

Education

Rice University <i>PhD in Atomic, Molecular, Optical, and Condensed Matter Physics</i>	Houston, Texas Fall 2022
Rice University <i>M. Sc. in Atomic, Molecular, and Optical Physics</i>	Houston, Texas Spring 2019
Universidad Nacional Autónoma de México (UNAM), Ciudad Universitaria <i>B. Sc. in Physics</i>	Mexico City, Mexico Fall 2016
<ul style="list-style-type: none"> ▪ Class Valedictorian in Physics ▪ GPA: 10 (scale from 0 to 10) 	

Research Experience

Sandia National Laboratories <i>Postdoctoral Scholar in the Quantum Information Science group</i>	Albuquerque, New Mexico Oct 2024 - Present
<ul style="list-style-type: none"> ▪ Model noise of trapped ions and Rydberg arrays for quantum computing. ▪ Design quantum algorithms and gates for quantum computers. 	
University of California, Davis/San José State University <i>Postdoctoral Scholar advised by Dr Richard T Scalettar and Dr Ehsan Khatami</i>	Davis, California Sept 2022-Sept 2024
<ul style="list-style-type: none"> ▪ Develop and apply quantum Monte Carlo and Density Matrix Renormalization Group methods to strongly correlated systems, such as Hubbard and Holstein models. ▪ Apply Machine Learning techniques to detect phase transitions in strongly correlated systems, including Fermi Hubbard and Hubbard-Holstein chains. ▪ Compute transport properties of dopant-based quantum dot arrays. ▪ Mentor graduate and undergraduate students in the group. 	
Rice University <i>PhD Researcher advised by Dr Kaden R A Hazzard</i>	Houston, Texas Jun 2019-Aug 2022
<ul style="list-style-type: none"> ▪ Pioneered a numerical algorithm using quantum Monte Carlo to simulate the $SU(N)$ Fermi Hubbard Model. ▪ Collaborated in the development of Exact Diagonalization and Numerical Linked Cluster Expansions to study the $SU(N)$ Fermi Hubbard Model. ▪ Contributed to the construction of a Constrained Path Quantum Monte Carlo and Hartree-Fock codes to investigate the $SU(N)$ Fermi Hubbard Model. ▪ Developed and maintained data analysis modules written in Python. ▪ Mentored graduate and undergraduate students in the group. 	
Rice University <i>Master Researcher advised by Dr Randall G Hulet</i>	Houston, Texas Jun 2017-Jun 2019
<ul style="list-style-type: none"> ▪ Improved performance of data analysis software by reducing run time by a factor of 10. ▪ Assembled optical setup for cooling and trapping bosonic and fermionic lithium. ▪ Automated and refined experimental equipment using Python, Raspberry Pi and Arduino. ▪ Designed and engineered electronic circuits for hardware control and PID stabilization. 	
Ultracold Matter National Laboratory, Physics Institute UNAM <i>Research Assistant of Dr Jorge A Seman-Harutinian</i>	Mexico City, Mexico 2014-2017
<ul style="list-style-type: none"> ▪ Designed and simulated an ultra-high vacuum system, which currently achieves a pressure of 10^{-12} Torr for experiments with ultracold quantum gases. ▪ Built optical setup for cooling and trapping ^6Li. 	
European Laboratory for Non-Linear Spectroscopy (LENS) <i>Internship with Dr Giacomo Roati</i>	Firenze, Italy Sep 2016
<ul style="list-style-type: none"> ▪ Built optical setup for studying spin-imbalanced Fermi Gases. 	
Fermi National Accelerator Laboratory <i>IPM (Internships for Physics Majors) Intern advised by Dr. Rahmat Rahmat</i>	Batavia, Illinois Jun-Aug 2014
<ul style="list-style-type: none"> ▪ Improved HF GFlash simulation written in Python. Simulation runs 76 % faster than the previous GFlash simulation, reducing error by 55 % when tested against Test Beam Data. 	

