MIGUEL ÁNGEL **SÁNCHEZ-MARTÍNEZ**

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Short Biography

I completed my Master's degree in Theoretical Physics at the Complutense University of Madrid, specializing in non-abelian gauge theories on high-energy physics. Shortly after this, I became more interested in the Condensed Matter realm during my studies at the Autonomous University of Barcelona.

I joined Dr. Adolfo G. Grushin's group at Néel Institute in Grenoble to do my PhD in Condensed Matter Physics as a Marie Curie fellow, working on theoretical aspects of topological materials. I developed a theoretical characterization of optical responses in multifold semimetals in close collaboration with experimentalists. In 2022, this work received the Springer Theses award and it was published as a book in the Springer Theses series.

I worked as a Research Intern at Microsoft Station Q in Santa Barbara, California, studying non-equilibrium quantum field theory methods to compute the charge state of topological superconducting islands. After this, I studied optical responses of superconducting phases as a postdoctoral researcher at the Donostia International Physics Center in Dr. Fernando de Juan's group. I am currently working as a Research Associate with Dr. Felix Flicker at the University of Bristol studying topological quasiparticles in quasicrystals and correlation effects in cuprates giving rise to acoustic plasmons.

Scientific Trajectory

2023-Present — **Postdoctoral Research Associate at the University of Bristol** in Dr Felix Flicker's Group. Funded by the EPSRC grant *Exact Results in Aperiodic Systems*.

Research topic: Topological properties and interaction effects in aperiodic systems: topologically-protected excitations in quasicrystals.

2022-2023 — **Postdoctoral Researcher at Donostia International Physics Center (DIPC)** in Dr Fernando de Juan's Group. San Sebastián, Spain.

Research topic: Optical properties and chiral superconductivity in Transition Metal Dichalcogenides.

2018-2021 — **PhD in Condensed Matter Physics by the Université Grenoble Alpes.** Marie Curie fellow with GreQue PhD fellowship at Néel Institute, CNRS. Thesis advisors: Dr Adolfo G. Grushin and Dr Serge Florens.

Title: Linear and nonlinear optical responses of chiral multifold semimetals.

Thesis Award: *Springer Theses* 2022.

03-06/2020 — **Research Intern** at Microsoft Station Q, Santa Barbara.

Research topic: Charge dynamics of a charged superconducting island proximity-coupled to metallic leads. Quantum Transport in Majorana systems.

10-12/2019 — **Industrial Secondment of GreQue PhD Fellowship.** Microsoft Station Q, Santa Barbara. Supervisors: Dr Andrey Antipov.

2016-2017 — **Severo Ochoa Excellence Program Fellowship Awardee.** Catalan Insitute of Nanoscience and Nanotechnology (ICN2), Barcelona.

2016 — **Master's Degree in Theoretical Physics.** Complutense University of Madrid, Madrid.

Scientific Production

Research papers

1: M. Á. Sánchez-Martínez, B. Gouteraux, L. Rademaker, F. Flicker. **Momentum-gapped quasiparticles in disordered metals.** *arXiv:2603.17002* (2026), doi: 10.48550/arXiv.2603.17002.

2: W. Caiger, F. Flicker, M. Á. Sánchez-Martínez†. **Fractal Topology of Majoraba Bound States in Superconducting Quasicrystals.** *arXiv:2602.02796* (2026), doi: 10.48550/arXiv.2602.02796.

3: M. Á. Sánchez-Martínez, I. C. Fulga, D. Varjas, A. G. Grushin, F. Flicker. **Giant Optical Response of Multi-Weyl fermions stabilized by quasicrystalline symmetries.** *In preparation, submission in Q1 2026.*

4: M. Á. Sánchez-Martínez†, D. Muñoz-Segovia, F. de Juan. **Optical probes of unconventional pairing states in transition metal dichalcogenides.** Physical Review B, 113, 054528 (2026), https://doi.org/10.1103/s1wd-25dz.

5: H. Takahashi, J. Murphy, M. Wood-Thanan, P. Puphal, M. Á. Sánchez-Martínez, F. Jerzembeck, C.C. Hsu, J. Ward, M. Isobe, Y. Matsumoto, H. Takagi, S. Blundell, M. Norman, F. Flicker, J.C. Séamus Davis. **Spinon Mediation of Witness-Spin Dynamics and Ground State in Herbertsmithite.** *arXiv:2510.11678* (2025), doi: 10.48550/arXiv.2510.11678. *Accetped in Nat. Phys. on 02/2026.*

6: B. Lu, S. Sayyad, M. Á. Sánchez-Martínez, K.Manna, C. Felser, A. G. Grushin, D. Torchinski. **Second-harmonic generation in the topological multifold semimetal RhSi.** *Phys. Rev. Research,* 4, L022022 (2022), doi: 10.1103/PhysRevResearch.4.L022022.

