



# LUIS VALENZUELA CAZARES

Tucson, Arizona

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 [github.com/luisval](https://github.com/luisval)

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 [Portfolio](#)

## Education

### Iowa State University

*Master of Science in Nuclear Physics*

**Aug 2020 – May 2023**

*Ames, Iowa*

### Universidad de Sonora

*Master of Science in Physics*

**Aug 2017 – Aug 2020**

*Hermosillo, Mexico*

### Universidad de Sonora

*Bachelor of Science in Physics*

**Aug 2011 – May 2016**

*Hermosillo, Mexico*

## Research interests and background

Physicist with experience in detector development, heavy-ion collision simulations, and precision data analysis within international nuclear physics experiments such as MPD-NICA at JINR and sPHENIX at BNL. Research interests include nuclear matter, detector *R&D*, computational methods, and data-driven analysis.

## Experience

### Math Teacher

**Aug 2023 – Present**

*Toltecalli High School, CPLC Community Schools*

*Tucson, AZ*

- Teaching Mathematics, Physics, and Programming classes to students of different historically marginalized and underserved populations
- Developed engaging and differentiated curricula aligned with district and state standards for STEM classes
- Increased student proficiency on district math benchmarks from 0% to over 30% grade-level performance or beyond
- Conducted credit recovery classes and tutoring sessions to support at-risk students, improving academic outcomes.

### Graduate Research Assistant

**Feb 2023 – April 2023**

*Iowa State University and Brookhaven National Laboratory*

*Long Island, NY*

- Computed an optimal firing pattern for the TPC calibration lasers in the sPHENIX experiment by developing and programming mathematical methods and performing physics analysis in the experiment simulation framework
- Responsible for the physics analysis of the TPC laser calibration system at the sPHENIX Commissioning Workfest
- Contributed to the development of the sPHENIX physics simulation framework through code implementation and collaboration in the project's Git repository.

### Graduate Research Assistant

**May 2021 – May 2023**

*Iowa State University*

*Ames, IA*

- Conducted physics analysis by combining calorimeter and detector simulation data to improve the sPHENIX detector performance
- Performed calibration studies of the sPHENIX hadronic calorimeter by analyzing cosmic ray signals, contributing to the detector's commissioning and performance validation
- Programmed and evaluated a jet reconstruction algorithm for the ePIC experiment
- Developed and programmed pion background rejection techniques for the ePIC experiment by analyzing energy deposition in the hadronic and electromagnetic calorimeters, achieving a 90% background rejection rate.

### Research Student

**Aug 2020 – June 2021**

*Iowa State University and Fermilab*

*Ames, IA*

- Implemented a Keras-based machine learning algorithm for neutron-background discrimination in the ANNIE experiment, achieving 92% background reduction, and conducted related *R&D* studies.

### Graduate Teaching Assistant

**Aug 2020 – May 2021**

*Iowa State University*

*Ames, IA*

- Taught physics classes and laboratories to students of different academic disciplines
- Led tutoring and discussion sessions among students, promoting a collaborative environment
- Developed teaching plans and graded homework, quizzes, and laboratory reports.

## Research Student

May 2016 – Aug 2020

*Universidad de Sonora and Joint Institute for Nuclear Research (JINR)*

*Hermosillo, Mexico*

- Contributed to the *R&D* of the Multi-Purpose Detector by performing scientific coding and analyzing physical observables, including energy deposition in the detectors
- Mentored undergraduate and graduate students in coding and physics topics in workshops and seminars
- Developed and programmed numerical methods to study nuclei collisions
- Regular presentations in group meetings and international conferences for diverse audiences
- Responsible of the Git repository maintenance of the MPD-NICA Experiment.

## Research Visitor

Feb 2019 – May 2019

*Joint Institute for Nuclear Research*

*Dubna, Russia*

- Conducted centrality determination and detector characterization studies in the Multi-Purpose Detector by analyzing physical observables and programming numerical methods in the experiment simulation framework.

## JINR Summer Student Program

July 2017 – Sep 2017

*Joint Institute for Nuclear Research*

*Dubna, Russia*

- Produced and analyzed simulation data to obtain rigorous scientific conclusions for the physical design of the Multi-Purpose Detector
- Worked on Monte Carlo simulations and completed training in data processing and visualization.