Honors, Awards and Fellowships

Steven Weinberg Research Award	American Physical Society (APS)
<i>Selected by the Texas APS Section based on excellence and potential impact in the relevant scientific community</i> 2022	
Outstanding Reviewer Awards 2021 - Journal of Physics: Condensed Matter	Institute of Physics (IOP)
<i>Selected by IOP Publishing's Editors based on the quality, quantity and timeliness of their reviews</i> 2022	
International Young Leaders Forum Contributor	American Physical Society (APS)
<i>Participation is by nomination only from a senior physicist who recognizes nominee's leadership, enthusiasm, and commitment to service-oriented activities beyond their physics research.</i> 2022	
Braslau Family Travel Grant	American Physical Society (APS)
<i>Competitive basis award for early career physicists, to attend APS March or April Meeting</i> 2022	
IOP Trusted Reviewer	Institute of Physics (IOP)
<i>Acknowledges a high level of peer review competence, upholding the scientific literature to an excellent standard</i> 2021	
▪ Journal of Physics: Condensed Matter	▪ Journal of Physics D: Applied Physics
Robert Lowry Patten Award	Rice University
<i>Honors graduate students for their service and achievements on behalf of graduate students</i> 2021	
Robert A. Welch Foundation Predoctoral Fellowship	The Welch Foundation
<i>Competitive basis fellowship for PhD Studies</i> 2017 & 2020	
Eric Umland Memorial Award	Rice University
<i>Honors the student who has contributed the most to the quality of graduate student life in the department</i> 2020	
Bonner Book Award	Rice University
<i>Given each year to the most outstanding first year graduate students in physics</i> 2018	
G. King Walters Fellowship	Rice University
<i>Competitive basis fellowship for PhD Studies</i> 2017	
Leon M. Lederman Award	Fundación Hertel
<i>The recipient of this merit based award participates at the IPM internship at Fermilab</i> 2014	

Publications

Number of citations: 251, h-index: 8 (Google Scholar on November 11 2024)

In preparation

19. R Pohle, M Nelson, B Pol, R T Scalettar, M Enjalran, and **E Ibarra-García-Padilla**, *The Blume-Capel Model on a Triangular Lattice: Interplay of Charge and Spin Order*.
18. L E Ramos-Solís, S Choudhury, F J Poveda-Cuevas, and **E Ibarra-García-Padilla**, *Dynamics of excited states in the one-dimensional spin-1 Heisenberg model*.
17. **E Ibarra-García-Padilla**, F Fei, R Silver, and E Khatami, *Transport through quantum dot arrays in a magnetic field*.
16. J D Stepp, **E Ibarra-García-Padilla**, R T Scalettar, J M Hutson, B Mukherjee, and K R A Hazzard, *The Attractive $SU(N)$ Fermi-Hubbard Model in Ultracold Molecules*.
15. B Stork, M Mulanix, R T Scalettar, **E Ibarra-García-Padilla**, and E Khatami, *Strongly-correlated electrons on the $1/5$ -depleted square lattice*.
14. Z Zhang, K Zheng, **E Ibarra-García-Padilla**, and K R A Hazzard, *$SU(3)$ Fermi-Hubbard Model with flavor imbalance*.

Published/submitted manuscripts

13. **E Ibarra-García-Padilla**, H Lange, R G Melko, R T Scalettar, J Carrasquilla, A Bohrdt, and E Khatami, *Autoregressive neural quantum states of Fermi Hubbard models*, arXiv:2411.07144 [submitted to Phys. Rev. Res.]
12. **E Ibarra-García-Padilla** and S Choudhury, *Many-body Physics of Ultracold Alkaline-Earth atoms with $SU(N)$ -symmetric interactions*, arXiv:2408.05359 [invited review by the Journal of Physics: Condensed Matter].
11. S Striegel, **E Ibarra-García-Padilla**, and E Khatami, *Machine Learning Detection of Correlations in Snapshots of Ultracold Atoms in Optical Lattices*, arXiv:2310.03267 [Proceedings of the Conference on Computational Physics].
10. **E Ibarra-García-Padilla**, S Striegel, R T Scalettar, and E Khatami, *Structural complexity of snapshots of 2D Fermi-Hubbard systems*, Phys. Rev. A **109** 053304 (2024).
9. G Pasqualetti, O Bettermann, N Darkwah Oppong, **E Ibarra-García-Padilla**, S Dasgupta, R T Scalettar, K R A Hazzard, I Bloch, and S Fölling, *Equation of State and Thermometry of the 2D $SU(N)$ Fermi-Hubbard*

