(908) 294-0761
Christopher.Anelli@gmail.com

Christopher Ryan Anelli

EDUCATION 09/10 - 05/16	**University of Maryland** PhD in High Energy Physics
	Stanford University
09/06 - 06/10	Bachelors Degree in Physics, Minor in Mathematics

WORK EXPERIENCE

Postdoctoral Fellow in Experimental Particle Physics, ATLAS Collaboration, University of Victoria, Victoria, BC. **11/16 - 11/19**

01/17 - 12/19

- $Z(\ell\ell) + E_T^{miss}$ **Search:** Using 139 fb^{-1} of 2015 - 2018, 13 TeV ATLAS data, searched for dark matter production in association with a leptonically decaying Z-boson, $Z(\ell\ell)+E_T^{miss}$. Similar to other Mono-X searches, this channel is sensitive to E_T^{miss} produced by dark matter recoiling against an Initial State Radiation (ISR) Z-boson. Distinctively, the search is sensitive to Extended Higgs Sector models, i.e. the Pseudoscalar Two Higgs Doublet Model (2HDMa), where signal production is resonantly enhanced. Responsibilities for the analysis included generating signal samples, calculating acceptances, and estimating systematic sources of uncertainty. Wrote analysis code optimizing selection cuts for the full Run-2 dataset, produced corresponding ROC curves, and motivated switching to a transverse mass (M_T) discriminating variable.

01/18 - 05/19

- **White Paper and Dark Matter Summary Paper:** $Z(\ell\ell) + E_T^{miss}$ liaison to an LHC White Paper and ATLAS Dark Matter Summary paper. For the White Paper, studied phenomenology of the novel 2HDMa model. Work included kinematic studies, estimating the detector's expected sensitivity, and outlining best practices for future searches. For the Summary Paper, gathered results from over 20 ATLAS dark matter searches. Previous results were reinterpreted to place limits on new models of dark matter, in particular NLO Simplified Dark Matter and 2HDM+a models. Responsible for calculating the $Z+E_T^{miss}$ exclusion limits including rescaling to emulate additional mass points and smooth contours. Limits were compared to other ATLAS searches and to direct detection experiments.

  Results published in JHEP-05 (2019) and LHC White Paper arXiv.1810.09420.

03/19 - 11/19

- **2HDMa Combination:** Coordinated simulation of 2HDMa signal samples for the Common Dark Matter Group. Defined a set of benchmark scans that highlighted key features of the theory and stressed complementarity between searches. Ensured analyses teams used common generator setting and defined orthogonal search regions.

11/16 - 11/19

- **Liquid Argon Calorimeter Phase-II:** In preparation for the HL-LHC, worked on upgrade studies of the readout electronics of the ATLAS Liquid Argon Calorimeter (LAr). Studies entailed simulating the performance of filtering algorithms under varied pileup scenarios and estimating the occupancy levels of calorimeter cells. Contributed to AREUS, readout electronic simulation software, and to CaloNoiseTool. Responsible for a project estimating the fraction of cells above a 2σ noise threshold and impact to the readout FPGA's bandwidth.

	Results published in a Technical Design Report ATLAS-TDR-027 and NIMA A936 (2018).
01/18 - 01/19	• **Liquid Argon Calorimeter Phase-I:** For the Phase-I upgrades new base-planes, specialized circuit boards connecting the LAr front-end electronics to the triggering hardware, were developed. With a test-stand setup at the University of Victoria, ran and contributed to code testing the transmission efficiency and cross-talk of base-planes before their installation into the detector.
11/16 - 12/19	• **Mentorship:** Mentored and oversaw the research of undergraduate and graduate physics students. Their work was showcased at new scientist conferences.

Graduate Research Assistant in Experimental Particle Physics, CMS Collaboration, University of Maryland, College Park, MD. **07/12 - 05/16**

