

CURRICULUM VITAE

Juan Felipe Méndez-Valderrama

CONTACT INFORMATION

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CITIZENSHIP: Colombian

RESEARCH INTERESTS

My research aims broadly at understanding quantum phases of matter where strong interactions drive unconventional orders which fall outside the scope of conventional weak coupling analyses. Topics that I am engaged in include: Strong correlations and unconventional superconductivity in moiré systems, collective modes in topological systems, Non-Fermi-liquid transport, development of numerical techniques focusing on different flavors of quantum Monte Carlo. Topics that interest me include: quantum spin liquids, disordered systems.

EDUCATION

AUG 2018- AUG 2024 **Ph.D. In Physics** at
[CORNELL UNIVERSITY](#) Ithaca, NY.

MAY 2021 **MSc. In Physics** at
[CORNELL UNIVERSITY](#) Ithaca, NY.

AUG 2016- Nov 2018 **MSc. In Physics** at
[UNIVERSIDAD DE LOS ANDES](#) , Bogota, Colombia
GPA: 4.84/5.

AUG 2012- OCT 2016 **BSc. In Physics** at
[UNIVERSIDAD DE LOS ANDES](#) , Bogota, Colombia.
GPA: 4.33/5.

AUG 2014-JUL 2016 **Minor in Mathematics** at
[UNIVERSIDAD DE LOS ANDES](#) , Bogota, Colombia.
GPA: 4.33/5.

ACADEMIC APPOINTMENTS

AUG 2024 - NOW Postdoctoral Research Associate at the Princeton Center
for Complex Materials (PCCM), Princeton University, Princeton, New Jersey, USA.

HONORS

- MAY 2025 Membership to Sigma Xi, The Scientific Research Honor Society.
AUG 2024 Princeton Center for Complex Materials (PCCM) postdoctoral fellowship, Princeton University, Princeton, New Jersey, USA.
AUG 2022 Feinberg Graduate School fellowship, Weizmann Institute of Science, Rehovot, Israel.
AUG 2018 Cornell Fellowship, Cornell University, Ithaca, New York, USA.
JUN 2016 Uniandes SURF program, (Beneficiaries are funded to conduct research at Cornell University for a period of two months)
JULY 2012 QUIERO ESTUDIAR FELLOWSHIP Universidad de los Andes, Bogota, Colombia

THESIS

- PHD. THESIS [Strong Coupling Approaches for Electronic Transport and Superconductivity](#)
Under supervision of Prof. Debanjan Chowdhury at Cornell University
MSC. THESIS [Quantum Szilard Engines and Breakdown of Adiabaticity](#)
Under supervision of Prof. Gabriel Tellez Acosta at U. de los Andes
BSC. THESIS [Polarization effects in a two-dimensional two-component plasma and a test charge](#)
Under supervision of Prof. Gabriel Tellez Acosta at U. de los Andes

IN PREPARATION

1. Ayelet J. Uzan-Narovlansky^{1*}, Ipsita Das ^{*}, J. F. Mendez-Valderrama^{*}, Yue Tang ^{*}, Jonah Herzog-Arbeitman, Haoyu Hu, Dumitru Calugaru, Pengjie Wang, Z. Joy Zheng, Haosen Guan, Yanyu Jia, Kenji Watanabe, Takashi Taniguchi, B. Andrei Bernevig, Sanfeng Wu THE FAR-INFRARED RESONANCES OF INTERACTING FERMIONS IN MAGIC ANGLE GRAPHENE.
2. Keshav Singh, J. F. Mendez-Valderrama, Erez Berg, Oskar Vafek, B. Andrei Bernevig DISTINGUISHING MOTT AND STRAIN-INDUCED NEMATIC SEMIMETALS IN MAGIC ANGLE TWISTED BILAYER GRAPHENE USING LANDAU LEVEL SPECTROSCOPY.
3. Miguel Gonçalves, Jonah Herzog-Arbeitman, J. F. Mendez-Valderrama, Andreas Feuerpfeil, Nicolas Regnault, B. Andrei Bernevig SYMMETRIC MODE ANSATZ: THEORY OF MAGNON COLLECTIVE MODES IN CHERN INSULATORS.

