

Juan Pablo González-Aguilera

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Education

- PhD in Physics** *University of Chicago* Chicago, IL 2020 - present
Studying coherent synchrotron radiation in particle accelerators using high-dimensional ML-based phase space reconstruction algorithms.
- MSc in Physics** *University of Chicago* Chicago, IL 2020-2022
Characterized emittance in particle accelerator using Bayesian optimization.
- BSc in Physics (*summa cum laude*)** *Universidad de Los Andes* Bogotá, Colombia 2016-2019
Thesis: Classification of variable stars using supervised learning.

Research Experience

- Graduate Research Assistant** *University of Chicago and Argonne National Laboratory* Chicago, IL 2020 - present
 - Characterizing coherent synchrotron radiation effects at the Argonne Wakefield Accelerator.
 - Developed six-dimensional phase space reconstruction method using neural networks and differentiable physics simulations.
 - Developed backward-differentiable particle tracking library in PyTorch.
 - Mentored three undergraduate students in accelerator physics summer projects.
 - Led accelerator group weekly meetings.
- Post-baccalaureate Research Scholar** *Cornell University* Ithaca, NY 2019 - 2020
 - Implemented genetic algorithms in particle accelerator multi-objective optimization.
 - Assisted in design, simulations and experiments of ultra-fast electron diffraction beamline.
 - Mentored an undergraduate student in experimental project.
- Undergraduate Research Assistant** *Universidad de Los Andes* Bogotá, Colombia 2016 - 2019
 - Implemented supervised learning methods in variable star classification.
 - Characterized entangled photon source in quantum optics lab.

Teaching Experience

- Graduate Teaching Assistant** *University of Chicago* Chicago, IL 2020 - present
 - Conducting discussion sessions and labs of the following courses: Mechanics, Electromagnetism, and Waves and Heat.
- Python for Research program Mentor** *University of Chicago* Chicago, IL 2024
 - Designed a research project for the *Python for Research* program.
 - Mentored and guided five students.
- Trainee Teacher and Peer Tutor** *Universidad de Los Andes* Bogotá, Colombia 2018 - 2019
 - Served as Physics Department tutor for students in the following courses: Physics I-II, Waves and Fluids, Modern Physics, and Mechanics.
 - Served as Sciences School tutor for students in the following courses: Precalculus, Calculus I-II-III, Linear Algebra I, Physics I-II, Probability and Statistics.
 - Obtained first place in tutor evaluation ranking.
- Grader** *Universidad de Los Andes* Bogotá, Colombia 2016 - 2019
 - Graded the following undergraduate courses: Electromagnetism I, Mathematical Methods for Physicists, Physics I and II, Probability I.

Honors and Awards

- Physical Sciences Division Fellowship** *Physical Sciences Division, University of Chicago* 2023
- Robert G. Sachs Fellowship** *Department of Physics, University of Chicago* 2021
- PAHBB Travel Grant** *Physics and Applications of High Brightness Beams, UCLA* 2023
- DPB APS April Meeting Travel Scholarship** *American Physical Society* 2022
- APS Braslau Family Travel Grant** *American Physical Society* 2022
- SURF Cornell Research Scholarship** *Universidad de Los Andes and Cornell University* 2019

Summa Cum Laude degree in Physics	<i>Facultad de Ciencias, Universidad de Los Andes</i>	2019
Distinción de Excelencia Semestral	<i>Departamento de Física, Universidad de Los Andes</i>	2018
Distinción Alberto Magno	<i>Universidad de Los Andes</i>	2014
First Place (Absolute Winner) - Colombian Physics Olympiad	<i>Olimpiadas Colombianas</i>	2013
Honorable Mention - Iberoamerican Physics Olympiad	<i>Olimpiadas Iberoamericanas</i>	2013
Second Place - Colombian Sciences Olympiad	<i>Olimpiadas Colombianas</i>	2012

