

Mikel Sanz

Ph. D. in Physics

F. of Science and Technology
Univ. of the Basque Country
48940, Leioa,
Spain



+ 34 94 601 6013

+ 34 639 865 037

mikel.sanz.ruiz@gmail.com

Summary of the CV

I am Ramón y Cajal Researcher and Ikerbasque Fellow at the University of the Basque Country, Bilbao, where I lead the group *Quantum Computation and Architectures* since 2018, which comprises two senior and one postdoctoral researchers, and seven PhD, three Master and two Bachelor students. The two main research lines that we are developing are *quantum computing in NISQ architectures* and *microwave quantum communication and sensing*. We have close experimental collaborations in superconducting circuits and quantum photonics with R. Gross and F. Deppe at the Walther-Meissner Institute (Garching, Germany), Y. Nakamura at the University of Tokyo (Japan), B. Huard at the École Normale Supérieure de Lyon (France), and A. Wallraff at ETH Zürich (Switzerland). We are also exploring a novel research line of in-hardware engineered quantum neural networks employing quantum memristors. We have the first experimental results in superconducting platforms in collaboration with M. Mariantoni at the IQC (Waterloo, Canada), and in quantum photonics with J. Lukens at the ORNL (Tennessee, USA).

I have actively participated in several National, European and International projects. I was PI of the European FP7-ICT project *Quantum Propagating Microwaves in Strongly Coupled Environments* (PROMISCE, €294,588) and I am currently PI of the Quantum Flagship projects *Quantum Microwave Communication and Sensing* (QMICS, €317,000) and *An Open Superconducting Quantum Computer* (OpenSuperQ, €420,000), and PI of the US DoE project *Heterogeneous Digital-Analog Quantum Dynamics Simulations* (HDAQDS, \$280,000). Currently, I also have, together with Dr. Jorge Casanova, several projects with the quantum computing company *IQM Germany* on Hybrid quantum algorithms and optimization for quantum computers (€240,000).

According to Google Scholar my h-index is 26 and my i10-index is 47. My 68 articles have received over 2227 citations, more than 1883 of which happened in the last 5 years. I have submitted, on average, 9 papers per year since 2015. I have organized the international Workshops *Ultra-Strong Light-Matter Interactions* in 2016 and *Quantum Machine Learning and Biomimetic Quantum Technologies* in 2018. Recently, I have organized an IBM Quantum Hackathon in Bilbao in collaboration with IBM and Innolab Bilbao, in which I was also mentor of several groups. Additionally, I am Guest Editor of a special issue entitled *Quantum Machine Learning and Biomimetic Quantum Technologies* in the prestigious journal *Advanced Quantum Technologies*, referee of multiple peer reviewed journals, secretary-treasurer of the Basque division of the Spanish Royal Physics Society (RSEF), and evaluator of the Polish National Science Center since September 2018.

Furthermore, I enjoy being deeply involved in the education of young researchers. Proof of this is that, in the last few years, I have supervised 13 Bachelor theses, some of them published as papers, 10 Master theses, and I am currently the official supervisor of 7 PhD students. I also have teaching experience at undergraduate level at the TU Munich.

Education

- Technische Universität München, Munich, Germany – **Ph. D. in Physics**, 2011
- Universidad Autónoma Madrid, Madrid, Spain – **M. Sc. in Theor. Physics**, 2008
- Technische Universität München, Munich, Germany – **Dipl.-Phys.**, 2007
- University of Basque Country, Bilbao, Spain – **Lic. Fis.**, 2005

Experience and Research

Ikerbasque Fellow, University of the Basque Country; Bilbao, Spain – 2020-present

Tenure-track position at the University of the Basque Country - Sep. 2020-present

Head of Quantum Finance, IQM Germany; Munich, Germany – 2020-present

Leading the department of application of quantum computing to Finance at IQM, the leading European company in quantum computing software and hardware - Jun. 2020-present

Group Leader, University of the Basque Country; Bilbao, Spain – 2018-present

Leading the group on Microwaves Quantum Technologies and Architectures - Aug. 2018-present

