



Rafael Álvaro Flores Calderón

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Education

- **Max Planck Institute for the Physics of Complex Systems** Dresden, Germany
Doctoral Student
– PhD. Co-supervised by Prof. Roderich Moessner and Dr. Ashley Cook
Aug. 2021 - present
- **Universidad Nacional Autonoma de Mexico, UNAM** Mexico City, Mexico
Bachelor of Science in Physics, summa cum laude
Aug. 2016 - January 2021
- **University of California, Berkeley** Berkeley, United States
Exchange semester abroad
Fall 2019
– A+ grades for graduate course on Solid State Physics, Quantum Field Theory, Introduction to Quantum Materials and Statistical Physics.

Research Stays

- **Non-linear Transport in Weyl Semimetals** Mexico City, Mexico
Research assistant
Spring 2019 - Fall 2020
– I researched non-linear transport properties of Weyl, and nodal-line (NLSM) semimetals at the Institute of Nuclear Sciences, UNAM, under the supervision of Prof. José Alberto Martín Ruiz.
- **Soliton dynamics in Bose-Einstein condensates** Mexico City, Mexico
Collaboration
Summer 2020
– Investigated with Prof. Jorge Fujioka at the Institute of Physics, UNAM, the soliton dynamics of a high density Bose-Einstein condensate subject to a time varying anharmonic trap.
- **Non-linear optical phenomena in Weyl Semimetals** Berkeley, United States
Collaboration
Fall 2019
– Collaborated with Prof. Daniel Parker, within Prof. Joel's Moore group, on theoretical calculations of the self-focusing conductivity for a Weyl Semimetal within a novel Feynman diagrammatic approach.

Vocational experience

- **Teacher assistant for Theoretical Mechanics** Dresden, Germany
Technische Universität Dresden
Spring 2023
- **Teacher assistant for Advanced Electromagnetism** Mexico City, Mexico
Faculty of sciences, UNAM
Fall 2020
- **Tutoring peers for final high school examinations** Mexico City, Mexico
Faculty of sciences, UNAM
Spring 2016

Academic Recognitions

- **Gabino Barreda Award** Mexico City, Mexico
Medal and certificate
Fall 2021
– Awarded the Gabino Barreda Medal for the best grade point average as a bachelor of science in Physics, UNAM
- **Full scholarship** Berkeley, United States
Exchange semester
Fall 2019
– Received a full scholarship for an exchange semester at UC, Berkeley from the international mobility program at UNAM
- **Graduated with honours** Mexico City, Mexico
Valedictorian
2013 - 2016

- Finished high school Jean Piaget with a final average of 99%. Awarded the best high school grade average by the Directorate General for Incorporation and Revalidation of Studies (DGIRE), UNAM.

- **Metropolitan Chemistry Competition**

Mexico City, Mexico

First place

Nov. 2015 - Jan. 2016

- First place at the XXVI Metropolitan Chemistry Competition organized by the Centre for Advanced Research and Studies of the National Polytechnic and the School of Chemistry, UNAM.

Skills

Languages: Native Spanish, Advanced English, Fluent German, Beginner Italian;

Computer skills: Python (including N.N. with Keras and Pytorch), C++, Fortran, Julia, Unix Shell

Applications: Mathematica, MatLab, L^AT_EX, OpenOffice, MS Office XP

Schools and Workshops

- **Theoretical and Experimental Magnetism Meeting (TEMM) 2024** Abingdon, Oxfordshire, UK
Speaker *June 2023*
 - Conference talk on *Irrational moments and signatures of higher-rank gauge theories in diluted classical spin liquids*
- **Topological Order: Anyons and Fractons** Les Houches, France
School *April 2024*
 - Poster presentation on *Irrational moments and signatures of higher-rank gauge theories in diluted classical spin liquids*
- **Cluster of excellence ct.qmat retreat** Weimar, Germany
Speaker *March 2024*
 - Cluster retreat talk on *Irrational moments and signatures of higher-rank gauge theories in diluted classical spin liquids*
- **Correlated Magnetism: From Frustration to Topology (SFB 1143)** Dresden, Germany
Speaker *October 2023*
 - Conference talk on *Irrational moments and signatures of higher-rank gauge theories in diluted classical spin liquids*.
- **DPG Spring Meeting of the Condensed Matter Section** Berlin, Germany
Speaker *March 2024*
 - Conference talk on *Irrational moments and signatures of higher-rank gauge theories in diluted classical spin liquids*.
- **Quantum Many-Body Phenomena out of Equilibrium** Trieste, Italy
School *August 2023*
 - Two week school in International Center for Theoretical Physics (ICTP) with high-level training in the context of non-equilibrium quantum many-body dynamics and criticality.
- **Condensed Matter in the City** London, UK
Workshop *July 2023*
 - One week workshop/school on “Quantum Materials: Information and Technology”.
- **Frontiers of Condensed Matter** Les Houches, France
International Doctoral Training Session *October 2022*
 - Two week school on current active research lines of condensed matter physics.
- **DPG Spring Meeting of the Condensed Matter Section** Regensburg, Germany
Speaker *September 2021 and March 2022*
 - Participated on both Condensed Matter meetings of the German Physical Society (DPG) in Regensburg and Dresden and gave a talk on *Time Reversal invariant finite-size topology*.
- **Novel Electronic Properties of two-dimensional materials** San Sebastian, Spain
Workshop *July 11-15 2022*
 - One week workshop on experimental and theoretical frontiers in two dimensional heterostructures sponsored by the Donostia International Physics Center.
- **Topological Phases in Condensed Matter and Ultracold Atom Systems** Corsica, France
School/Workshop *June 28 - July 8 2022*

