

## Humberto Alonso Reyes González

Current position:

### PERSONAL INFORMATION.

Date of birth:

Postdoctoral researcher at RWTH Aachen, Aachen, Germany.

Place of Birth:

June 14, 1991.

Nationality:

Saltillo, Coahuila de Zaragoza, Mexico.

Address:

Mexican.

E-mail:

Room 28A 408, Physikzentrum, Sommerfeldstraße 14, D-52074 Aachen, Germany

Github:

[humberto.reyes@rwth-aachen.de](mailto:humberto.reyes@rwth-aachen.de)

INSPIRE-HEP:

<https://github.com/hreyes91>

Languages:

<http://inspirehep.net/author/profile/H.Reyes.Gonzalez.1>

English (Fluent), Spanish (Native), French (Advanced), Italian (Intermediate).

### EDUCATION.

PhD in Subatomic  
physics and  
astroparticles.

2017-2020 Université Grenoble-Alpes.

Thesis: *Beyond vanilla new physics at the LHC.*

Advisor: Dr. Sabine Kraml.

Master in Sciences  
(Physics).

2014-2017 Universidad Nacional Autónoma de México.

Thesis: *Materia oscura en un modelo de 4 dobletes de Higgs con simetría  $S_3$ .*

(*Dark matter in a model with 4 Higgs doublets with  $S_3$  symmetry.*)

Advisor: Dr. Myriam Mondragón Ceballos.

Bachelor in  
Physics.

2009-2013 Universidad Autónoma de Coahuila.

Thesis: *Estudio de la dispersión  $\rho$ -electrón en las representaciones  $(1/2, 1/2)$  y  $(1, 0) + (0, 1)$ .*

(*Study of the  $\rho$ -electron dispersion in the  $(1/2, 1/2)$  and  $(1, 0) + (0, 1)$  representations.*)

Advisor: Dr. Simón Rodríguez.

Graduated with honors.

### ACADEMIC CAREER.

2023-Present. Postdoctoral researcher.

Department of Physics, RWTH Aachen, Aachen, Germany.

2020-2023 Postdoctoral researcher.

Department of Physics, University of Genoa - INFN Genoa, Genoa, Italy.

### AWARDS.

2014. Medal *Juan Antonio de la Fuente*.

For obtaining the highest grades of my class during my undergraduate studies.

### SPECIALIZATIONS AND COURSES.

2021. **Course: The Introduction to Quantum Computing**

Offered by Saint Petersburg State University through Coursera.

2021. **Specialization: TensorFlow 2 for Deep Learning**

Courses: Getting started with TensorFlow 2 · Customising your models with TensorFlow 2 · Probabilistic Deep Learning with TensorFlow 2. Offered by Imperial College London through Coursera.

2017. **Specialization: Python for everybody**

Courses: Programming for Everybody · Using Databases with Python · Python Data Structures · Capstone: Retrieving, Processing, and Visualizing Data with Python. Offered by University of Michigan through Coursera.

### TEACHING EXPERIENCE.

Spring 2024 Graduate level.

RWTH Aachen, Germany. Teaching assistant: Quantum Field Theory II.

Spring 2020 Undergraduate level.

Université Grenoble-Alpes, Grenoble, France.

Lectures taught (in english and french): TP muon cosmiques (Experimental physics). 32h.

Spring 2019 Undergraduate level.

Université Grenoble-Alpes, Grenoble, France.

Lectures taught (in english and french): TP muon cosmiques (Experimental physics). 32h.

Fall 2016 High school level.

Universidad del Valle de México (UVM), Campus Saltillo in Saltillo, Coahuila, Mexico.

Lectures taught (in english): Math I and Math III. 320h

July 2016 Engineering school.

Universidad Politécnica de Ramos Arizpe (UPRA), in Ramos Arizpe, Mexico.

Lectures taught (in english): Vectorial Calculus and Probability and Statistics. 40h.

