

# Pablo Martín Ramiro

Instituto de Física Teórica IFT-UAM/CSIC  
28049, Madrid, Spain

pma.ramiro@gmail.com  
+34628778459

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Artificial intelligence researcher. Develop AI models for anomaly detection in particle physics experiments.

## EDUCATION

### Instituto de Física Teórica IFT-UAM/CSIC

PhD in Theoretical Particle Physics

Thesis: Machine learning techniques for new physics searches at the LHC.

Madrid, ES

Oct. 2017 - Oct. 2021

### Durham University

MSc in Particles, Strings and Cosmology

Graduated with Distinction

Durham, UK

Oct. 2015 - Oct. 2016

### Universidad Complutense de Madrid

B.S. Physics, specialization in Fundamental Physics

Madrid, ES

Sept. 2010 - June 2014

## RESEARCH EXPERIENCE

### Instituto de Física Teórica IFT-UAM/CSIC

Graduate Researcher

Improve the search for new physics with machine learning and investigate the nature of Dark Matter.

Madrid, ES

Mar. 2017 - Oct. 2021

- Developed unsupervised deep learning techniques for anomaly detection of new physics signals at the LHC, with focus on identifying the key features of the anomalous signal in high-dimensional spaces.
- Examined high-dimensional spaces to identify and prepare the key features for anomaly detection.
- Explored different model architectures, defined custom metrics and performed hyperparameter optimization for less-than-supervised models.
- Construction of mathematical models to explain the potential effects of Dark Matter in B-physics observables, focusing on the distinctive experimental signatures they would produce.

### Lawrence Berkeley National Laboratory (LBNL)

Research Affiliate

Berkeley, US

Aug. 2019 - Oct. 2019

- Studied and further developed label-free learning methods to deploy less-than-supervised machine techniques directly on unlabeled data.

### Institute for Particle Physics Phenomenology (IPPP)

Research Affiliate

Durham, UK

Jan. - Oct. 2016

- Investigated the properties of Dark Matter in the NMSSM, performing complex simulations to connect fundamental theories to observable experimental quantities.

### Neumann Institute for Computing (NIC), DESY

Graduate Research Assistant

Zeuthen, DE

Sept. 2014 - July 2015

- Worked on Monte Carlo simulations and data analysis techniques for the numerical computation of meson masses in lattice QCD.

## RESEARCH ACTIVITY

### Publications

J. Collins, P. Martín-Ramiro, B. Nachman, and D. Shih, “Comparing Weak- and Unsupervised Methods for Resonant Anomaly Detection”, article manuscript submitted for publication, [[arXiv:2104.02092](#)]

G. Kasieczka, B. Nachman, D. Shih, P. Martín-Ramiro et al., “The LHC Olympics 2020: A Community Challenge for Anomaly Detection in High Energy Physics”, article manuscript submitted for publication, [[arXiv: 2101.08320](#)]

P. Martín-Ramiro and J. M. Moreno, “Improving top quark pair reconstruction in the dilepton channel at future lepton colliders”, article manuscript submitted for publication, [[arXiv: 2003.12320](#)]

D. G. Cerdeno, A. Cheek, P. Martín-Ramiro, and J. M. Moreno, “B anomalies and dark matter: a complex connection”, Eur. Phys. J. C, [[arXiv: 1902.01789](#)]

F. Domingo, J. S. Kim, V. Martín-Lozano, P. Martín-Ramiro, and R. Ruiz de Austri, “Confronting the neutralino and chargino sector of the NMSSM to the multi-lepton searches at the LHC”, Phys. Rev. D, [[arXiv:1812.05186](#)]

### Conference presentations

“Comparing weak and unsupervised anomaly detection”. ML4Jets 2020 Workshop, United States, Jan. 2020.

“Testing B physics anomalies at ATLAS and CMS”. X CPAN Days Workshop, Spain, Oct. 2018.

“Constraining the electroweak sector of the NMSSM at the LHC”. IX CPAN Days Workshop, Spain, Oct. 2017.

### Invited Talks

“Comparing weak and unsupervised anomaly detection at the LHC”. Machine Learning Group Seminar, Universidad Autónoma de Madrid, Feb. 2020.

### Referee

Reviewer at the 2020 NeurIPS workshop on Machine Learning and the Physical Sciences.

### Schools

MCnet Summer School on Monte Carlo Event Generators for the Large Hadron Collider. Italy, July 2018.

Taller de Altas Energías (TAE). Spain, Sept. 2017.

## SKILLS AND TECHNIQUES

**Languages:** native in Spanish and proficient in English.

**Computing:** Python, C, Bash, AWK.

**Libraries:** Keras, Scikit-learn, NumPy, SciPy, Matplotlib.

**Interpersonal Skills:** project management, leadership, effective communication, knowledge sharing.

### Competences:

- Strive for quality in everything I do.
- A critical thinker with strong analytical skills.
- Enterprising, hardworking and eager to learn.
- Get on well with people at all levels, easily making good working relationships.

## REFEREES

Dr. Benjamin Nachman  
Lawrence Berkeley National Laboratory (LBNL)  
1 Cyclotron Road, Berkeley  
CA 94720, United States  
bpnachman@lbl.gov

Dr. Jesús M. Moreno  
Instituto de Física Teórica (IFT) UAM/CSIC  
C/ Nicolás Cabrera 13-15, Cantoblanco  
28049 Madrid, Spain  
jesus.moreno@csic.es

Dr. David García Cerdño  
Instituto de Física Teórica (IFT) UAM/CSIC  
C/ Nicolás Cabrera 13-15, Cantoblanco  
28049 Madrid, Spain  
davidg.cerdeno@gmail.com