- Participated at the two week school/workshop on topological phases at the Institute d'Etudes Scientifiques de Cargèse

- **Cluster of excellence ct.qmat retreat** Merseburg, Germany
Speaker March 2022
 – Cluster retreat talk on *Quantized nonlinear transport phenomena in Weyl semimetals*
- **CMD2020GEFES** Madrid, Spain (online)
Speaker Sep 2020
 – Conference talk on *Quantized nonlinear transport phenomena in Weyl semimetals* sponsored by the Condensed Matter Divisions of the Spanish Royal Physics Society (RSEF-GEFES) and of the European Physical Society (EPS-CMD).

Publications

- **Flores-Calderón, R.**, Benton Owen., and Moessner, Roderich. “*Irrational Moments and Signatures of Higher-Rank Gauge Theories in Diluted Classical Spin Liquids*”. *Physical Review Letters*, vol. 133, 106501, 2024. Crossref, doi: 10.1103/PhysRevLett.133.106501. <https://link.aps.org/doi/10.1103/PhysRevLett.133.106501>
- K. T. K. Chung, **Flores-Calderón, R.**, R. C. Torres, P. Ribeiro, S. Moroz, and P. McClarty. “*Higgs Phases and Boundary Criticality*”. arXiv 2404.17001 [cond-mat.str-el]. 2024. <https://arxiv.org/abs/2404.17001>
- **Flores-Calderón, R.**, Md Mursalin Islam, Michele Pini, and Francesco Piazza “*Nonthermal electron-photon steady states in open cavity quantum materials*”. arXiv 2312.17436 [cond-mat.str-el]. 2024. <https://arxiv.org/abs/2312.17436>
- **Flores-Calderón, R.**, Elio J. König and Ashley M. Cook “*Topological quantum criticality from multiplicative topological phases*”. arXiv 2311.17799 [cond-mat.str-el]. 2024. <https://arxiv.org/abs/2311.17799>
- **Flores-Calderón, R.**, and Ashley M. Cook. “*Time-reversal invariant topological skyrmion phases*”. *Physical Review B*, vol. 108, 235102, 2023. doi: 10.1103/PhysRevB.108.235102. <https://journals.aps.org/prb/abstract/10.1103/PhysRevB.108.235102>
- **Flores-Calderón, R.**, Roderich Moessner and Ashley M. Cook. “*Time-reversal invariant finite-size topology*”. *Physical Review B*, vol. 108, 125410, 2023. doi: 10.1103/PhysRevB.108.125410. <https://journals.aps.org/prb/abstract/10.1103/PhysRevB.108.125410>
- **Flores-Calderón, R.**, Leonardo Medel, and A. Martín-Ruiz. “*Electrochemical transport in Dirac nodal-line semimetals*”. *EPL*, vol. 143, 16001, 2023. doi: 10.1209/0295-5075/acde5e. <https://iopscience.iop.org/article/10.1209/0295-5075/acde5e>
- **Flores-Calderón, R.**, Fujioka J., and A. Espinosa-Cerón. “*Soliton Dynamics of a High-Density Bose-Einstein Condensate Subject to a Time Varying Anharmonic Trap*”. *Chaos, Solitons & Fractals*, vol. 143, Jan. 2021, p. 110580., doi: 10.1016/j.chaos.2020.110580. url: <https://www.sciencedirect.com/science/article/pii/S0960077920309711?via%3Dihub>
- **Flores-Calderón, R.**, and A. Martín-Ruiz. “*Quantized Electrochemical Transport in Weyl Semimetals*”. *Physical Review B*, vol. 103, no. 3, 2021. Crossref, doi: 10.1103/PhysRevB.103.035102. <https://journals.aps.org/prb/abstract/10.1103/PhysRevB.103.035102>