Lucas Flores

Corona, California ◦ (951) 545-3382 ◦ lucasmacrorieflores@gmail.com
lucasflores.com ◦ gitlab.cern.ch/luflores ◦ github.com/lucasflores ◦ linkedin.com/in/lucas-m-flores/

Skills

	(*Proficient*)	(*Good*)	(*Basic*)
Languages:	C++, Python, Bash	SQL, HTML, CSS	YAML, JavaScript
Software/Tools:	UNIX, Git, CI, LaTeX	matplotlib, scikit-learn, pandas, Docker	scipy, NumPy
Other:	Hypothesis testing, statistics, machine learning, regression analysis, data visualization, scraping, JIRA, GitHub, HTCondor, Google Colab, Jupyter, Web design		

Education

AUG. 2015 – DEC. 2021 **PhD/MS** – Particle Physics *University of Pennsylvania, Philadelphia, PA*
SEPT. 2010 – JUNE 2015 **BS** – Physics & Applied Math. *UC Riverside, Riverside. CA*

Experience

JULY 2015 – DEC. 2021 **Research Assistant** ***University of Pennsylvania, Philadelphia, PA*** ***CERN, Geneva, Switzerland***

Responsible for designing and implementing control and validation regions in a particle physics analysis using 7× the data as the previous most analogous analysis iteration. Developed a framework for the preservation, re-usability, and reinterpretation of this analysis using git, Continuous Integration (CI), Docker images, and workflows. Gave weekly reports to audiences of varying expertise within the ATLAS collaboration.

- Investigated petabytes of proton-proton collision data (≈13.9 million billion collisions) produced by the Large Hadron Collider (LHC) with the ATLAS detector in a search for theorized subatomic particles, furthering our knowledge of fundamental physics.
- Utilized the Worldwide LHC Computing Grid, a powerful distributed computing resource, and HTCondor (distributed parallelization software) enabled dedicated computing clusters to process big data sets.
- Developed C++/Python framework to clean, analyze, transform, and visualize data.
- Engineered new features to optimize selections for control, validation, and signal regions.
- Set exclusion limits at a 95% confidence level (exclude for $p<0.05$) for the existence of new fundamental particles via a profile likelihood ratio fit.
- Presented results to the broader physics community at two international conferences.

Served as a software expert for the "electron-photon" performance group, a major working group within the ATLAS collaboration tasked with measuring the properties of electrons/photons that emerge from the proton collisions. Responsible for maintaining and developing the electron identification analysis framework (Python/C++). Responsible for re-optimization of a data-driven multivariate likelihood based electron identification algorithm, the *electron likelihood*, used in nearly all analyses on ATLAS (over 5000 members).

- Transitioned the electron likelihood from being trained on a hybrid of simulated and real data to a fully real data driven algorithm.
- Re-optimized the electron likelihood by utilizing all newly available *high-energy* data that was collected.
- Investigated a new metric for tuning the algorithm to retain desired signal and background rates for different detector environments, i.e. the detector can see anywhere from 1 to 80 "simultaneous" collisions.
- Validated the electron likelihood after a major upgrade of software that produces its lower level inputs (i.e. an "electron reconstruction" object that gets fed into the electron identification).
- Ported framework from RootCore (deprecated physicist built package build manager) to CMake and migrated framework from longstanding version control software SVN, to gitlab.
- Mentored new framework users/developers. Hands on help and served as expert contact.

AUG. 2015 – MAY 2016 **Teaching Assistant** ***University of Pennsylvania, Philadelphia, PA***

Responsible for laying out the purpose of each lab and grading bi-weekly homework assignments for physics lecture component of 40+ undergraduate students.

- Lead lab sections in both classical mechanics and electromagnetism.
- Guided students to complete each lab with a good understanding of the experimental techniques and physics principles as well as how the lab connected to the lecture component.

JULY 2013 – MAY 2015 **Undergraduate Researcher** ***UC Riverside, Riverside, CA***

By studying direct photon and jet+photon events in simulations of protons on heavy nuclei, we aim to determine how well measurements of the Gluon Structure function can be made by the Muon Piston Calorimeter Extension (MPC-EX) detector. Performed 'jet' studies from simulated data interacting with a simulated MPC-EX detector. Jet momentum resolution of the MPC-EX was studied.

JULY 2012 – SEPT. 2012 **Research Internship** ***Brookhaven National Laboratory, Upton, NY***
I worked with the PHENIX collaboration under professor Richard Seto of UC Riverside. For the whole of the summer I worked on describing the properties of 'jets' (conical sprays of particles) emanating from simulated heavy Ion (Au+Au) particle collision event at forward rapidity (nearest to the beamline).