## Research Visit

Jan 2017 – March 2017

*Benemérita Universidad Autónoma de Puebla (BUAP)*

*Puebla, Mexico*

- Conducted simulations of heavy-ion collisions using the HIJING Monte Carlo program and received training in ROOT for data analysis and visualization.

## Research Summer Student Program at BUAP

Aug 2014

*Benemérita Universidad Autónoma de Puebla*

*Puebla, Mexico*

- Contributed to the development of the Cosmic Piano, a scintillator-based muon detector that converts cosmic-ray signals into light and sound for science outreach.

## Collaboration Articles and Reports

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- L Valenzuela Cazares (2023). Firing Pattern for the TPC Calibration Lasers in the sPHENIX Experiment. DOI: 10.31274/cc-20240624-740
- VD Burkert et al. (2023). Precision Studies of QCD in the Low Energy Domain of the EIC. ArXiv:2211.15746v3
- V Abgaryan et al. (2022). Status and Initial Physics Performance Studies of the MPD Experiment at NICA. ArXiv:2202.08970
- RA Kado et al. (2020). Conceptual Design of the miniBeBe Detector Proposed for NICA-MPD. ArXiv:2007.11790
- A Ayala et al. (2020). Core meets corona: a two-component source to explain  $\Lambda$  and  $\Lambda^-$  global polarization in semi-central heavy-ion collisions (2020). ArXiv:2003.13757
- M Alvarado et al. (2019). Time resolution studies for scintillating plastics coupled to silicon photomultipliers. ArXiv:1901.04964

## Talks

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- Laser alignment optimization for the TPC detector at the 2nd commissioning workfest for the sPHENIX experiment (2023)
- Physics simulations with the MPDROOT framework at the 2nd Computing and Analysis Workshop of MexNICA Collaboration (2020)
- Centrality determination of heavy-ion collisions in the MPD-NICA experiment at the Heavy Second Colima Winter School on High Energy Physics at the Universidad de Colima (2018)
- Physics simulations in the MPD-NICA experiment at the seminar of the Particles and Cosmology group of the Universidad de Sonora (2018)
- Monte Carlo workshop at the seminar of the Particles and Cosmology group of the Universidad de Sonora. (2018)

## Awards and recognition

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- Nominated as one of the lead teachers at Chicanos Por La Causa Community Schools (2024)
- Awarded a research visit at the Joint Institute for Nuclear Research as part of the Summer Student Program competition (2017)
- Awarded as the second-best group presentation in the CERN-Latin-American School of High-Energy Physics (CLASHEP) (2017)
- Finalist in the National Nuclear Physics Summer School (NNPSS) contest (2016)
- Finalist in the theoretical-research summer Mexican contest on High Energy Physics (2016)
- Third place, XIX and XX Mexican Chemistry Olympiads (2010, 2011).

## Organizational Involvement and Outreach Activities

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- Led STEM outreach initiatives at Toltecalli High School, expanding student and family engagement in hands-on science activities within CPLC Community Schools (2024-2025)
- Responsible for software development and physics analysis of the TPC laser calibration system at the sPHENIX Commissioning Workfest (2023)
- Director and trainer of simulation and software of the Computing and Analysis Workshops of MexNICA Collaboration (2020)
- Organizer of the Seminar of Particles and Cosmology group of the Universidad de Sonora (2017-2020)
- Organizer of the Physics Film Club at Universidad de Sonora (2016-2017)
- Responsible for coordinating participant reception and transportation logistics for international CLASHEP attendees (2017)
- Outreach presentation of a cosmic rays detector (cosmic piano) and the muon paradox at *Noche de las estrellas* (2014).

## Skills

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**Programming Languages:** Fortran, C++, Python, Shell Scripting, SQL

**HEP Tools:** Root, Geant4, AliRoot, mpdroot, EIC Software, Coresoftware, Hijing, UrQMD

**Data Analysis:** High-Performance Computing, data visualization, data mining, Cloud computing

**Modeling:** Monte Carlo simulation, machine learning, differential equation models, linear programming, statistical models

**Technical Tools:** Microsoft Office Suite, Teams, Outlook, Slack, Linux OS, MATLAB, GitHub, Jupyter.