ILIOMAR RODRÍGUEZ RAMOS

Mayagüez, PR, USA
iliomar.rodriguez@upr.edu • +1 787 469 3981 • iliomar.github.io

EDUCATION

M.S. in Physics August 2024 – Expected May 2027
University of Puerto Rico – Mayagüez
Department of Physics

B.S. in Theoretical Physics August 2018 – May 2024
University of Puerto Rico – Mayagüez
Department of Physics
Minor: Astronomy and Astrophysics

SKILLS AND RESEARCH INTERESTS

Research Interests	CMS Experiment, Dark Matter searches, Dark QCD, Emerging Jets, LLPs, Trigger Efficiency Modeling, Anomaly Detection, End-to-End Simulation, Machine Learning for Detector Quality Monitoring
Technical Skills	Python, C++, Bash, ROOT; PyTorch, TensorFlow; CMSSW, MadGraph, Pythia, FastJet; CMS DQM GUI; Docker, Singularity

RESEARCH EXPERIENCE

Trigger Efficiency Modeling and Uncertainty Estimation January 2025 – Present
CMS Collaboration – conducted at UPRM
With guidance from Kevin Pedro, Associate Scientist at Fermilab

- Developed a neural network-based CMS trigger efficiency model for Emerging Jet signatures in Run 3 analyses, producing smooth, differentiable efficiency estimates from generator- and reconstruction-level observables.
- Evaluated uncertainty estimates through training variations, model stability tests, and control-region vs. signal-region comparisons.
- Built a reproducible Python analysis pipeline for data processing, training, validation, and visualization.

Machine Learning for Data Quality Monitoring (ML4DQM) June 2025 – Present
CMS Collaboration – conducted at UPRM
With guidance from Gabriele Benelli, LPC Researcher, and Richa Sharma, Postdoctoral Researcher

- Applied unsupervised ML methods (non-negative matrix factorization) to CMS Data Quality Monitoring, focusing on anomaly detection in 2D tracking histograms.
- Studied model sensitivity and stability across runs and detector conditions, evaluating separation between nominal behavior and anomalous patterns in monitoring distributions.
- Contributing to CMS ML4DQM tooling, including development and integration efforts for DQMExplore (interactive DQM data exploration) and Reference Run Rank to support reference-run selection and data certification workflows.

End-to-End Simulation Studies with Conditional Generative Models September 2025 – Present
Expand AI Research Group – conducted at UPRM
With supervision of Dr. Sudhir Malik and Dr. Arghya Chattopadhyay, Postdoctoral Researcher

- Developed and evaluated end-to-end simulation pipelines using conditional flow-based generative models linking generator- and reconstruction-level representations.
- Explored extensions of the context vector with geometry- and physics-informed features to improve control, robustness, and interpretability of generated events.

Exploring Complex Structure of Ancient Stars June 2023 – July 2023
REU at Michigan State University, East Lansing, MI
With supervision of Dr. Wolfgang Kerzendorf and Dr. Joshua Shields

- Calibrated and validated the open-source radiative-transfer code STARDIS for stellar atmosphere and spectral simulations using high-resolution solar reference data.
- Compared observational spectra from the University of Tabriz siderostat and spectrograph with synthetic STARDIS spectra to assess model fidelity and systematic effects.
- Contributed to a broader effort to model and interpret spectra of extremely distant, early-universe stars, including applications to objects such as Earendel.

A Statistical Analysis of Crab Pulsar Giant Pulse Rates June 2023 – June 2024
Pulsar Science Collaboration – conducted at UPRM
With supervision of Dr. Graham Doskoch

- Analyzed Crab pulsar giant pulse rates from radio observations, with emphasis on signal-to-noise–based event selection and statistical robustness.
- Quantified how S/N thresholds affect pulse-rate measurements, timing properties, and frequency-dependent behavior.
- Co-authored a refereed publication in The Astronomical Journal reporting statistical properties of Crab giant pulses.

PUBLICATION

G. M. Doskoch, A. Basuroski, K. Halley, A. Sookram, **I. Rodríguez Ramos**, V. Nahata, Z. Rahman, M. Zhang, A. Uhlmann, A. Lynch *et al.*, "A Statistical Analysis of Crab Pulsar Giant Pulse Rates," *The Astrophysical Journal*, 2024. DOI: 10.3847/1538-4357/ad6304.

WORKSHOPS & SCHOOLS

Python for Analysis workshop, Virtual December 2025
IRIS-HEP Software Basics Training, Virtual September 2025
CMS Data Analysis School, Fermilab January 2025
QuarkNet Workshop, University of Puerto Rico at Mayagüez November 2022
Plasma Physics Workshop, Princeton Plasma Physics Laboratory August 2022

TEACHING & OUTREACH

- Conducted a Python training workshop for faculty December 2025
- Led introductory Python training workshops for high school students November 2025
- Taught a Bash shell tutorial as part of HSF training November 2025
- Delivered a Bash shell tutorial for PURSUE interns June 2025
- Physics Laboratory Instructor August 2024 – May 2025

PRESENTATIONS

Trigger Efficiency Modeling for Emerging Jets Using Neural Networks — Physics Research Symposium (Summer 2025), University of Puerto Rico at Mayagüez, September 2025.

Exploring Complex Structures of Ancient Stars — Conference for Women in Physics (CUWiP), Clemson University, January 2024; Physics Research Symposium (Summer 2023), University of Puerto Rico at Mayagüez, September 2023; Physics and Astronomy Research Symposium, Michigan State University, July 2023; Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE), Michigan State University, July 2023.