- Model*, Phys. Rev. Lett. **132** 083401 (2024) [Featured in Physics, Editors' Suggestion].
8. H-T Wei, **E Ibarra-García-Padilla**, M L Wall, and K R A Hazzard, *Hubbard parameters for programmable tweezer arrays*, Phys. Rev. A **109** 013318 (2024) [Editors' Suggestion].
 7. C Feng, **E Ibarra-García-Padilla**, K R A Hazzard, S Zhang, R T Scalettar, and E Vitali, *Metal-insulator transition and quantum magnetism in the $SU(3)$ Fermi-Hubbard Model*, Phys. Rev. Res. **5** 043267 (2023).
 6. **E Ibarra-García-Padilla**, C Feng, G Pasqualetti, S Fölling, R T Scalettar, E Khatami, and K R A Hazzard, *Metal-insulator transition and magnetism of $SU(3)$ fermions in the square lattice*, Phys. Rev. A **108** 053312 (2023).
 5. Z Z Yan, B M Spar, M L Prichard, S Chi, H-T Wei, **E Ibarra-García-Padilla**, K R A Hazzard, and W S Bakr, *A two-dimensional programmable tweezer array of fermions*, Phys. Rev. Lett. **129** 123201 (2022) [Featured in Physics, Editors' Suggestion].
 4. S Taie & **E Ibarra-García-Padilla**, N Nishizawa, Y Takasu, Y Kuno, H-T Wei, R T Scalettar, K R A Hazzard, and Y Takahashi, *Observation of antiferromagnetic correlations in an ultracold $SU(N)$ Hubbard model*, Nat. Phys. **18** 1356-1361 (2022).
 3. **E Ibarra-García-Padilla**, S Dasgupta, H-T Wei, S Taie, Y Takahashi, R T Scalettar, and K R A Hazzard, *Universal thermodynamics of an $SU(N)$ Fermi-Hubbard Model*, Phys. Rev. A **104** 043316 (2021) [Editors' Suggestion].
 2. **E Ibarra-García-Padilla**, R Mukherjee, R G Hulet, K R A Hazzard, T Paiva, and R T Scalettar, *Thermodynamics and magnetism in the two-dimensional to three-dimensional crossover of the Hubbard model*, Phys. Rev. A **102** 033340 (2020).
 1. **E Ibarra-García-Padilla**, C G Malanche-Flores, and F J Poveda-Cuevas, *The hobbyhorse of magnetic systems: the Ising model*, Eur. J. Phys **37** 065103 (2016) [Eur. J. Phys 2016 Highlights].

Teaching Experience and Competitions

Teaching experience

Responsibilities included lecturing, grading, and designing exams and homeworks.

UNAM, Rice Univ, and SJSU

Active since 2015

Freshman		
RL	Single Variable Calculus II	Spring 2015
TA	General Physics	Fall 2018, Fall 2019
RL	Honors Mechanics	Spring 2016, Fall 2020, Fall 2021
RL	Honors Electricity and Magnetism	Spring 2020, Spring 2021
L	Seminar in Physics and Astronomy at Rice and Beyond	Spring 2022
GL	Invitation to Physics and Astronomy	Fall 2023
Junior		
TA	Introduction to Quantum Physics I	Fall 2015, Fall 2016
Senior		
TA	Introduction to Quantum Physics II	Spring 2018
SL	Computational Methods in Physics	Spring 2023
SL	Fundamentals of Quantum Information	Fall 2023
Graduate		
TA	Mathematical Methods	Spring 2017
TA	Quantum Mechanics II	Spring 2019
DL	PhD Proposal Writing Seminar	Summer 2020, Summer 2021
GL	Quantum Information Science and Technology	Fall 2021

Experience obtained at Universidad Nacional Autónoma de México, Rice University, and San José State University. First column corresponds to the role I held: TA (teaching assistant), RL (recitation lecturer), L (lecturer), GL (guest lecturer), SL (substitute lecturer), and DL (Developer and lecturer).