7: Z. Ni, B. Xu, M. Á. Sánchez-Martínez, Y. Zhang, K. Manna, C. Bernhard, J.W.F. Venderbos, F. de Juan, C. Felser, A.G. Grushin, Liang Wu. **Linear and nonlinear optical responses in the chiral multifold semimetal RhSi**, npj Quantum Mater, 5, 96 (2020). doi:10.1038/s41535-020-00187-y.

8: B. Xu*, Z. Fang*, M. Á. Sánchez-Martínez*, J.W.F. Venderbos, Z. Ni, T. Qiu, K. Manna, W. Wang, J. Paglione, C. Bernhard, C. Felser, E.J. Mele, A.G. Grushin, A.M. Rappe, Liang Wu. **Optical signatures of multi fold fermions in the chiral topological semimetal CoSi**, *Proceedings of the National Academy of Sciences*, 202010752 (2020). doi:10.1073/pnas.2010752117.

9: M.-Á. Sánchez-Martínez*, I. Robredo*, A. Bidaurrazaga, A. Bergara, F. de Juan, A.G. Grushin and M.G. Vergniory. **Spectral and optical properties of $Ag_3Au(Se_2,Te_2)$ and dark matter detection.** *J. Phys. Mater.*, 3, 014001 (2019). doi:10.1088/2515-7639/ab3ea2.

10: M.-Á. Sánchez-Martínez, F. de Juan, and A. G. Grushin. **Linear optical conductivity of chiral multifold fermions.** *Phys. Rev. B*, 99, 155145 (2019). doi:10.1103/PhysRevB.99.155145.

11: M.-Á. Sánchez-Martínez, F. Alzina, J. Oyarzo, C.M. Sotomayor Torres and E. Chavez-Angel, **Impact of the Regularization Parameter in the Mean Free Path Reconstruction Method: Nanoscale Heat Transport and Beyond**, *Nanomaterials*, 9, 414 (2019). doi:10.3390/nano9030414.

**Equally contributing authors*

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Books

1: M. Á. Sánchez-Martínez. Linear and nonlinear optical responses of chiral multifold semimetals (Cham, Switzerland: *Springer Theses Series,* Springer-Nature, 2023).

Invited talks

1: Superconductors, Disorder, Interactions and Quantum Technologies (SDIQT25). *Optical probes of topological systems: semimetals, superconductors and quasicrystals.* 11/06/2025

2: University of Geneva, invited by Prof. Louk Rademaker. *Unraveling Pines' Demon in Sr2RuO4.* 13/06/2024

3: Nanyang Technological University invited by Prof. Justin Song: *Linear and nonlinear optical responses of chiral multifold semimetals.* Virtual. 09/2021.

Selected conferences, schools, and workshops

1: APS March Meeting 2026. **Oral presentation**. Session MAR-S33. *A momentum-gapped collective mode in Nature: Pines' demon in Sr2RuO4.* Denver, Colorado. 03/2026.

2: SDIQT25 International Workshop. **Poster presentation by Will Caiger**: *Abundance of Majorana modes in quasicrystals,* W. Caiger, N. Girish, F. Flicker, M.Á. Sánchez-Martínez. Salamanca, Spain. 06/2025.

3: NGSCES 2024 International Conference. **Oral presentation**: *Linear optical response of chiral multifold fermions.* Girona, Spain. 10/2024.

4: Electrons, Photons and Plasmons 2024 International Workshop. **Poster presentation**: *Unraveling Pines' demon in Sr2RuO4.* Nyon, Switzerlad. 06/2024.

5: Condensed Matter Physics in the City 2024. **Oral presentation**: *Unraveling Pines' demon in Sr2RuO4.* Nyon, Switzerlad. 06/2024.

6: APS March Meeting 2023. **Oral presentation**. Session M25. *Fingerprints of multifold fermions in optics: linear and nonlinear optical responses of CoSi and RhSi.* Las Vegas, Nevada. 03/2023.