PUBLICATIONS

[Google Scholar](#), [Arxiv](#), ORCID: <https://orcid.org/0000-0003-3026-8940>

* Authors contibuted equally

1. Miguel Gonçalves, J. F. Mendez-Valderrama, Jonah Herzog-Arbeitman, Jiabin Yu, Xiaodong Xu, Di Xiao, B. Andrei Bernevig, Nicolas Regnault
SPINLESS AND SPINFUL CHARGE EXCITATIONS IN MOIRÉ FRACTIONAL CHERN INSULATORS
[arxiv cond-mat 2506.05330](#)
2. Heonjoon Park, Weijie Li, Chaowei Hu, Christiano Beach, Miguel Gonçalves, J. F. Mendez-Valderrama, Jonah Herzog-Arbeitman, Takashi Taniguchi, Kenji Watanabe, David Cobden, Liang Fu, B. Andrei Bernevig, Nicolas Regnault, Jiun-Haw Chu, Di Xiao, Xiaodong Xu
OBSERVATION OF HIGH-TEMPERATURE DISSIPATIONLESS FRACTIONAL CHERN INSULATOR
[arxiv cond-mat 2503.10989](#)
3. Sunghoon Kim^{*}, J.F. Méndez-Valderrama^{*}, Xuepeng Wang^{*}, and Debanjan Chowdhury
THEORY OF CORRELATED INSULATOR(S) AND SUPERCONDUCTOR AT $\nu = 1$ IN TWISTED WSe_2
[Nature Communications 16, 1701 \(2025\)](#)

4. J.F. Méndez-Valderrama*, Sunghoon Kim*, and Debanjan Chowdhury
CORRELATED TOPOLOGICAL MIXED-VALENCE INSULATORS IN MOIRÉ HETERO-BILAYERS
Phys. Rev. B 110, L2011105 (2024)
5. J.F. Méndez-Valderrama, Dan Mao, and Debanjan Chowdhury
LOW-ENERGY OPTICAL SUM RULE IN MOIRÉ GRAPHENE
Phys. Rev. Lett. 133, 196501 (2024)
6. Dan Mao, J.F. Méndez-Valderrama, and Debanjan Chowdhury
INTERTWINED MAGNETISM AND SUPERCONDUCTIVITY IN ISOLATED CORRELATED FLAT BAND
Phys. Rev. B 110, L041105 (2024)
7. Xuepeng Wang, J.F. Méndez-Valderrama, Johannes S. Hofmann, and Debanjan Chowdhury
INTERTWINED MAGNETISM AND SUPERCONDUCTIVITY IN ISOLATED CORRELATED FLAT BAND
Phys. Rev. B 110, L041105 (2024)
8. Colin R. Bundschu, Mahdi Ahmadi, J.F. Méndez-Valderrama, Yao Yang, Héctor D. Abruña, Tomás A. Arias
THE OXYGEN REDUCTION PATHWAY FOR SPINEL METAL OXIDES IN ALKALINE MEDIA: AN EXPERIMENTALLY SUPPORTED AB INITIO STUDY
Journal of the American Chemical Society 146 (7), 4680-4686 (2023)
9. J.F. Méndez-Valderrama*, E. Tulipman*, E. Zhakina, A.P. Mackenzie, E. Berg and Debanjan Chowdhury
T-LINEAR RESISTIVITY FROM MAGNETO-ELASTIC SCATTERING: APPLICATION TO PdCrO₂
Proceedings of the National Academy of Sciences 120 (36) e2305609120 (2023).
10. E. Zhakina, R. Daou, A. Maignan, P.H. McGuinness, M. König, H. Rosner, S. Kim, S. Khim, R. Grasset, M. Konczykowski, E. Tulipman, J.F. Méndez-Valderrama, Debanjan Chowdhury, E. Berg, and A.P. Mackenzie
INVESTIGATION OF PLANCKIAN BEHAVIOR IN A HIGH-CONDUCTIVITY OXIDE: PdCrO₂
Proceedings of the National Academy of Sciences , 120 (36) e2307334120 (2023).
11. A.J. McRoberts*, J.F. Méndez-Valderrama*, R. Moessner and Debanjan Chowdhury
AN INTERMEDIATE SCALE THEORY FOR ELECTRONS COUPLED TO FRUSTRATED LOCAL-MOMENTS
Physical Review B 107 , L020402 (2023).(Letter)
12. J.F. Méndez-Valderrama, Debanjan Chowdhury
BAD METALLIC TRANSPORT IN GEOMETRICALLY FRUSTRATED MODELS
Physical Review B 103 , 195111 (2021).
13. J.F. Méndez-Valderrama*, Y.A. Kinkhabwala*, J. Silver, I. Cohen, T.A. Arias
DENSITY-FUNCTIONAL FLUCTUATION THEORY OF CROWDS
Nature communications 9 (1), 3538 (2018)
14. Santiago Aguirre, Juan Diego Arango-Montoya, David Jaramillo-Duque, J.F. Méndez-Valderrama, Nicolás Morales-Durán, Mateo Restrepo
A QUANTUM RANDOM NUMBER GENERATOR IMPLEMENTATION WITH POLARIZED PHOTONS
Emergent Scientist 1 2 (2017)