#### COMPUTING SKILLS.

##### PYTHON.

Tensorflow 2, Keras, Pytorch.

SModelS, MadAnalysis, MicrOMEGAs, SPheno, MadGraph, etc.

##### SERVICE.

JHEP, SciPost.

ML club at TTK-RWTH Aachen.

#### PUBLICATIONS.

**Les Houches guide to reusable ML models in LHC analyses.** J. Araz, A. Buckley, G. Kasieczka, J. Kieseler, S. Kraml, A. Kvellestad, A. Lessa, T. Procter, A- Raklev, **H. Reyes-Gonzalez**, K. Rolbiecki, S. Sekmen, G. Unel. [arXiv:2312.14575](#). 2023. Submitted to SciPost Physics Community Reports.

**The NFLikelihood: an unsupervised DNNLikelihood from Normalizing Flows.** H. Reyes-González, R. Torre. [arXiv:2309.09743](#). 2023. Submitted to SciPost Physics.

**Comparative Study of Coupling and Autoregressive Flows through Robust Statistical Tests.** A. Coccaro, M. Letizia, **H. Reyes-González**, R. Torre. [arXiv:2302.12024](#). 2023. Submitted to IOP Machine Learning Science and Technology.

**CaloMan: Fast generation of calorimeter showers with density estimation on learned manifolds.** A. L. Caterini, J. Cresswell, B. Leigh Ross, G. Loaiza-Ganem, **H. Reyes-González**, M. Letizia. 2022. Accepted in NeurIPS Machine Learning and the Physical Sciences. [arXiv:2211.15380](#).

**Strength in numbers: optimal and scalable combination of LHC new-physics searches.** J. Araz, A. Buckley, B. Fuks, **H. Reyes-González**, W. Waltenberger, S. Williamson, J. Yellen. [arXiv:2209.00025](#). SciPost Phys. 14 (2023) 4, 077, SciPost Phys. 14 (2023) 077.

**Testing the boundaries: Normalizing Flows for higher dimensional data sets.** H. Reyes-González, Riccardo Torre. In 20th International Workshop on Advanced Computing and Analysis Techniques in Physics Research: AI Decoded - Towards Sustainable, Diverse, Performant and Effective Scientific Computing, 2 2022. [arXiv:2202.09188](#)

**Constraining new physics with SModelS version 2.** G. Alguero, J. Heisig, C. Khosa, S. Kraml, S. Kulkarni, A. Lessa, **H. Reyes-González**, W. Waltenberger. JHEP 08 (2022) 068, [arXiv:2112.00769](#), DOI:[10.1007/JHEP08\(2022\)068](#).

**New signatures of Dirac neutralino dark matter.** M. Goodsell, S. Kraml, **H. Reyes-González**, S. Williamson. In 55th Rencontres de Moriond on Electroweak Interactions and Unified Theories. 2021. [arXiv:2105.08456](#)

**New developments in SModelS.** G. Alguero et al. In Proceedings, Tools for High Energy Physics and Cosmology (TOOLS 2020), PoS TOOLS 2020 (2021) 022. [arXiv:2012.08192](#), DOI:[10.22323/1.392.0022](#).

**An Inert Scalar In The S3 Symmetric Model.** C. Espinoza, E. A. Garcés, M. Mondragón, **H. Reyes-González**. In Proceedings, 6th Symposium on Prospects in the Physics of Discrete Symmetries (DISCRETE 2018), J.Phys.Conf.Ser. 1586 (2020) 1, 012025. DOI:[10.1088/1742-6596/1586/1/012025](#).

**Constraining Electroweakinos in the Minimal Dirac Gaugino Model.** M. Goodsell, S. Kraml, **H. Reyes-González**, S. Williamson. SciPost Phys. (2020) 9. [arXiv:2007.08498](#), DOI:[10.21468/SciPostPhys.9.4.047](#).

