Laura Pereira Sanchez

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Linkedin | Github | CERN Gitlab | Publication List

Geneva, Switzerland

About me

PhD in experimental particle physics currently employed by Stanford University. I am driven by the possibility of applying my experience analyzing big data and my knowledge in AI, statistics, data science and software development, to projects that will generate value and have a direct positive impact in society.

Experience

- **Stanford University & SLAC National Laboratory** *Oct 2023 -*
  Postdoctoral Research Fellow - ATLAS Collaboration (CERN) Menlo Park, CA, USA & Geneva, Switzerland
  - Developed AI algorithms to identify key signatures in particle physics collisions.
  - Contributed to building a state of the art tracking particle physics detector.
- **Stockholm University** *September 2018 - August 2023*
  Doctoral Researcher - ATLAS Collaboration (CERN) Stockholm, Sweden
  - Analyzed large datasets from particle physics collisions resulting in 12 scientific articles in peer-reviewed journals and high impact conferences.
  - Coordinated 2 scientific projects over a period of 2 and 4 years overseeing the work of more than 15 people each.
  - Developed frameworks for data visualization, statistical analysis and classification exploiting AI and ML techniques.

Education

- **PhD in Physics** *September 2023 - May 2024*
  Stockholm University Stockholm, Sweden
  - Supervisor: Sara Strandberg
  - Thesis title: The Beauty in Broken Symmetries: *b*-jet identification and searches for Supersymmetry, Dark Matter and multi-Higgs production with the ATLAS experiment
- **Master in Particle Physics, Astrophysics and Cosmology** *September 2017 - July 2018*
  Universitat Autonoma de Barcelona Barcelona, Spain
- **Bachelor in Physics** *September 2013 - July 2017*
  Universitat Autonoma de Barcelona Barcelona, Spain

Projects

- **AI and Machine Learning algorithms for particle physics** *September 2021 -*
  Tools: JAX, PyTorch, Tensorflow, Keras [ ]
  - Developed and benchmarked AI algorithms leveraging transformers, graph neural networks, deep neural networks and boosted decision trees.
  - Implement state-of-the-art research in auto-differentiable programming to train physics aware neural networks.
  - Process datasets of Big Data for Machine Learning projects (Data engineering).
  - Calibration of AI algorithms to account for the domain shift between simulation and data.
- **Building a particle physics detector** *October 2023 -*
  Tools: MongoDB database, Docker
  - Designed and implemented the database architecture for a new experiment, ensuring robust data handling throughout pre-production and production phases.
  - Collaborated with cross-functional teams to align database functionality with project needs, improving data accessibility and workflow integration.
  - Set up the software required for testing during integration using *Docker* containers.
  - Point of contact between multiple sites and detector sub-systems.
  - Laboratory experience handling sensitive material in the clean room.
- **Statistics and Data Analysis** *September 2018 - October 2023*
  Tools: python, C++, Bash, ROOT, Git
  - Published analyses of complex Big Data from particle physics collisions.
  - Contributed to large scale frameworks developed within the ATLAS collaboration, ranging from statistical and data analysis, applying machine learning algorithms and automating workflows using bash.
  - Applied experience from particle physics to published research in autonomous driving.

SELECTED SCIENTIFC PUBLICATIONS

C=CONFERENCE, J=JOURNAL, S=IN SUBMISSION, T=THESIS

[J.1] ATLAS Collaboration. (2024). **Search for a resonance decaying into a scalar particle and a Higgs boson in the final state with two bottom quarks and two photons in proton-proton collisions at a center of mass energy of 13 TeV with the ATLAS detector**. Manuscript accepted for publication in *Journal of Hight Energy Physics*. arXiv.2404.12915.

[J.2] ATLAS Collaboration (2023). **Calibration of the light-flavour jet mistagging efficiency of the b-tagging algorithms with Z+jets events using 139 fb^{-1} of ATLAS proton-proton collision data at $\sqrt{s}$ = 13 TeV**. In *Eur. Phys. J. C, 83(8), 728.*. DOI: 10.1140/epjc/s10052-023-11736-z

[C.1] A. Khoche, L.Pereira Sanchez et al. (2024). **Towards Long-Range 3D Object Detection for Autonomous Vehicles**. Presented at the *Intelligent Vehicle Symposium (IV) 2024*. arXiv.2310.04800.

TECHICAL SKILLS

- **Programming Languages:** Python, C++, ROOT, Bash/UNIX
- **Database Systems:** Mongo DB
- **Data Visualization:** Pandas, Matplotlib, Seaborn
- **AI & Machine Learning:** Keras, JAX, Pytorch, Tensorflow, TMVA
- **Cloud Technologies:** CERN, SLAC
- **DevOps & Version Control:** Gitlab, Github, VSCode, JIRA
- **Statistics:** Hypothesis Testing, Log-likelihoods, Uncertainty Modeling

SOFT SKILLS

- **Leadership:** Served a project owner in a team of 15 physicist in a novel data analysis project during 4 years, from its start until its publication.
- **Coordination:** Liaison between different international and interdisciplinary teams for 2 different projects
- **Supervision:** Supervised master and PhD students from different universities.
- **Team work** Collaborated in different international and interdisciplinary teams of between 4 and 40 people, resulting in more than 10 scientific publications and two hardware implementations.
- **Languages:** Native Spanish and Catalan, Proficient English (C2), Beginner German (B1) and French (A2).
- **Communication:** Presented research to experts (meetings, conferences and journals) and public (outreach events).

HONORS AND AWARDS

- **Postdoctoral Fellow at Stanford University** *May 2023*
  Knut and Allice Wallenberg Foundation - KAW 2022.0358 [🌐]
  ◦ My research proposal "Measuring the shape of the Higgs potential in ATLAS" was funded for up to 4 years.
- **Travel Grants** *2023 / 2021*
  Kinanders, Lydia and Emil, Foundation / Kobbs, Gustaf and Ellen, Scholarship Foundation [🌐]
  ◦ Two independent grants to present research at cutting edge international conferences.
- **69th Lindau Nobel Leaureate Meeting in Physics** *2019*
  Ragnar Söderberg Foundation [🌐]
  ◦ Selected to spend one week discussing with Nobel Laureates and other young scientists about Physics.

CERTIFICATIONS

- **Coursera:** Deep Learning Specialization (4/5) *2021*
- **CERN, HSF and SIDIS:** HEP C++ course *2020*
- **University of Michigan:** Proficiency in English *2014*