PRESS ARTICLES

1. [Revealing the superconducting limit of twisted bilayer graphene](#) By Kate Blackwood for Phys.org on November 4, 2024
2. [Revealing the superconducting limit of ‘magic’ material](#) By Kate Blackwood for Cornell Chronicle on November 4, 2024
3. [Comparing ‘sister’ compounds may hold key to quantum puzzle](#) By Kate Blackwood for Cornell Chronicle on August 30, 2023, 2023

4. [Fruit flies and electrons: Researchers use physics to predict crowd behavior](#) By Linda B. Glaser for Phys.org on August 30, 2018
5. [Physics theory used to predict crowd behavior](#) By Linda B. Glaser for Cornell Chronicle on August 30, 2018

TALKS

- MAR 2026 APS Global Summit,
Itinerant Anyons in Fractionally filled Chern Bands:
(Invited talk)
- NOV 2025 Pennsylvania State University,
Spinless and spinful charge excitations in moiré FCIs
- OCT 2025 Flatiron Insitute,
Spinless and spinful charge excitations in moiré FCIs
- MAR 2026 Princeton Quantum Initiative Seminar,
Correlated mixed-valence insulators in moiré transition metal dichalcogenides.
- JAN 2024 Flatiron Insitute,
Superconductivity and Strong Interactions in Twisted Bilayer Graphene:
Insights from Sum-Rules and Monte Carlo Studies.
- JUN 2023 LASSP/AEP Student Seminar Series,
Monte Carlo Studies of Moire Graphene
- MAR 2023 APS March Meeting,
Linear-in-temperature resistivity in PdCrO₂ from magneto-elastic interactions
- JUN 2022 Quantum Matters Today, Weizman Institute student seminar,
Semi-quantum regimes for unconventional metallic transport
- MAR 2022 APS March Meeting,
Frustration induced non-Fermi liquid behavior.
- MAR 2021 APS March Meeting,
Bad metallic transport in geometrically frustrated models