Talks

Detailed Characterization of Coherent Synchrotron Radiation Effects using Generative Phase Space Reconstruction	Gyeongju, South Korea	2024
4th Machine Learning Applications for Particle Accelerators		
Detailed Phase Space Reconstruction from a Limited Number of Beam Measurements Using Neural Networks and Differentiable Simulations	San Sebastián, Spain	2023
Physics and Applications of High Brightness Beams		
Towards End-to-End Differentiable Accelerator Modeling	Chicago, IL	2022
3rd Machine Learning Applications for Particle Accelerators		
Novel Accelerator Diagnostic Development for Multi-Objective Bayesian Optimization at the Argonne Wakefield Accelerator Facility	USA (online)	2021
American Physical Society April Meeting		

Poster Presentations

Towards Fully Differentiable Accelerator Modeling	Venice, Italy	2023
14th International Particle Accelerator Conference		
Bayesian Active Learning for Autonomous Parameter Space Exploration in Particle Accelerators	New York, NY	2022
American Physical Society April Meeting		
Beam Diagnostics for Multi-Objective Bayesian Optimization at the Argonne Wakefield Accelerator Facility	Brazil (online)	2021
12th International Particle Accelerator Conference		

Publication List

- Kim, S., **Gonzalez-Aguilera, J. P.**, Piot, P., Chen, G., Doran, S., Kim, Y.-K., Liu, W., Whiteford, C., E., W., A., E., Roussel, R., & Power, J. (2024). Four-dimensional phase-space reconstruction of flat and magnetized beams using neural networks and differentiable simulations. *arXiv:2402.1824*. <https://doi.org/10.48550/arXiv.2402.18244>
- Roussel, R., Edelen, A., Mayes, C., Ratner, D., **Gonzalez-Aguilera, J. P.**, Kim, S., Wisniewski, E., & Power, J. (2023). Phase space reconstruction from accelerator beam measurements using neural networks and differentiable simulations. *Phys. Rev. Lett.*, 130, 145001. <https://doi.org/10.1103/PhysRevLett.130.145001>
- Gonzalez-Aguilera, J. P.**, Kim, Y.-K., Roussel, R., Edelen, A., & Mayes, C. (2023). Towards fully differentiable accelerator modeling. *Proc. 14th Int. Particle Acc. Conf. (IPAC'23)*, 2797–2800. <https://doi.org/10.18429/JACoW-IPAC2023-WEPA065>
- Roussel, R., Edelen, A., Ratner, D., Dubey, K., **Gonzalez-Aguilera, J. P.**, Kim, Y.-K., & Kuklev, N. (2022). Differentiable preisach modeling for characterization and optimization of particle accelerator systems with hysteresis. *Phys. Rev. Lett.*, 128, 204801. <https://doi.org/10.1103/PhysRevLett.128.204801>
- Roussel, R., **Gonzalez-Aguilera, J. P.**, Kim, Y.-K., Wisniewski, E., Liu, W., Piot, P., Power, J., Hanuka, A., & Edelen, A. (2021). Turn-key constrained parameter space exploration for particle accelerators using bayesian active learning. *Nat. Commun.*, 12(1), 5612. <https://doi.org/10.1038/s41467-021-25757-3>
- Gonzalez-Aguilera, J. P.**, Roussel, R., Kim, Y.-K., Liu, W., Power, J. G., & Wisniewski, E. E. (2021). Beam diagnostics for multi-objective bayesian optimization at the Argonne Wakefield Accelerator Facility. *Proc. 12th Int. Particle Acc. Conf. (IPAC'21)*, 960–962. <https://doi.org/10.18429/JACoW-IPAC2021-MOPAB304>

Skills

- **Programming Languages:** Python, PyTorch, C++, Mathematica, Fortran, Julia, Java.
- **Computer Skills:** Git, Linux, Bash, High-Performance Computing, Parallel Computing, GPU Acceleration, \LaTeX .
- **Experimental Skills:** Image post-processing, Electronics, Data Acquisition, Control System (EPICS), Laser Alignment, Particle Accelerator Components.
- **Soft Skills:** Leading Meetings, Teamwork Collaboration (remote and in-person), Presentation, Communication, Adaptation, Learning, Resilience, Critical Thinking, Teaching, Mentoring.

Areas of Expertise

Differentiable Simulations - Accelerator Physics - Computational Physics - Experimental Physics - Data Analysis
Probability - Statistics - Machine Learning - Bayesian Optimization - University Teaching - University Mentoring

References

Young-Kee Kim

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