**Les Houches 2019 Physics at TeV Colliders: New Physics Working Group Report.** G. Brooijmans et al. In 11th Les Houches Workshop on Physics at TeV Colliders: PhysTeV Les Houches, 2 2020. [arXiv:2002.12220](#).

**LHC limits constraints on the minimal Dirac gaugino model.** G. Chalons, M. Goodsell, S. Kraml, **H. Reyes-González**, S. Williamson. EPS-HEP 2019. [arXiv:1910.12846](#).

Programming and  
Data Analysis

Machine Learning

HEP software

Journal referee.

Organization.

**LHC limits on gluinos and squarks in the minimal Dirac gaugino model.** H. Reyes-González. ALPS2019, PoS 2021. DOI:[10.22323/1.360.0041](https://doi.org/10.22323/1.360.0041)

**LHC limits on gluinos and squarks in the minimal Dirac gaugino model.** G. Chalons, M. Goodsell, S. Kraml, H. Reyes-González, S. Williamson. J. High Energ. Phys. (2019) 2019: 113. [arXiv:1812.09293](https://arxiv.org/abs/1812.09293), DOI:[10.1007/JHEP04\(2019\)113](https://doi.org/10.1007/JHEP04(2019)113).

**SModelS v1.2: long-lived particles, combination of signal regions, and other novelties.** Federico Ambroggi, et al. *Comput. Phys. Commun.*, vol. 251, p. 106848, 2020.. [arXiv:1811.10624](https://arxiv.org/abs/1811.10624), DOI:[10.1016/j.cpc.2019.07.013](https://doi.org/10.1016/j.cpc.2019.07.013).

**The  $S_3$  Symmetric Model with a Dark Scalar.** C. Espinoza, E. A. Garcés, M. Mondragón, H. Reyes-González. *Phys.Lett. B*788 (2019) 185-191. [arXiv:1804.01879](https://arxiv.org/abs/1804.01879), DOI:[10.1016/j.physletb.2018.11.028](https://doi.org/10.1016/j.physletb.2018.11.028).

**Unitarity and stability conditions in a 4-Higgs doublet model with an  $S_3$ -family symmetry.** C. Espinoza, E. A. Garcés, M. Mondragón, H. Reyes-González. *J.Phys.Conf.Ser.* 912 (2017) no.1, 012022. DOI:[10.1088/1742-6596/912/1/012022](https://doi.org/10.1088/1742-6596/912/1/012022)

To appear

**Machine Learning the profile likelihoods of LHC results.** Jack Araz, A. Butter, S. Kraml, C. Krause, R. Maselek, H. Reyes-González, Wolfgang Waltenberger.

#### SELECTED TALKS.

Seminars

Seminar at Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen. **Talk:** ‘Normalizing Flows for high-dimensional HEP’.

Cultural Thursdays of the School of Physical and Mathematical Sciences (FCFM) at Universidad Autónoma de Coahuila, Saltillo, Mexico (Virtual). **Talk:** ‘Machine Learning in High Energy Physics’.

HEP seminars at Institute of Physics at UNAM. November 2023, Mexico city, Mexico (Virtual). **Talk:** “Machine Learning in High Energy Physics: The power of Normalizing Flows”.

HEP seminars at Institute of Physics at UNAM. March 2021, Mexico city, Mexico (Virtual). **Talk:** “Reinterpretation of LHC searches: Constraining the Minimal Dirac Gaugino Model”.

Particle Physics Seminars of the Department of Physics at University of Genoa. December 2020, Genoa, Italy . **Talk:** “Constraining the Minimal Dirac Gaugino Model”.

Cultural Thursdays of the School of Physical and Mathematical Sciences (FCFM) at Universidad Autónoma de Coahuila. March 16, 2017, Saltillo, Mexico. **Talk:** ‘Dark Matter in a 4 Higgs doublet model with  $S_3$  symmetry’.