SCHOOLS AND EVENTS

- MAR 2024 American Physical Society (APS) March Meeting,
Denver, CO, USA.
Talk Itinerant Anyons in Fractionally Filled Chern Bands
- JUL 2025 2025 PCCM (Princeton center for complex materials) Summer school
Princeton, NJ, USA
- JUN 2025 2025 EPiQS Postdoctoral Symposium
Lake Arrowhead Lodge, CA, USA
Talk Spinless and spinful charge excitations in moiré Fractional Chern Insulators
- MAR 2025 American Physical Society (APS) March Meeting,
Anaheim, CA, USA.
Talk Low-Energy electromagnetic response in moiré materials
- JUN 2024 Gordon Research Conference, Strongly correlated electrons
Mount Holyoke College, South Hadley, MA, USA
Poster A theory for the low-energy optical sum-rule in moiré graphene
- JUN 2024 Gordon Research Seminar, Strongly correlated electrons
Mount Holyoke College, South Hadley, MA, USA
Poster A theory for the low-energy optical sum-rule in moiré graphene
- MAR 2024 American Physical Society (APS) March Meeting,
Minneapolis, MN, USA.
Talk Exact results for low-energy many-body optical sum-rule in moiré graphene
- SEPT 2023 Electron Correlations beyond the Quasiparticle Paradigm: Theory and Experiment,
Kavli Institute for Theoretical Physics, Santa Barbara, CA, USA.
- SEPT 2023 KITP program: Quantum Materials With and Without Quasiparticles,
Kavli Institute for Theoretical Physics, Santa Barbara, CA, USA.
- JUL 2023 PCCM Summer School 2023:
FRACTIONALIZATION, CRITICALITY AND UNCONVENTIONAL QUANTUM MATERIALS
Zoom
- MAR 2023 American Physical Society (APS) March Meeting,
Las Vegas, NV, USA.
Talk Linear-in-temperature resistivity in PdCrO₂ from magneto-elastic interactions
- DEC 2022 A Quantum Many-Body Handshake: Theory and Simulation meet Experiment
Weizmann Institute of Science, Rehovot, Israel.
Poster A Monte Carlo study of the electron-phonon problem in twisted bilayer graphene
Poster \bar{T} -linear resistivity from magneto-elastic scattering: application to PdCrO₂
- OCT 2022 Weizmann-Max Planck Young researcher Workshop
Weizmann Institute of Science, Rehovot, Israel.

- AUG 2022 PCCM Summer School 2022: HIDDEN CORRELATIONS IN FLAT BANDS, Zoom
- JUN 2022 Gordon Research Conference, Strongly correlated electrons
Mount Holyoke College, South Hadley, MA, USA
Poster Semi-quantum regimes of unconventional metallic transport
- JUN 2022 Gordon Research Seminar, Strongly correlated electrons
Mount Holyoke College, South Hadley, MA, USA
Poster Semi-quantum regimes of unconventional metallic transport
- MAR 2022 American Physical Society (APS) March Meeting,
Zoom.
Talk Frustration induced non-Fermi liquid behavior
- JUN 2020 PCCM Summer School 2020: MAGNETISM IN QUANTUM MATERIALS, Zoom
- FEB 2019 GAPLESS FERMIONS - FROM FERMILIQUIDS TO STRANGE METALS SCHOOL, MPIPKS, Dresden, Germany
Poster An intermediate scale incoherent metal on the triangular lattice
- JAN 2019 QUANTUM MATTER WITHOUT QUASIPARTICLES , Maglab Winter school
- FEB 2019 CABES Scientific Advisory Board (SAB) meeting
Poster Alkaline Fuel Cell Design Using Joint Density-Functional Theory
- DEC 2017 Course on DYNAMICS OF QUANTUM SYSTEMS OUT OF EQUILIBRIUM, U. de los Andes, Bogota
- APR 2017 Gothenburg Physics Centre INTERNATIONAL PHYSICIST'S TOURNAMENT , University of Gothenburg, Chalmers, Gothenburg, Sweden
- JULY 2016 Summer school on RANDOM GEOMETRIES, U. de los Andes, Bogota
- APR 2016 French physical society INTERNATIONAL PHYSICIST'S TOURNAMENT , ESPCI ParisTech Paris, France
- JULY 2015 Summer school on TOPOLOGICAL QUANTUM MATTER, U. de los Andes, Bogota
- MAY 2012 Continued Education Course QUANTUM UNIVERSE, U. de los Andes, Bogota

COMPUTER SKILLS

Programming Languages: Python, C++, FORTRAN, \LaTeX , Mathematica.
 Basic Knowledge On: Julia, Octave/Matlab
 Packages: ALF (algorithms for lattice fermions), jDFTX.
 Other: Git
 Operating Systems: UNIX based systems;

GRANTS/EXTERNAL FUNDING

1. Provided preliminary calculations and input for the NSF-ACCESS grant: Quantum Monte Carlo studies of strongly correlated phases and superconductivity in moiré materials and beyond. Listed as a user for the development of the research under supervision of prof. Debanjan Chowdhury and prof. Erez Berg and in collaboration with Dr. Johannes S. Hofmann who is also the allocation Manager
 Awarded Resources:
 SDSC Expanse Projects Storage: 2,730.0 GB
 SDSC Expanse CPU: 4,900,000.0 Core-hours