Postdoctoral Researcher, University of the Basque Country; Bilbao, Spain – 2013-present

QUTIS Center (Prof. E. Solano), Quantum Simulations, Quantum Computing, Quantum Biomimetics, Superconducting Circuits, Propagating Quantum Microwaves - Mar. 2013-present

Mida's Comparatives; Bilbao-Geneva, Spain-Switzerland – 2012-2013

CEO & Researcher, Algorithms and Rating Agencies evaluation- Jun. 2012 – Feb. 2013

Ph. D., Max-Planck Inst. for Quantum Optics; Munich, Germany – 2006-2010

Theory Division (supervisor Hon. Prof. Dr. J. I. Cirac). Acad. title: *Doktor der Naturwissenschaften (Dr. rer. nat.)*. Topic: *Tensor Networks in Condensed Matter*. Grade: *Cum Laude*.

Postgraduate Student, CSIC; Madrid, Spain – 2005-2006

Institute of the Structure of Matter (Prof. J. Bermejo & Dr. C. Cabrillo). Grant I3P-CSIC. Nanotubes and algorithms. Topic: *Large Matrix Inversion via a Monte-Carlo Algorithm*.

Teaching Experience

Tutorial assistant, Technische Universität München, Germany – 2007-2008

Faculty of Physics - Sep. 2007 - Jun. 2008 (two semesters). Theoretische Physik 4A (Quantenmechanik II) - WS and Theoretische Physik 1 (Mechanik) - SS

Bachelor Theses Supervisor, University of the Basque Country, Spain – 2015-2021

Faculty of Science and Technology – I have supervised 13 Bachelor Theses: Nikolaus Rath. (Jacobs University Bremen, 2008), Hodei Eneriz (2015), Ibai Zabala (2016), Cristian Romero (2016), Jon Cipitria (2018), Bruno Candelas (2018), Borja Ramón (Physics and Electronic Engineering, 2019), Asier Galicia (2019, he won the *Excellence Fellowship* of the Basque Government and published a paper), Asier Izquierdo (2019), and Rubén Ibarrondo (Physics and Electronic Engineering, 2020, for which he has won the competitive *Ikasiker Grant*, and published a paper). I am currently supervising the Bachelor theses of Julen Uribecheberria and Iñaki Iriarte.

Master Theses Supervisor, University of the Basque Country, Spain – 2015-2021

Faculty of Science and Technology – I have supervised 10 Master Theses: Paul Pfeiffer (co-supervision, LMU, 2015), Hodei Eneriz (2016), Tasio González-Raya (2018), Francisco Horta (co-supervision, University of Lisbon, 2018), Dennis Portmann (2018), Bruno Candelas (2019), and Borja Ramón and Paula García (2020). I'm currently supervising the master theses of Rubén Ibarrondo, Gabriel Marín and Mikel García de Andoin.

PhD Theses Supervisor, University of the Basque Country, Spain – 2018-2021

Faculty of Science and Technology – I have supervised the day-to-day Theses of Roberto di Candia and Urtzi Las Heras, and I am currently officially supervising Tasio González-Raya, Ana Martín, Giancarlo Gatti, Javier Gonzalez-Conde, Rubén Ibarrondo, Maximilian Reichert, and Mikel García de Andoin.

R&D Projects

As PI of the project

- **Hybrid quantum algorithms and optimization for quantum computers.** Project with the company IQM Germany (17/06/2020-30/07/2021). €120,000 (My part €60,000)
- **Generating quantum algorithms and quantum processor optimization.** Project with the company IQM Germany (01/08/2021-30/07/2022). €60,000
- **Quantum Microwaves for Communication and Sensing (QMICS).** FET-FLAG Project (01/10/2018-31/03/2022). €317,500
- **An Open Superconducting Quantum Computer (OpenSuperQ).** FET-FLAG Project (01/10/2018-31/03/2022). €420,000
- **Heterogeneous Digital-Analog Quantum Dynamics Simulations (HDAQDS).** US DoE Project (07/11/2017-06/09/2020). \$290,000
- **Propagating Microwaves in Strongly Coupled Environments (PROMISCE).** FET-OPEN Project (01/04/2012-30/09/2015). €294,588 (I play the role of co-PI from 2013 on)
- **Quantum Technologies (QUANTEK).** Elkartek Project (01/08/2021-31/12/2022). €132,098