Texas Medical Center Consulting Club Competition

Semifinalist

TMCCC
2021

Coach of the Mexican Physics Olympiads Team

The five members of the team won a bronze medal

UNAM
2017

Invited Talks and Conferences

Seminars, talks and conferences

- Contributed posters and oral presentations at more than 25 local and international conferences, workshops, and summer schools.
- Session chair at APS March Meetings 2020-2024, APS April Meeting 2024, and at the Texas Section APS Meeting 2022.
- Invited talks:
 21. Portland State University, Physics and Astronomy Department, Portland OR, USA, *Using generative artificial intelligence in Physics: Understanding strongly correlated electrons*, November 2024.
 20. Rice University, Physics and Astronomy Department, Houston TX, USA, *Transport through quantum dot arrays in a magnetic field*, May 2024.
 19. Lawrence Livermore National Laboratory, Livermore CA, USA, *Novel directions in quantum simulators with ultracold atoms*, February 2024.
 18. 53rd Winter Colloquium on the Physics of Quantum Electronics (PQE), Snowbird UT, USA, *Quantum simulation: Higher symmetries, new architectures, and artificial intelligence*, January 2024.
 17. Los Alamos National Laboratory, Los Alamos NM, USA, *Structural complexity of projective measurements of interacting fermions in optical lattices*, September 2023.
 16. Rice University, Physics and Astronomy Department, Houston TX, USA, *A new perspective into quantum gas microscopy*, July 2023.
 15. University of Houston, Physics and Astronomy Department, Houston TX, USA, *Fermi Hubbard models with higher symmetries*, July 2023.
 14. UT Knoxville, Physics and Astronomy Department, Knoxville TN, USA, *Structural complexity of many-body Hamiltonians*, June 2023.
 13. Stanford University, Department of Materials Science and Engineering, Stanford CA, USA, *Metal-insulator transition and magnetism of $SU(3)$ fermions in the square lattice*, May 2023.
 12. UC Davis, Physics and Astronomy Department, Davis CA, USA, *Hues and cues: Learning about the universe with light*, April 2023. [Talk for the general public with science demos at Picnic Day].
 11. UC Davis, Physics and Astronomy Department, Davis CA, USA, *Finite-temperature signatures of quantum criticality and magnetic crossovers of $SU(3)$ fermions in the square lattice*, April 2023.
 10. San Francisco State University, Physics and Astronomy Department, San Francisco CA, USA, *The Coldest Matter in the Universe*, February 2023. [Talk in English and Spanish for the general public].
 9. San José State University, Physics and Astronomy Department, San José CA, USA, *Quantum Simulation of the $SU(N)$ Fermi Hubbard Model*, October 2022.
 8. Fresno State University, Physics and Astronomy Department, Fresno CA, USA, *Quantum Simulation of the Hubbard Model: Higher Symmetries and New Architectures*, October 2022.
 7. UC Davis, Physics and Astronomy Department, Davis CA, USA, *Universality and magnetism of interacting fermionic systems with $SU(N)$ symmetry*, November 2021.
 6. Trinity University, Physics and Astronomy Department, San Antonio TX, USA, *Quantum simulation & large spins: Toy models for understanding solids*, October 2021.
 5. Rice University, Rice Quantum Group Meeting, Houston TX, USA, *Universality and quantum magnetism in the $SU(N)$ symmetric Fermi Hubbard Model*, September 2021.
 4. Rice University, Smalley-Curl Institute, Houston TX, USA, *Universal thermodynamics of an $SU(N)$ Fermi Hubbard Model*, August 2021.
 3. Rice University, Physics and Astronomy Department, Houston TX, USA (virtual), *Magnetism in the $SU(N)$ Fermi Hubbard Model*, November 2020.
 2. Physics Institute UNAM, Mexico City, Mexico (virtual workshop), *An Introduction to Determinant Quantum Monte Carlo*, June 2021.
 1. Physics Institute UNAM, Mexico City, Mexico (virtual), *Short-range magnetism in the $SU(N)$ symmetric Fermi Hubbard model*, September 2020.