09/13 - 05/16	• $W\gamma\gamma$ **Physics Analysis:** Using 2012, 8 TeV CMS data, studied a rare Standard Model (SM) process: $W\gamma\gamma$ production for leptonic decays of the W, $pp \to \ell\nu\gamma\gamma$. $W\gamma\gamma$ production is a validation of the SM vector gauge boson self-interactions. Combining electron and muon channels, the fiducial cross section was measured and compared to NLO theory predictions. Through the $WW\gamma\gamma$ vertex, the analysis is sensitive to BSM physics in the from of anomalous Quartic Gauge Couplings (aQGC). 95% confidence level limits were placed on dimension-8 effective field theories. Responsibilities included generating aQGC monte carlo samples, setting limits, calculating the fiducial acceptance, validating jet fake background estimates, and quantifying and propagating sources of systematic and statistical uncertainty.
08/15 - 05/16	• $Z\gamma\gamma$ **Physics Analysis:** For a separate analysis of the $Z\gamma\gamma$ cross section, contributed to the acceptance calculation, propagation of systematics, and generation of the signal samples.
09/13 - 08/14	• **Detector Upgrade Simulation:** Responsible for a project simulating the integration of the Outer Hadron Calorimeter (HO) - upgraded with new silicon photomultipliers (SiPM) - into the current Level 1 Muon Trigger. The work was documented in Detector Note CMS DN-2014/027.
03/13 - 09/13	• **Upgrade Work at CERN:** Worked directly on the CMS Hadron Calorimeter (HCAL), physically installing the new SiPMs described in the previous section.
07/12 - 03/13	• **Work at Maryland:** Used a Cs-137 source (660 MeV Gamma) to measure the light yield of LYSO crystals, the active material in next generation detectors. Setup a single photon test-stand to calibrate the gain of the lab's photomultiplier tubes (PMT). Required statistically modeling the PMT response.

SKILLS	**Programming Languages & Software:** Fluent with C++ and Python programming languages Proficient with Linux, Bash, Pandas, LaTeX, and Git Expertise with ROOT, MadGraph, and Mathematica Familiar with SQL and Docker Capable with SQL, Hadoop, and Pandas Experience with Machine Learning and Scientific Computing

TEACHING EXPERIENCE	**Teaching Assistant** University of Maryland, College Park, MD. **08/10 - 05/11** Teaching assistant and grader for multiple courses: Classical Mechanics, Electricity & Magnetism, and Quantum Mechanics. My responsibilities included leading a lab and weekly discussion sections.

TALKS   **Presented:** Overview of Pseudoscalar Two Higgs Doublet Models, ATLAS Exotics + HDBS Workshop, Naples Italy, June 11-14, (2019).
Invited Speaker: Overview of Dark Matter Searches by the ATLAS Experiment, Canadian Association of Physicists Congress, Vancouver Canada, June 3 - 7, (2019).
Presented: Future of the ATLAS Liquid Argon Calorimeter, Winter Nuclear Particle Physics Conference, Banff Canada, February 14-17, (2019).
Presented: Paper Approval Meeting Dark Matter Summary Paper, CERN Switzerland, October 25, (2018).
Presented: Development of the ATLAS Liquid Argon Readout Electronics for the HL-LHC, Pisa Meeting on Advanced Detectors, Elba Italy, May 27-June 2, (2018)
Presented: Search for Dark Matter Production in Association with a leptonically decaying Z boson with the ATLAS Detector, Dark Matter @ LHC, Heidelberg Germany, April 3-6, (2018)
Invited Speaker: Dark Matter Searches at Colliders, Banff DM-Statistics Workshop, Banff Canada, February 26 - March 2, (2018).
Presented: Quartic Gauge Boson Coupling Results from the LHC, Winter Nuclear Particle Physics Conference, Banff Canada, Feb 16-19, (2017).
Presented: Measurement of Multi-Boson Final States $W\gamma\gamma$ and $Z\gamma\gamma$ at CMS, Lake Louise Winter Institute, Lake Louise Canada, Feb 7-13, (2016).

PAPERS   ATLAS Collaboration, 2019. Constraints on mediator-based dark matter and scalar dark energy models using $\sqrt(s) = 13$ TeV pp collision data collected by the ATLAS detector. JHEP-05 (2019) 142
ATLAS Collaboration, 2019. Report Summarises Dark-Sector Exploration. CERN Courier
LHC Dark Matter Working Group, 2018. Next Generation Spin-0 Dark Matter Models. arXiv.1810.09420
Anelli et al., 2018. Phase-II Readout Electronics Upgrade of the ATLAS LAr Calorimeter. NIMA A936 (2018) 274-277
ATLAS Collaboration, 2018. Technical Design Report for the ATLAS Liquid Argon Calorimeter Phase-II Upgrade. ATLAS-TDR-027, 2018
CMS Collaboration, 2017. Measurements of the $pp \to W^{\pm}\gamma\gamma$ and $pp \to Z\gamma\gamma$ Cross Sections and Limits on Anomalous Quartic Gauge Couplings at $\sqrt(s) = 8$ TeV. JHEP-10 (2017) 072
Anelli et al., 2014. Study of Outer Hadron Calorimeter Minimum Ionization Bit in the Level 1 Muon Trigger. CMS Detector Note (2014) 027
Anelli, C.R. 2016. Measurement of $W\gamma\gamma$ Cross Section and Limits on Anomalous Quartic Gauge Couplings in Proton-Proton Collisions at 8 TeV with the CMS Detector [Doctoral Dissertation, University of Maryland, College Park]