As team member and active participant

- **Electronic-Photonic Integrated Quantum (EPIQuS).** FET-OPEN Project (01/10/2020-30/09/2023). € 297,750
- **Neuromorphic Quantum Computing (QuroMorphic).** FET-OPEN Project (01/06/2019-30/05/2022). € 304,750
- **Quantum Information, Science, and Technology (QulnST II).** Basque Government Project (01/01/20016-31/12/2021). €796,000
- **Quantum Information with Quantum Technologies.** MINECO Project (01/01/2016-31/12/2018). €106,722
- **Ultra-Strong Light-Matter Interactions: Theory and Applications to Quantum Information.** UPV-EHU Project (21/09/20016-21/03/2017). €4,000
- **Scalable Superconducting Processors for Entangled Quantum Information (SCALEQIT).** FET-OPEN Project (01/04/2013-31/01/2016). €298,990
- **Circuit Quantum Electrodynamics.** MINECO Project (01/02/2013-31/12/2018). €41,000
- **Circuit and Cavity Quantum Electrodynamics (CCQED).** ITN Marie Curie Project (01/01/2011-31/12/2015). €451,959.20
- **Quantum Information, Science, and Technology (QulnST).** Basque Government Project (01/01/2010-31/12/2015). €562,000

- **Solid State Systems for Information Processing** (SOLID). FET-OPEN Project (01/02/2010-30/09/2013). €220,380

Impact - Technology Transfer

Through the project Hybrid quantum algorithms and optimization for quantum computers with the quantum computing company IQM Germany, we have a licensing and patenting agreement since June 2020. I have already a **European patent** application called *Quantum Computer-Implemented Method for Solving a Partial Differential Equation* (Appl. Number EP20382822 of the 17.09.2020). We are currently applying for another patent.

Awards and Recognitions

- Awarded with the **Ikerbasque Fellow** tenure track in 2020.
- **Evaluator** for the *National Science Center* in Poland and of the *Quantum Center* in Trento (Italy).
- **Guest Editor** of special issue entitled *Quantum Machine Learning and Biomimetic Quantum Technologies* in the journal *Advanced Quantum Technologies* (Wiley).
- **Secretary-Treasurer** of the Basque Country section of the *Spanish Royal Society of Physics*. Among other tasks, I organize the local stage of the Olympiads of Physics.
- **Referee** of scientific journals of ISI (indexed) in Mathematics and Physics, among them *Nature Communications*, *npj Quantum Information*, *Physical Review Letters*, *Physical Review X*, *A* and *B*, *Review of Modern Physics*, *Scientific Reports*, several *IEEE* journals and *Communications of Mathematical Physics*.
- **Fellow** of Program of Excellence *Quantum Computing, Control and Communication* of the Elite NetzWerk Bayern (2006-2010).
- **Grantee** of the prestigious PhD Fellowships FPU (Ministry of Science) and I3P (CSIC).
- Highest grade out of the students of the class of 2005 at the Faculty of Physics of the *University of Basque Country*. Awarded with the *Premio Extraordinario de Licenciatura* (Special Price for Outstanding Academic Achievement).

Publications

ORCID: [0000-0003-1615-9035](https://orcid.org/0000-0003-1615-9035).

ResearcherID: [A-8731-2019](https://orcid.org/A-8731-2019).

