

Juan Pablo González-Aguilera

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Education

- PhD in Physics** *University of Chicago* Chicago, IL 2025 (expected)
Studying coherent synchrotron radiation in particle accelerators using high-dimensional ML-based phase space reconstruction algorithms.
- MSc in Physics** *University of Chicago* Chicago, IL 2022
Characterized emittance in particle accelerator using Bayesian optimization.
- BSc in Physics (summa cum laude)** *Universidad de Los Andes* Bogotá, Colombia 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 2018 - 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 - 2024
 - Conducted 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 tutor in the Physics Department and School of Sciences. Courses: Physics I-II, Waves and Fluids, Modern Physics, Mechanics, Precalculus, Calculus I-II-III, Linear Algebra I, Probability and Statistics.
 - Obtained first place in tutor evaluation ranking.
- Grader** *Universidad de Los Andes* Bogotá, Colombia 2017 - 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
- SURF Cornell Research Scholarship** *Universidad de Los Andes and Cornell University* 2019
- Summa Cum Laude degree in Physics** *Facultad de Ciencias, Universidad de Los Andes* 2019
- Distinción de Excelencia Semestral** *Departamento de Física, Universidad de Los Andes* 2018
- Distinción Alberto Magno** *Universidad de Los Andes* 2014
- First Place (Absolute Winner) - Colombian Physics Olympiad** *Olimpiadas Colombianas* 2013
- Honorable Mention - Iberoamerican Physics Olympiad** *Olimpiadas Iberoamericanas* 2013
- Second Place - Colombian Sciences Olympiad** *Olimpiadas Colombianas* 2012

Talks

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

Poster Presentations

- Detailed Characterization of Coherent Synchrotron Radiation Effects using Generative Phase Space Reconstruction**
15th International Particle Accelerator Conference
Nashville, TN 2024
- Towards Fully Differentiable Accelerator Modeling**
14th International Particle Accelerator Conference
Venice, Italy 2023
- Bayesian Active Learning for Autonomous Parameter Space Exploration in Particle Accelerators**
American Physical Society April Meeting
New York, NY 2022
- Beam Diagnostics for Multi-Objective Bayesian Optimization at the Argonne Wakefield Accelerator Facility**
12th International Particle Accelerator Conference
Brazil (online) 2021

Publications

- Gonzalez-Aguilera, J.**, Kim, Y., Roussel, R., & Edelen, A. (2024). Detailed characterization of coherent synchrotron radiation effects using generative phase space reconstruction. *Proc. IPAC'24*, 2400–2403. <https://www.jacow.org/ipac2024/doi/jacow-ipac2024-wepg94>
- Roussel, R., **Gonzalez-Aguilera, J. P.**, Edelen, A., Wisniewski, E., Ody, A., Liu, W., Kim, Y.-K., & Power, J. (2024). Efficient 6-dimensional phase space reconstruction from experimental measurements using generative machine learning [Submitted to Phys. Rev. Accel. Beams]. *arXiv:2404.10853*. <https://doi.org/10.48550/arXiv.2402.18244>
- Kim, S., **Gonzalez-Aguilera, J. P.**, Piot, P., Chen, G., Doran, S., Kim, Y.-K., Liu, W., Whiteford, C., Wisniewski, E., Edelen, A., Roussel, R., & Power, J. (2024). Four-dimensional phase-space reconstruction of flat and magnetized beams using neural networks and differentiable simulations [Submitted to Phys. Rev. Accel. Beams]. *arXiv:2402.1824*. <https://doi.org/10.48550/arXiv.2402.18244>
- Gonzalez-Aguilera, J.**, Kim, Y., Roussel, R., Edelen, A., & Mayes, C. (2023). Towards fully differentiable accelerator modeling. *Proc. IPAC'23*, 2797–2800. <https://doi.org/10.18429/JACoW-IPAC2023-WEPA065>
- 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>
- 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. 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, Adept, Receptive, Resilient, 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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