Leadership and Service

American Physical Society

Career Mentoring Fellow

Sep 2023–Present

- Provide feedback on presentations in the undergraduate research sessions at APS Meetings.
- Participate in career mentoring and resumé help desk in APS Job Fairs.
- Give a talk to raise awareness about diverse physics careers.

Rice University Physics and Astronomy Graduate Student Association

Houston, Texas
Sep 2017-Aug 2022

Officer

- Graduate Program Committee Student Representative: Voice graduate students concerns and ideas regarding how to improve the program (Aug 2021- Aug 2022)
- President: Coordinate and supervise activities, panels, approve budgets (Aug 2020- Aug 2021)
- PhD Proposal Writing Seminar: Founder and lecturer of the seminar (Jun-Aug 2020 & 2021)
- Journal Club Coordinator: Managed a \$2000 annual budget (Sep 2017-Jun 2020)

Grad STRIVE (Students Transforming Rice Into a Violence-Free Environment)

Houston, Texas
Feb 2019-Aug 2022

Secretary & Liaison

- Hosted events to engage in positive, open dialogue about gender-based inequality and interpersonal violence, as well as providing tools and skills necessary to create cultural change for graduate students. Organizer of 2 major panels in 2020-2021.

Fundraiser for the victims of Hurricane Maria and the Earthquakes in Mexico

Houston, Texas
2017

Organizer of the fundraiser

- Raised \$3322.07 that was split among 3 non-profit organizations
- Coordinated and scheduled appointments to ensure success of the event

President of the OSA-UNAM Student Chapter

Mexico City, Mexico

Science communication organization sponsored by the Optical Society of America (OSA)

2014-2016

- Organized the IONS (International OSA Network of Students) Mexico City conference in 2015 during the International Year of Light, with an initial budget of \$4000.
- Submitted and won a grant from Consejo Nacional de Ciencia y Tecnología (CONACyT) for \$25,000 to organize the conference, where 100+ students participated.
- The chapter participated in 5 major science communication activities each year.

In the News

Featured in Physics: A General Equation of State for a Quantum Simulator [PRL **132** 083401 (2024)]

UCD News: Physicists Expand Equation of State for Fermi-Hubbard Model [PRL **132** 083401 (2024)]

Featured in Physics: Strobing Light Shapes Atomic Array [PRL **129** 123201 (2022)]

BBC España: Los científicos que lograron la temperatura más baja registrada en el universo (y cómo puede servir para desarrollar tecnologías inimaginables) [Nat. Phys. **18** 1356 (2022)]

Rice News: $SU(N)$ matter is a billion times colder than deep space [Nat. Phys. **18** 1356 (2022)]

Rice University Weiss School of Natural Sciences: Graduate student research profile

Rice News: Rice's Latin American Graduate Student Association sends aid to Mexico and Puerto Rico

Peer-Reviewing

Refereeing experience

Number of reviews

Peer reviewed for:

35

- APS Physical Review Letters [6]
- APS Physical Review A [6]
- APS Physical Review B [6]
- APS Physical Review Research [1]
- APS PRX Quantum [1]
- EPL (Europhysics Letters) [2]
- SciPost Physics [2]
- IOP Journal of Physics: Condensed Matter [7]
- IOP Journal of Physics D: Applied Physics [3]
- Physica A: Statistical Mechanics and its Applications [1]

Other Interests

- Amateur guitar player and songwriter.
- Enjoy going for bike rides and playing board games.
- Percussionist in Brazilian music band Batalá Houston (2018-2021) and Batalá San Francisco (2024).
- Played baseball (1996-2016).
- Practiced fencing (2002-2012).