Complete list of publications in ArXiv: https://arxiv.org/a/sanz_m_1.html

- D. Pérez-García, M. M. Wolf, M. Sanz, F. Verstraete, and J. I. Cirac. *String order and symmetries in quantum spin lattices*. *Phys. Rev. Lett.* **100**, 167202 (2008).
- M. Sanz, M. M. Wolf, D. Pérez-García, and J. I. Cirac. *Matrix product states: Symmetries and two-body Hamiltonians*. *Phys. Rev. A* **79**, 042308 (2009).
- D. Pérez-García, M. Sanz, C. E. González-Guillén, M. M. Wolf, and J. I. Cirac. *Characterizing symmetries in a projected entangled pair state*. *New J. Phys.* **12**, 025010 (2010).
- M. Sanz, D. Pérez-García, M. M. Wolf, and J. I. Cirac. *A quantum version of Wielandt's inequality*. *IEEE Transactions on Information Theory* **56**, 4668 (2010).
- H. -H. Tu and M. Sanz. *Exact renormalization in quantum spin chains*. *Phys. Rev. B* **82**, 104404 (2010).
- A. Cadorso, M. Sanz, M. M. Wolf, J. I. Cirac, and D. Pérez-García. *Entanglement, fractional magnetization and long-range interactions*. *Phys. Rev. B* **87**, 035114 (2013).

- S. Felicetti, M. Sanz, L. Lamata, G. Romero, G. Johansson, P. Delsing, and E. Solano, *Dynamical Casimir effect entangles artificial atoms*. Phys. Rev. Lett. **113**, 093602 (2014).
- U. Alvarez-Rodriguez, M. Sanz, L. Lamata, and E. Solano, *Biomimetic Cloning of Quantum Observables*. Sci. Rep. **4**, 4910 (2014).
- U. Alvarez-Rodriguez, M. Sanz, L. Lamata, E. Solano, *The Forbidden Quantum Adder*. Sci. Rep. **5**, 11983 (2015).
- M. Sanz, E. Solano, and I. L. Egusquiza. *Beyond adiabatic elimination: Effective Hamiltonians and singular perturbation*. Chapter in R. S. Anderssen et al. (eds.), Mathematics for Industry 11 (Springer Japan, 2015).
- R. Di Candia, et. al. *Quantum teleportation of propagating quantum microwaves*. EPJ Quantum Technology **2**, 25 (2015).
- A. Mezzacapo, M. Sanz, L. Lamata, I. L. Egusquiza, S. Succì, and E. Solano. *Quantum Simulator for Transport Phenomena in Fluid Flows*. Sci. Rep. **5**, 13153 (2015).
- D. Z. Rossatto, S. Felicetti, H. Eneriz, E. Rico, M. Sanz, E. Solano, *Entangling polaritons via dynamical Casimir effect in circuit quantum electrodynamics*. Phys. Rev. B **93**, 094514 (2016).
- P. Pfeiffer, I. L. Egusquiza, M. di Ventra, M. Sanz, E. Solano, *Quantum memristors*. Sci. Rep. **6**, 29507 (2016).
- U. Las Heras, U. Alvarez-Rodriguez, E. Solano, and M. Sanz, *Genetic Algorithms for Digital Quantum Simulations*. Phys. Rev. Lett. **116**, 230504 (2016).
- L. García-Álvarez, U. Las Heras, A. Mezzacapo, M. Sanz, E. Solano, and L. Lamata. *Quantum chemistry and charge transport in biomolecules with superconducting circuits*. Sci. Rep. **6**, 27836 (2016).
- K. G. Fedorov, et. al. *Displacement of propagating squeezed microwave states*. Phys. Rev. Lett. **117**, 020502 (2016).
- M. Sanz, I. L. Egusquiza, R. Di Candia, H. Saberì, L. Lamata, and E. Solano, *Entanglement classification with matrix product states*. Sci. Rep. **6**, 30188 (2016).
- U. Alvarez-Rodriguez, M. Sanz, L. Lamata, and E. Solano, *Artificial Life in Quantum Technologies*. Sci. Rep. **6**, 20956 (2016).
- R. Sweke, M. Sanz, I. Sinayskiy, F. Petruccione, and E. Solano. *Digital quantum simulation of many-body non-Markovian dynamics*. Phys. Rev. A **94**, 022317 (2016).
- M. Sanz, U. Las Heras, J. J. Garcia-Ripoll, E. Solano, and R. Di Candia, *Quantum Estimation Methods for Quantum Illumination*. Phys. Rev. Lett. **118**, 070803 (2017).
- J. Salmilehto, F. Deppe, M. di Ventra, M. Sanz, and E. Solano, *Quantum memristors with superconducting circuits*. Sci. Rep. **7**, 42044 (2017).
- U. Alvarez-Rodriguez, R. Di Candia, J. Casanova, M. Sanz, and E. Solano, *Algorithmic quantum simulation of memory effects*. Phys. Rev. A **95**, 020301R (2017).
- U. Alvarez-Rodriguez, A. Perez-Leija, I. L. Egusquiza, M. Gräfe, M. Sanz, L. Lamata, A. Szameit, and E. Solano, *Advanced-Retarded Differential Equations in Quantum Photonic Systems*. Sci. Rep. **7**, 42933 (2017).
- D. Z. Rossatto, C. J. Villas-Bôas, M. Sanz, and E. Solano, *Spectral Classification of Coupling Regimes in the Quantum Rabi Model*. Phys. Rev. A **96**, 013849 (2017).