7: GEFES 2023. XII meeting of the Condensed Matter Division of the Spanish Royal Physics Society. **Poster presentation**: *Unconventional fermions and where to find them: linear and nonlinear optical responses of multifold semimetals CoSi and RhSi.* Salamanca, Spain. 23/2023.

8: International Focus Workshop in Topological Materials: From Weak to Strong Correlations. **Oral presentation**: *Unconventional fermions and how to find them: optical probes of chiral multifold semimetals.* **Poster presentation**: *Linear and nonlinear optical responses of chiral multifold semimetals.* Max Planck Institute for the Physics of Complex Systems, Dresden, Germany. 04/2022.

9: APS March meeting 2022. Live **oral presentation**. Session Y59: *Linear and nolinear optical responses of chiral multifold semimetals.* Sponsored by the Marie Curie Alumni Asociation through the Micro Travel Grants program, and the SCHINEs project. Chicago, Illinois. 03/2022.

10: LEES 2021: Internation conference on Low Energy Electrodynamics in Solids. Live **poster presentation**: *Optical signatures of multifold fermions in the chiral topological semimetals RhSi and CoSi.* Virtual. 06-07/2021.

11: APS March meeting 2021. Live **oral presentation**. Session A45: *Optical signatures of multifold fermions in the chiral topological semimetals RhSi and CoSi.* Virtual. 03/2021.

12: Dynamics of Emerging Quasiparticles in Topological Dirac Materials (731 WE-Heraeus seminar). **Poster presentation**: *Linear optical conductivity of the chiral multifold semimetal RhSi.* Physikzentrum Bad Honnef, Germany. 10/2020.

13: CMD 2020 GEFES. Biennial meeting of the Condensed Matter Divisions of the Spanish Royal Physics Society (RSEF-GEFES) and of the European Physical Society (EPS-CMD). **Poster presentation**: *Optical conductivity of the multifold semimetal RhSi.* Virtual. 08-09/2020.

14: Microsoft Station Q Research Intern Talk. **Oral presentation**: *Charge dynamics of metallic and superconducting islands coupled to metallic leads*. Microsoft Station Q, Santa Barbara, California. 06/2020.

15: Spin and Heat Transport in Quantum and Topological Materials program. Presentation of the **Blackboard Seminar**: *Multifold fermions in conventional crystals*. Kavli Institute for Theoretical Physics, Santa Barbara, California. 10-12/2019.

16: Ultrafast and Nonlinear Dynamics of Quantum Materials. **Poster presentation**: *Linear optical response of chiral multifold fermions*. University of Paris-Diderot, Paris, France. 06/2019.

17: NGSCES 2018 International Conference. **Oral presentation**: *Linear optical response of chiral multifold fermions*. Donostia-San Sebastián, Spain. 09/2018.

18: LETI innovation days, 2nd quantum engineering day. **Poster presentation**: *A paradigm for anomalies and non-linear responses in topological matter*. Grenoble, France. 06/07/2018.

19: 3rd Scientific Meeting of BCN-b PhD students in Nanoscience. **Oral presentation**: *The role of the reconstruction parameter in the MFP reconstruction technque*. Autonomous University of Barcelona, Barcelona, Spain. 07-08/11/2017.

20: III Severo Ochoa Scientific Workshop. **Oral presentation**: *Impact of the regularization parameter in the MFP reconstruction technique*. ICN2, Barcelona, Spain. 12-13/06/2017.

21: Wave phenomena and phonon thermal transport. **Poster presentation**: *Dependence of the accumulation function on the regularization parameter in the MFP reconstruction technique*. Oléron, France. 03-08/06/2017.

22: III Doctoral Conference of the University of Murcia. **Oral presentation**: *Perturbative quantization of Yang-Mills theory with the classical double of su(N) as a symmetry algebra*. University of Murcia, Murcia, Spain. 30/05/2017-01/06/2017.

23: E-MRS Spring Meeting 2017. **Poster presentation**: *Study of the impact of the regularization parameter in the phonon mean free path reconstruction*. Strasbourg, France. 22-26/05/2017.

Teaching activity

Supervision of MSc projects

1: Will Caiger, co-supervised with Felix Flicker. MSc at the University of Bristol. Topological Quantum Computation with Quasicrystals. HH. Wills Physics Laboratory, Bristol, United Kingdom. 2024/2025.

2: Nanda Girish, co-supervised with Felix Flicker. MSc at the University of Bristol. Topological Quantum Computation with Quasicrystals. HH. Wills Physics Laboratory, Bristol, United Kingdom. 2024/2025.