TEACHING

JAN - MAY, 2023	TA for PHYS1112, Physics I: Mechanics and Heat CORNELL U., Ithaca, NY under the supervision of Prof. Robert Fullbright
JAN - MAY, 2022	TA for PHYS1112, Physics I: Mechanics and Heat CORNELL U., Ithaca, NY under the supervision of Prof. Robert Fullbright
AUG - DEC, 2021	Grader for PHYS6572 Quantum Mechanics I CORNELL U., Ithaca, NY under the supervision of Prof. Eana Flannagan
JAN - MAY, 2021	TA for PHYS2214 Physics III: Oscillations, Waves and Quantum Physics CORNELL U., Ithaca, NY under the supervision of Prof. Dan Ralph
JAN - JUN, 2021	Grader for PHYS6574 Applications of Quantum Mechanics II CORNELL U., Ithaca, NY under the supervision of Prof. Debanjan Chowdhury
AUG - DEC, 2020	TA for PHYS2213 Physics II: Electromagnetism CORNELL U., Ithaca, NY under the supervision of Prof. Ivan Bazarov
AUG - DEC, 2019	TA for PHYS1112, Physics I: Mechanics and Heat CORNELL U., Ithaca, NY under the supervision of Dr. Phil Krasicky
AUG - DEC, 2018	TA for PHYS1112, Physics I: Mechanics and Heat CORNELL U., Ithaca, NY under the supervision of Prof. Jeevak Parpia
SEP - DEC, 2017	TA for the Computational Tools course U. DE LOS ANDES, Bogota under the supervision of Prof. Veronica Arias
SEP - DEC, 2017	TA for the Laboratory for Computational Physics U. DE LOS ANDES, Bogota under the supervision of Prof. Veronica Arias
AUG -DEC, 2016	TA for the Experimental physics I course at U. DE LOS ANDES, Bogota under the supervision of Prof. Bensamin Oostra
AUG -DEC, 2016	TA for the Experimental physics I course at U. DE LOS ANDES, Bogota under the supervision of Prof. Bensamin Oostra
JAN, 2016- MAY, 2016	TA for the Experimental physics II course at U. DE LOS ANDES, Bogota under the supervision of Prof. Juan Gabriel Ramirez
JUL, 2015-JUL, 2016	Grader for the Statistical physics course at U. ANDES, Bogota under the supervision of Prof. Gabriel Tellez Acosta
JAN, 2016-JUL, 2016	Grader for Solid state physics at U. DE LOS ANDES, Bogota under the supervision of Prof. Luis Quiroga Puello
JAN, 2015-JUN, 2015	TA for Computational physics at U. DE LOS ANDES, Bogota under the supervision of Prof. Sebastian Perez Saabi

ADDITIONAL INFORMATION

MAY-AUG 2017	Reaserch intern at Cornell University, Arias group.
APR 2017	14TH PLACE International Physicists' Tournament 2017, Sweden.
JUN-AUG, 2016	Research intern at CORNELL UNIVERSITY, Ithaca, NY under the supervision of Prof. Tomas Arias
JAN,2016	Team captain of the Colombian for the International Physicists' Tournament
DEC 2016	1ST PLACE Colombian Physicists' Tournament 2016.
APR 2016	11TH PLACE International Physicists' Tournament 2016.
APR 2016	11TH PLACE International Physicists' Tournament 2016.
JAN-JUN, 2015	Social service volunteer at U. ANDES, Bogota Taught physics and mathematics to high school students under the supervision of David Felipe Parga Alonso
SEP 2014-AUG, 2015	Tutor at CLÍNICA DE PROBLEMAS AT U. DE LOS ANDES, Bogota Helped first and second year students of introductory physics courses (Physics I, II, Waves and Fluids, Modern Physics) with solutions to homework problems and course content related issues under the supervision of Simon Mejia Moreno

SCIENTIFIC OUTREACH

Nov 2024 Dia de la ciencia at the Princeton Center for Complex Materials (PCCM), Princeton University, Princeton, New Jersey, USA.

LANGUAGES

ENGLISH: Fluent, TOEFL:107 Reading:30 Listening:29 Speaking:23 Writing:25

SPANISH: First language