein condensate of erbium and pioneering work on dipolar mixtures of erbium and dysprosium, supersolid states, and complex many-body quantum phenomena. Since 2014, she has been a Full Professor of Experimental Physics at the University of Innsbruck and Scientific Director at the Institute for Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Sciences. Her work has earned multiple European Research Council (ERC) grants and international awards, she was elected to the Austrian Academy of Sciences, and in 2025 was named Austria's Scientist of the Year for her contributions to quantum science and public engagement.

David Hayes

David Hayes is a quantum computing scientist and Director of Computational Design and Theory at Quantinuum, where he leads theoretical modeling of quantum operations and the architecture of high-fidelity trapped-ion quantum processors. His academic trajectory includes graduate theoretical research at the University of New Mexico and experimental work at the University of Maryland and the University of Sydney, followed by industry research roles since 2014 with Honeywell Quantum Solutions and Quantinuum. Hayes specializes in quantum error correction, quantum charge-coupled device (QCCD) architectures, and rigorous benchmarking of quantum hardware performance, contributing to fault-tolerant gate design and scalable quantum computing. He has presented at major conferences and co-authored research on trapped-ion systems and error-corrected logical operations.

Michael Meth

Michael Meth is an experimental physicist in the trapped-ion quantum optics group at the University of Innsbruck. His research focuses on precision control of atomic ions for quantum information processing, quantum simulation, and high-fidelity coherent operations. He develops and operates complex laser systems, ultra-high-vacuum apparatus, and electronic control hardware, and implements experimental protocols for state preparation, manipulation, and measurement. His work includes system optimization, noise reduction, and automation of experimental sequences, contributing to scalable and robust trapped-ion platforms. He collaborates closely with theorists and engineers, supports laboratory infrastructure, and contributes to the training of students. His interests include quantum technologies, experimental methods, and advancing reliable architectures for quantum computing and simulation.

Markus Mueller

Prof. Dr. Markus Müller is a German theoretical quantum physicist and Professor of Theoretical Quantum Technology jointly at RWTH Aachen University and Forschungszentrum Jülich, where he leads the Theoretical Quantum Technology Group focused on quantum information processing, quantum simulation, topological quantum computing, and error correction in atomic, molecular, and optical systems. He earned a Diplom in Physics from the University of Konstanz (2000–2006) and completed his PhD (Dr. rer. nat.) under Prof. Peter Zoller at the University of Innsbruck and IQOQI (2007–2011) with a thesis on many-body quantum simulation with Rydberg atoms and ions. After a postdoctoral research appointment at the Complutense University of Madrid (2011–2015), he held faculty positions at Swansea University (Senior Lecturer to Professor, 2015–2019) before taking up his current professorship in 2019. His research spans scalable quantum computing, quantum error correction, and the theory of many-body quantum physics, with numerous peer-reviewed publications in leading journals.

Pedram Roushan Roushan

Dr. Pedram Roushan is an Iranian-American physicist and Staff Research Scientist at Google Quantum AI, where he leads experimental research on Noisy Intermediate-Scale Quantum (NISQ) algorithms and quantum simulation with superconducting qubits. He received his B.S. in Physics and Mathematics from the University of Pittsburgh and his Ph.D. in Physics from Princeton University in 2011, where he performed the first scanning tunneling microscopy studies of topological insulators. After postdoctoral work on superconducting qubits at the University of California, Santa Barbara, he joined Google in 2014 and contributed to the team that demonstrated quantum computational supremacy. His research focuses on simulating complex quantum dynamics and non-equilibrium phenomena, including time crystals, topological states, measurement-induced entanglement, and non-Abelian excitations on programmable quantum processors, resulting in numerous high-impact publications in Nature and Science.

Luca Tagliacozzo -

IFF-CSIC

Luca Tagliacozzo is a tenured Scientist at the Instituto de Física Fundamental (IFF-CSIC), Madrid,

where he leads research in quantum information, many-body quantum systems, gauge theories, and tensor network methods. He holds dual PhDs from Politecnico di Torino and the University of Barcelona, and has held positions at the University of Strathclyde, University of Barcelona, University of Queensland, and ICFO. Tagliacozzo has authored 50+ peer-reviewed publications in high-impact journals, including Nature Physics, Nature Communications, Science, Physical Review X, and Physical Review Letters, on topics such as entanglement, tensor networks, and out-of-equilibrium quantum dynamics. He has supervised multiple PhD and master's students, contributes to international collaborations, and teaches tensor network methods in quantum technologies. His work advances theoretical and computational frameworks for simulating complex quantum dynamics and exploring emergent phenomena in strongly correlated systems.

Kristan Temme

Kristan Temme is a Principal Research Staff Member and Manager of the Theory of Quantum Algorithms group at IBM's T.J. Watson Research Center, where he leads research on quantum algorithms, noise in complex quantum systems, and error mitigation on near-term quantum processors. He earned a Diploma in Physics from the University of Heidelberg (2007) and a Ph.D. in Physics from the University of Vienna (2011), followed by postdoctoral fellowships at MIT (Erwin Schrödinger Fellowship, 2012–2014) and Caltech (2014–2015) before joining IBM Research in 2015. His scientific contributions span quantum error mitigation for short-depth circuits (Phys. Rev. Lett.), hardware-efficient variational quantum eigensolvers for molecular and magnet systems (Nature), quantum machine learning, and algorithms for Gibbs partition functions, with numerous peer-reviewed publications in high-impact journals. Temme's work advances both theoretical foundations and practical techniques for exploiting noisy intermediate-scale quantum (NISQ) computers and informs strategies for reliable computation in the presence of noise.

Precios matrícula

En el precio de matrícula se incluye el material del workshop, pausas-café, comidas y la cena.

ALOJAMIENTO: Se recomienda a todos los asistentes al congreso que realicen su reserva de alojamiento lo antes posible. San Sebastián es una ciudad con una alta afluencia turística durante todo el año, por lo que encontrar plazas hoteleras disponibles, especialmente a precios económicos, puede resultar complicado si se espera hasta el último momento.

- En el registro se facililita la información de OLARAIN y se proporciona un código promocional. Sólo para asistentes con el registro confirmado.

- Web oficial de alojamiento en Donostia / San Sebastián??

MATRÍCULA	HASTA 01-06-2026	HASTA 07-09-2026
Estudiante doctorando	390,00 EUR	440,00 EUR
General	440,00 EUR	440,00 EUR

Lugar

Palacio Miramar

Pº de Miraconcha nº 48. Donostia / San Sebastián

Gipuzkoa