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.

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.

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.

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.

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	*Facultad de Ciencias, Universidad de Los Andes*	*2019*
Distinción de Excelencia Semestral	*Departmento de Física, Universidad de Los Andes*	*2018*
Distinción Alberto Magno Scholarship	*Universidad de Los Andes*	*2014*
First Place - 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

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*

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

Mentoring

- Mentored three undergraduate students at Cornell and UChicago in accelerator physics summer projects.
- Served as a graduate mentor in *Python for Research* program at UChicago.

Skills

- **Programming:** Python, PyTorch, C++, Mathematica, Fortran, Julia, Java.

- **Computing:** Linux, Bash, High-Performance Computing, Parallel Computing, GPU Acceleration, LaTeX.
- **Experimental:** 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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