Conferences

LHCP 2023, May 22- 26, 2023 Belgrade, Serbia. **Talk:** ‘Analyses together strong: Optimal combination of LHC new physics searches.’ ([see here](#))

ACAT 2022, October 23- 28, 2022 Bari, Italy. **Talk:** ‘Learning full-likelihoods of LHC results with Normalizing Flows.’

Learning to Discover, April 27 - 29, 2022, Institut Pascal, Université Paris-Saclay, Orsay, France. **Talk:** ‘Unsupervised Learning Likelihood functions of LHC results.’

ACAT 2021, November 29 - December 3, 2021 (Virtual attendance). **Talk:** ‘Testing the boundaries: Normalizing Flows for high-dimensional data sets.’

EW-Moriond 2021. March 20-27, 2021, (Virtual). **Talk:** ‘New signatures of Dirac neutralino dark matter’.

Sixth workshop on (Re)interpreting the results of new physics searches at the LHC. February 15-19, 2021, (Virtual). **Talk:** ‘Constraining electroweakinos in the Minimal Dirac gaugino model’.

EPS-HEP 2019. July 10-17, 2019, Ghent, Belgium. **Parallel talk:** ‘LHC constraints on the minimal Dirac gaugino model’.

ALPS 2019. April 22-27, 2019, Obergurgl, Austria. **Parallel talk:** ‘LHC constraints in the gluinos and squarks of the minimal Dirac gaugino model’.

Meetings and workshops

6th inter-experimental machine learning workshop, January 29-February 2., 2024. CERN. **Talk:** ‘Parametrising profiled likelihoods with neural networks.’ ([see here](#))

Reinterpretation of the LHC results for new physics workshop, April 29- September 1., 2023. Durham, England. **Talk:** ‘Parametrising profiled likelihoods with neural networks.’ ([see here](#))

CaloChallenge workshop, May 30-31, 2023. Frascati, Italy. **Talk:** ‘CaloMan: Fast generation of calorimeter showers with density estimation on learned manifolds’ ([see here](#))

ML Machine Learning Working Group meeting, December 13-15, 2022. CERN. **Talk:** ‘The Unsupervised DNN Likelihood: Learning Likelihoods with Normalizing Flows’.

Reinterpretation of LHC Results for New Physics workshop, December 12–15, 2022, CERN. **Talk:** ‘Machine Learning LHC likelihoods’.

IN2P3/IRFU Machine Learning workshop. January 22-23, 2020, Lyon, France. **Talk:** (Machine) Learning the production cross sections of the Inert Doublet Model.

IRN Tescale@Annecy. May 20-22, 2019, Annecy, France. **Talk:** 'LHC limits on Gluinos and Squarks in the Minimal Dirac Gaugino Model'.

Rencontre de Physique des Particules 2019. January 23-25, 2019, Clermont-Ferrand. **Talk:** 'LHC limits on gluinos and squark in the minimal Dirac gaugino model'.

31st Annual Meeting of the Division of Particles and Fields of the Mexican Physical Society. May 24-26, Mexico City, Mexico. **Talk:** 'Dark Matter in a 4 Higgs doublet model with  $S_3$  symmetry'.

#### SELECTED WORKSHOPS.

Machine learning at GGI. August 22-September 30, 2022. Galileo Galilei Institute for theoretical physics, Arcetri, Italy.

A deep learning era of particle theory. June 13-July 8, 2022. Mainz Institute for Theoretical Physics, Mainz, Germany.

Learning to Discover. April 19-29, 2022. Institut Pascal, Université Paris-Saclay, Orsay, France.

Machine Learning for Particle Physics. June 21-July 2, 2021. Mainz Institute for Theoretical Physics, Mainz, Germany (Virtual).

Les Houches 2019. Physics at TeV Colliders. June 19-28, 2019, Les Houches, France.

Fourth workshop on (Re)interpreting the results of new physics searches at the LHC. 14-16 May, 2018, CERN.

July 18, 2024