Awards and Grants

1: Becas Fundación Ramón Areces para Estudios Postdoctorales. Awarded to pursue my postdoc under the supervision of Dr. Robert-Jan Slager at the Cavendish Laboratory of the University of Cambridge. Cambridge, United Kingdom. 2023. Declined.

2: Springer Theses Award. Awarded for my thesis *Linear and nonlinear optical responses of chiral multifold semimetals*. Thesis published by Springer in the *Springer Theses* series. 2022.

3: Forum for Early Career Scientists of the American Physical Society. March meeting mini-grant. Awarded to cover the registration in the APS March Meeting. 2022.

4: Marie Curie Alumni Association Micro Travel Grant. Awarded to cover the expenses of my

participation in the APS March Meeting. 2022.

5: GEFES travel grant. Awarded by the Condensed Matter Division of the Spanish Royal Physics Society to participate in the International Focus Workshop in Topological Materials at the Max Planck Institute for the Phsyics of Complex Systems. 2022.

6: Marie Curie GreQue COFUND Fellowship. Awarded to pursue my PhD under the supervision of Adolfo Grushin at Néel Institute and the University of Grenoble-Alpes. Grenoble, France. 2018-2021.

7: FPI-Severo Ochoa Excellence Fellowship. Awarded by the Spanish Government and the Severo Ochoa Excellence Program to develop a research project at the Catalan Institute of Nanoscience and Nanotechnology (ICN2). Barcelona, Spain. 2016.

Dissemination and science policy activity

1: Promoter and contributor of the policy briefing *National Quantum Strategies* in the Scientific Advisory Program (PRAC) of the Network of associations of Spanish researchers and scientists abroad (RAICEX). Since 2025.

1: Member of the Science Policy department of the Spanish Researchers in the United Kingdom (SRUK/CERU) society. Member since 2023.

2: Member of the Science Diplomacy Task Force in the Policy Working Group of the Marie Curie Alumni Association. Member since 2023.

Advanced Training Courses

1: CodeRefinery workshop. **20-hour** workshop on good coding practices, reproducible research principles, and using Git for version control and collaboration. Online, CodeRefinery. 21-30/03/2023.

2: Workshop on Recent Developments in Exotic and Unconventional Superconductivity. **Two-day** workshop . Online, Virtual Science Forum. 30-31/03/2022.

3: Mesoscopic Superconductivity. **16-hour** course on introductory aspects of mesoscopic superconductivity at the Doctoral School of the Unviersity of Grenoble Alpes. Grenoble, France. 05-06/2021.

4: Career management for early career academic researchers. **12-hour** course on early career management for academic reserachers by the University of Glasgow, the University of Edinburgh, and the University of Sheffield . Online, Future Learn Platform. 29-31/05/2021.

5: Mini-workshop: Introduction to computational quantum transport with Kwant. **Four-hour** workshop on the basics of quantum transport simulations of mesoscopic devices using the Kwant software package. Online, Virtual Science Forum. 17/12/2020.

6: Winter School on Strongly Correlated Quantum Matter. **Three-week** school presenting on strongly correlated systems, with particular attention dedicated to cross-disciplinary aspects. Online, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, and Abdus Salam International Centre for Theoretical Physics, Trieste, Italy. 30/11/2020-18/12/2020.

7: IV Course Writing Science in English: practical course on scientific writing. **25-hour** course on writing of academic and financial proposals for the scientific career. University of Murcia, Murcia, Spain. 16-18/07/2019.

8: Introduction to Topological Phases in Condensed Matter. **10-hour** course on topological phases of matter at the Doctoral School of the Unviersity of Grenoble Alpes. Grenoble, France. 04-05/2019.

9: Topological Matter School 2018. **One-week** school on basic and advanced aspects of topology and lattice symmetries. Donsotia-San Sebastian, Spain. 27-31/08/2018.

10: Satellite Course on Group Theory, Topological Matter School 2018. **Four-day** course on the role and applications of modern group theory in condensed matter physics and the Topological Quantum Chemistry formalism. Donsotia-San Sebastian, Spain. 23-16/08/2018.

11: Quantum Many-Body Theory. **12-hour** course on introductory aspects of quantum many-body theory in condensed matter at the Doctoral School of the Unviersity of Grenoble Alpes. Grenoble, France. 05-06/2018.