PROJECTS, PUBLICATIONS, AND POSTERS

2022 [Project] – ***"PermaLost"*** – Predictive permafrost loss tool in application to the vulnerability of "soft" artifacts to rot and decay in Greenland due to climate change induced warming. Built with pandas, geopandas, matplotlib, scikit-learn, and skforecast. Identifying list of localities with greatest rate in permafrost reduction. github.com/lucasflores/PermaLost

2022 [Project] – ***Web-based PhD Thesis*** – make4ht/Python based LaTeX→ HTML/CSS/JavaScript conversion framework. Single command that compiles, converts, stylizes, implements a Wikipedia-like hover glossary, and publishes website to github pages. lucasflores.com/thesis/

2021 [Talk] – ***"Search for chargino pair-production and chargino-neutralino production with R-Parity Violating decays in pp collisions at $\sqrt{s}$ = 13 TeV with ATLAS"*** @ The Meeting of the Division of Particles and Fields of the American Physical Society (APS), indico.cern.ch/event/1034469/contributions/4427253/

2021 [Publication, PhD Thesis] – ***"Identifying Electrons and Searching for Electroweak R-Parity Violating Supersymmetry at ATLAS"*** [lucasflores.com/thesis] [repository.upenn.edu/dissertations/AAI28722112/]

2021 [Publication] – ***"Search for trilepton resonances from chargino and neutralino pair production in $\sqrt{s}$=13 TeV pp collisions with the ATLAS detector"***, PhysRevD.103.112003

2020 [Project] – ***"The Large Google Maps Collider"*** – Animating a big particle accelerator (the Large Hadron Collider) on Google Maps, [lucasflores.com/blogfolio/LGMC/] [github.com/lucasflores/lucas.github.io/blob/master/src/components/map.js]

2019 [Publication] – ***"ATLAS electron and photon reconstruction and energy calibration with 2015-2017 data"*** 2019 JINST 14 P12006 (Section: 6 Electron Identification)

2019 [Publication] – ***"Electron reconstruction and identification in the ATLAS experiment using the 2015 and 2016 LHC proton-proton collision data at $\sqrt{s}$= 13 TeV"*** doi.org/10.1140/epjc/s10052-019-7140-6

2019 [Poster] – ***"Search for chargino pair-production and chargino-neutralino production with R-Parity Violating decays in pp collisions at $\sqrt{s}$ = 13 TeV with ATLAS"*** @ The 2019 Meeting of the Division of Particles & Fields, indico.cern.ch/event/782953/contributions/3515495/

2019 [Talk] – ***"Search for chargino pair-production and chargino-neutralino production with R-Parity Violating decays in pp collisions at $\sqrt{s}$ = 13 TeV with ATLAS"*** @ The 2019 Meeting of the Division of Particles & Fields, indico.cern.ch/event/782953/contributions/3459978/

2019 [Poster] – ***"The ATLAS Electron and Photon Trigger Performance in Run 2"*** @ The 29^{th} International symposium on Lepton and Photon Interactions at High Energies – Overview of the trigger system at ATLAS, its performance, and its most recent new features, indico.cern.ch/event/688643/contributions/3429780/

2018 [Project] ***"keypacitance"*** @ PennApps XVII Hackathon – Adds a capacitive touch layer input to keyboard. Built VR keyboard object in Unity in demonstrated application. Built Unity application for visualizing VR keyboard, blog post: lucasflores.com/blogfolio/keypacitance/

2017 [Project] – ***"cryptoino"*** @ PennApps XV Hackathon – Lightweight symmetric key exchange via Tree Parity Machine (TPM) neural nets. Targeted small insecure Internet of Things devices. Semi-final qualifier. Contributed to arduino/C# code development and sole creator of the TPM synchronization visualization, blog post: lucasflores.com/blogfolio/cryptoino/

2016 [Project] – ***"eyeHUD"*** @ PennApps XIV Hackathon – Smart eye-tracking transparent window 'heads-up' display. Responsible for developing the calibration/training method for transform factors for the 3 different 'pixel' spaces (2 webcams and LCD). **Third place overall** and *"Best Public Safety or Video Processing App."*, blog post: lucasflores.com/blogfolio/eyeHUD/

2016 [Talk] – ***"Electron Identification with the ATLAS detector"*** @ APS April Meeting 2017 – This talk describes the current state of electron identification (ID) at ATLAS as well as the investigation of a new performance metric for tuning the ID algorithm, meetings.aps.org/Meeting/APR17/Session/R9.2

2014 [Poster] – ***"Jet Studies on the MPC-EX pre-shower detector upgrade to the PHENIX experiment"*** @ Department of Nuclear Physics Conference/Conference Experience for Undergraduates] – By studying direct photon and jet+photon events in simulations of protons on heavy nuclei, we aim to determine how well measurements of the Gluon Structure function can be made by the MPC-EX detector. One of the leading hypothesis to explain gluon distributions at low momentum fraction is the Color Glass Condensate.

Honors & Awards

2016 [Award] – ***"Third place overall & Best Public Safety or Video Processing App."*** @ PennApps XIV Hackathon – "eyeHUD" is a smart eye-tracking transparent window 'heads-up' display, blog post: lucasflores.com/blogfolio/eyeHUD/

2014-2015 [Honor] – ***"MARC U STAR Scholar Fellowship "*** @ The University of California, Riverside.

2015 [Award] – ***"The Robert T. Poe Memorial Scholarship Award for Outstanding Bachelor of Science Graduate"*** @ The University of California, Riverside.

2014 [Award] – ***"Benjamin C. Shen Memorial Undergraduate Scholarship Award for Outstanding Academic Achievement by a 3rd Year Undergraduate Student"*** @ The University of California, Riverside.