- G. Gatti, D. Barberena, M. Sanz, and E. Solano, *Protected State Transfer via an Approximate Quantum Adder*. Sci. Rep. **7**, 6967 (2017).
- M. Sanz, D. Braak, E. Solano, and I. L. Egusquiza, *Entanglement Classification with Algebraic Geometry*. J. Phys. A: Math. Theor. **50**, 195303 (2017).
- U. Las Heras, R. Di Candia, K. G. Fedorov, F. Deppe, M. Sanz, and E. Solano, *Quantum illumination reveals phase-shift inducing cloaking*. Sci. Rep. **7**, 9333 (2017).
- M. Sanz, L. Lamata, E. Solano, *Quantum Memristors in Quantum Photonics*. APL Photonics **3**, 080801 (2018).
- L. Lamata, A. Parra-Rodriguez, M. Sanz, and E. Solano, *Digital-Analog Quantum Simulations with Superconducting Circuits*. Advances in Physics: X **3**, 1457981 (2018).
- N. Klcó, et. al., *Quantum-Classical Computation of Schwinger Model Dynamics using Quantum Computers*. Phys. Rev. A **98**, 032331 (2018).
- K. G. Fedorov, et. al. *Finite-time quantum entanglement in propagating squeezed microwaves*. Sci. Rep. **8**, 6416 (2018).
- F. Albarrán-Arriagada, G. Alvarado-Barrios, M. Sanz, G. Romero, L. Lamata, J. C. Retamal, and E. Solano, *One-way quantum computing in superconducting circuits*. Phys. Rev. A **97**, 032320 (2018).
- M. Sanz, W. Wieczorek, S. Gröblacher, and E. Solano, *Electro-mechanical Casimir effect*. Quantum **2**, 91 (2018).
- U. Alvarez-Rodriguez, M. Sanz, L. Lamata, and E. Solano, *Quantum Artificial Life in an IBM Quantum Computer*. Sci. Rep. **8**, 14793 (2018).
- M. Sanz, K. G. Fedorov, F. Deppe, and E. Solano, *Challenges in Open-air Microwave Quantum Communication and Sensing*. 2018 IEEE Conference on Antenna Measurements & Applications (CAMA), Västerås, Sweden.
- M. Capela, M. Sanz, E. Solano, and L. C. Céleri, *Kolmogorov-Sinai entropy and dissipation in driven classical Hamiltonian systems*. Phys. Rev. E **98**, 052109 (2018).
- L. Lamata, U. Alvarez-Rodriguez, J. D. Martín-Guerrero, M. Sanz, and E. Solano, *Quantum autoencoders via quantum adders with genetic algorithms*. Quantum Sci. Technol. **4**, 014007 (2019).
- F. A. Cárdenas-López, M. Sanz, J. C. Retamal, E. Solano, *Enhanced Quantum Synchronization via Quantum Machine Learning*. Adv. Quantum Technol. 1800076 (2019).
- Y. Ding, L. Lamata, M. Sanz, X. Chen, and E. Solano, *Experimental Implementation of a Quantum Autoencoder via Quantum Adders*. Adv. Quantum Technol. 1800065 (2019).
- S. Pogorzalek, et. al. *Secure quantum remote state preparation of squeezed microwave states*. Nat. Commun. **10**, 2604 (2019).
- T. Gonzalez-Raya, X.-H. Cheng, I. L. Egusquiza, X. Chen, M. Sanz, E. Solano, *Quantized Hodgkin-Huxley Model for Quantum Neurons*. Phys. Rev. Applied **12**, 014037 (2019).
- G. Alvarado Barrios, J. C. Retamal, E. Solano, and M. Sanz, *Analog simulator of integro-differential equations with classical memristors*. Scientific Reports **9**, 12928 (2019).
- Y. Ding, J. D. Martín-Guerrero, M. Sanz, R. Magdalena-Benedicto, X. Chen, E. Solano, *Retrieving Quantum Information with Active Learning*. Phys. Rev. Lett. **124**, 140504 (2020).

