

# 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 - 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 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
- 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** *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

## 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

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

- 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. *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. *arXiv:2402.1824*. <https://doi.org/10.48550/arXiv.2402.18244>
- 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., 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. 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,  $\text{\LaTeX}$ .

- **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

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

## References

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### Young-Kee Kim

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### Auralee Edelen

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### John Power

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