- H. Eneriz, D. Z. Rossatto, E. Solano, and M. Sanz, *Degree of Quantumness in Quantum Synchronization*. Scientific Reports **9**, 19933 (2019).
- F. Silva, M. Sanz, J. Seixas, E. Solano, and Y. Omar, *Perceptrons from Memristors*. Neural Networks **122**, 273 (2020).
- A. Martin, L. Lamata, E. Solano, and M. Sanz, *Digital-analog quantum algorithm for the quantum Fourier transform*. Physical Review Research **2**, 013012 (2020).
- T. Gonzalez-Raya, E. Solano, and M. Sanz, *Quantized Three-Ion-Channel Neuron Model for Neural Action Potentials*. Quantum **4**, 224 (2020).
- T. Gonzalez-Raya, J. M. Lukens, L. C. Céleri and M. Sanz, *Quantum Memristors in Frequency-Entangled Optical Fields*. Materials **13**, 864 (2020).
- A. Parra-Rodriguez, P. Lougovski, L. Lamata, E. Solano, and M. Sanz, *Digital-Analog Quantum Computation*. Phys. Rev. A **101**, 022305 (2020).
- D. Headley, T. Müller, A. Martin, E. Solano, M. Sanz, and F. K. Wilhelm, *Approximating the Quantum Approximate Optimisation Algorithm*. ArXiv preprint: 2002.12215 (2020).
- F. Hu, L. Lamata, M. Sanz, X. Chen, X. Chen, C. Wang, and E. Solano, *Quantum computing cryptography: Unveiling cryptographic Boolean functions with quantum annealing*. Phys. Lett. A **384**, 126214 (2020).
- F. Hu, L. Lamata, C. Wang, X. Chen, E. Solano, and M. Sanz, *Quantum Advantage in Cryptography with a Low-Connectivity Quantum Annealer*. Phys. Rev. Applied **13**, 054062 (2020).
- R. Ibarrondo, M. Sanz, and R. Orus, *Forecasting Election Polls with Spin Systems*. ArXiv preprint: 2007.05070 (2020).
- A. Galicia, B. Ramon, E. Solano, and M. Sanz, *Enhanced connectivity of quantum hardware with digital-analog control*. Phys. Rev. Research **2**, 033103 (2020).
- B. O. Goes, G. T. Landi, E. Solano, M. Sanz, and L. C. Céleri, *Wehrl entropy production rate across a dynamical quantum phase transition*. Phys. Rev. Research **2**, 033419 (2020).
- T. Gonzalez-Raya and M. Sanz, *Coplanar Antenna Design for Microwave Entangled Signals Propagating in Open Air*. ArXiv preprint: 2009.03021 (2020).
- M. Casariego, Y. Omar, and M. Sanz, *Bi-frequency illumination: a quantum-enhanced protocol*. ArXiv preprint: 2010.15097 (2020).
- Y. Ding, L. Lamata, J. D. Martín-Guerrero, E. Lizaso, S. Mugel, X. Chen, R. Orús, E. Solano, and M. Sanz, *Towards Prediction of Financial Crashes with a D-Wave Quantum Computer*. ArXiv preprint: 1904.05808. Accepted in Quantum Information Processing.
- Y. Ding, X. Chen, L. Lamata, E. Solano, and M. Sanz, *Implementation of a Hybrid Classical-Quantum Annealing Algorithm For Logistic Network Design*. SN Comput. Sci. **2**, 68 (2021).
- J. Gonzalez-Conde, Á. Rodríguez-Rozas, E. Solano, and M. Sanz, *Pricing Financial Derivatives with Exponential Quantum Speedup*. ArXiv preprint: 2101.04023 (2021).
- N. N. Hegade, K. Paul, Y. Ding, M. Sanz, F. Albarrán-Arriagada, E. Solano, and X. Chen, *Shortcuts to Adiabaticity in Digitized Adiabatic Quantum Computing*. Phys. Rev. Applied **15**, 024038 (2021).

- A. Martin, B. Candelas, Á. Rodríguez-Rozas, J. D. Martín-Guerrero, X. Chen, L. Lamata, R. Orús, E. Solano, and M. Sanz, *Towards Pricing Financial Derivatives with an IBM Quantum Computer*. Phys. Rev. Research **3**, 013167 (2021).
- G. Gatti, D. Huerga, E. Solano, and M. Sanz, Random access codes via quantum contextual redundancy. ArXiv preprint: 2103.01204 (2021).
- L. C. Céleri, D. Huerga, F. Albarrán-Arriagada, E. Solano, and M. Sanz, Digital-analog quantum simulation of fermionic models. ArXiv preprint: 2103.15689 (2021).
- J. Yu, J. C. Retamal, M. Sanz, E. Solano, and F. Albarrán-Arriagada, Superconducting Circuit Architecture for Digital-Analog Quantum Computing. ArXiv preprint: 2103.15696 (2021).
- T. Gonzalez-Raya, R. Asensio-Perea, A. Martin, L. C. Céleri, M. Sanz, P. Lougovski, and E. F. Dumitrescu. Digital-Analog Quantum Simulations Using The Cross-Resonance Effect. PRX Quantum **2**, 020328 (2021).
- P. García-Molina, A. Martin, and Mikel Sanz. Noise in Digital and Digital-Analog Quantum Computation. ArXiv preprint: 2107.12969 (2021).

Conferences and Workshops

Organizer	Co-organizer of ICE-6 · Madrid (ES), May. 2022
	Co-organizer of the ICE-5 2021
	Bilbao Qiskit Quantum Hackathon · Bilbao (ES), Dec. 2019
	Quantum Machine Learning & Biomimetic Quantum Technologies · Bilbao (ES), Mar. 2018
	Ultra-Strong Light-Matter Interaction · Bilbao (ES), Sep. 2016
	II QCCC Workshop · Bad Tölz (DE), Oct. 2009
	I QCCC Workshop · Aschau (DE), Oct. 2007
Speaker	I have given over 30 talks in International Workshops and Congresses, around 17 of which have been invited talks. My most prestigious contribution was an invited talk at the APS March Meeting in Boston (2019) and an invited talk by the Editorial Board of Nature Publishing Group (2020). Additionally, I have given over 40 invited seminars in different groups worldwide.

Languages

Spanish	Mother tongue	
English	Proficient user*	
Portuguese	Advanced user*	
German	Independent user*	* Common European Framework of Reference
Basque	Independent user*	

Skills

Computer	<i>IBM Diploma</i> in computer programming: Pascal, C++, Functional programming with Mathematica · Matlab · LaTeX · Office
Free time	Basic music skills · biking · mountaineering · swimming · finances