Etienne Dreyer

Curriculum Vitæ

Postdoc in ATLAS focusing on deep learning for data reconstruction and simulation challenges in particle physics.

Education

10/2021 – present	**Postdoc** *Weizmann Institute of Science (WIS)*	
09/2015 – 09/2021	**PhD Experimental High Energy Physics** *Simon Fraser University (SFU)*	4.04 GPA
09/2011 – 05/2015	**BSc Physics** *University of the Fraser Valley (UFV)*	4.10 GPA

Employment

04/2023 – 09/2024 **Teaching assistant** *WIS*
Practical Deep Learning for Science.

09/2019 – 04/2020 **Teaching assistant** *SFU*
Analog Electronics Laboratory (3rd-year); Physics for the Life Sciences (1st-year).

10/2013 – 03/2017 **Tutor**
University math and physics, self-employed and via SFU Academics First program.

05/2015 – 09/2015 **Research assistant** *SFU*
Summer project in high energy physics which segued into graduate research.

01/2014 – 04/2015 **Student monitor** *UFV Math Center*
Homework help tutor for a range of math courses.

05/2014 – 09/2014 **Undergraduate research assistant** *SFU*
Prepared and characterized 2D materials using scanning tunneling microscopy.

10/2011 – 04/2012 **Physics laboratory assistant** *UFV*
Work-study position repairing and troubleshooting physics laboratory electronics.

Distinctions

(Amounts in CAD)

Funding

09/2023	**Faculty Postdoctoral Excellence Fellowship** *WIS*	
10/2021	**Postdoctoral scholarship** *Zuckermann STEM Leadership Program*	
01/2019	**Michael Smith Foreign Study Supplement** *NSERC*	$6,000
09/2018	**Dr. Howard Malm Graduate Award** *SFU*	$5,200
09/2016	**Canada Graduate Scholarship - Doctoral** *NSERC*	$105,000
09/2015	**Canada Graduate Scholarship - Masters** *NSERC*	$17,500
09/2015	**Faculty of Science Graduate Entrance Scholarship** *SFU*	$2,800
04/2015	**VPR Undergraduate Student Research Award** *SFU*	$4,500
06/2014	**Ken Caple College Transfer Entrance Scholarship** *SFU*	(declined) $3,500
04/2014	**Undergraduate Student Research Award** *NSERC*	$4,500

Awards

02/2020	**Best poster, annual poster competition** *SFU Physics Dept.*	$100
06/2019	**Best oral presentation (particle physics division)** *Canadian Association of Physicists*	$250
06/2019	**Best final project group presenation** *GRIDS (TRIUMF)*	$225/3
09/2018	**Outstanding student contributions to physics outreach** *SFU Physics Dept.*	$50
09/2016	**3rd-best student presentation** *WNPPC*	$250
06/2015	**Dean's medal** *UFV Faculty of Science*	
05/2013, 05/2014	**Outstanding achievement award** *UFV Department of Mathematics*	
04/2011	**Gold medalist, senior division** *Fraser Valley Regional Science Fair*	

Leadership

12/2023 – present	**Co-convener** *ATLAS tau reconstruction & identification subgroup*
05/2023 – present	**Member** *ATLAS Statistics Committee*
03/2023 – 12/2023	**Editorial board chair** *3rd-generation LQ pair production combination – Phys. Lett. B 854 (2024)*
02/2023 – present	**Organizer** *WIS experimental HEP joint seminars*
10/2022	**Session chair** *ATLAS Exotics Workshop (Statistics and ML session)*
07/2019	**Head volunteer** *CAP Congress Local Organizing Committee*
05/2018 – 04/2019	**Analysis co-coordinator** *Full Run-2 high-mass dilepton analysis*
09/2015 – 09/2018	**President, Treasurer** *SFU Physics Graduate Caucus*
10/2014 – 05/2015	**Student representative** *UFV Science Faculty Council*
09/2013 – 05/2015	**Vice-president** *UFV Physics Students Association*

Publications

Papers

2023 [link] **Configurable calorimeter simulation for AI applications** *F. A. Di Bello, A. Charkin-Gorbulin, K. Cranmer, E. Dreyer, et al.* Machine Learning: Science and Technology

2023 [link] **Reconstructing particles in jets using set transformer and hypergraph prediction networks** *F. A. Di Bello, E. Dreyer, et al.* European Physical Journal C

2022 [link] **Set-Conditional Set Generation for Particle Physics** *N. Soybelman, N. Kakati, E. Dreyer, et al.* Machine Learning and the Physical Sciences workshop, NeurIPS 2022

2022 [link] **Machine Learning and LHC Event Generation** *A. Butter, T. Plehn, et al.* SciPost Phys.
I wrote section 4.1.

2020 [link] **Search for new non-resonant phenomena in high-mass dilepton final states with the ATLAS detector** *ATLAS collaboration* JHEP, 5
The sequel to the 2019 full Run-2 search for dilepton resonances. I helped develop a strategy of estimating electron misidentification rates and propagated experimental and theoretical uncertainties into the expected signal yield.

2020 [link] **Testbeam studies of barrel and end-cap modules for the ATLAS ITk strip detector before and after irradiation** *F. Rühr, et al.* Nucl. Instrum. Meth. A
Analysis of the testbeam data collected at DESY including from the campaign I joined in April 2019.

2019 [link] **Search for high-mass dilepton resonances using 139 fb^{-1} of pp collision data collected at $\sqrt{s}$=13 TeV with the ATLAS detector** *ATLAS collaboration* Phys. Lett. B, 796 68-87
↻ 470 citations – The first publication to use the full Run-2 ATLAS dataset and the central topic of my PhD thesis. I co-coordinated the analysis team, maintained the data selection pipeline, developed an alternate data-driven statistical framework, performed reinterpretation of limits, derived an estimate of the fake electron background, and formatted results for RECAST and HEPData.

2017 [link] **Search for new high-mass phenomena in the dilepton final state using 36.1 fb^{-1} of proton-proton collision data at $\sqrt{s}$=13 TeV with the ATLAS detector** *ATLAS collaboration* JHEP, 182
↻ 487 citations – The first paper from the dilepton analysis team using Run-2 data. I ran the signal significance machinery and calculated/studied the accompanying trials factor.

Other published results

2023 [link] **Electron Identification with a Convolutional Neural Network in the ATLAS Experiment** *ATLAS collaboration*
I helped develop the selection pipeline for the multijet samples used for fake electron candidates.

2020 [link] **Dark matter summary plots for s-channel mediators** *ATLAS collaboration*
I produced the exclusion contours resulting from the full Run-2 limits on dilepton resonances.

2019 [link] **HVT exclusion contours from full run-2 searches at high-mass in $\ell\ell$ and $\ell\nu$ final states** *ATLAS collaboration*
Public plots from my reinterpretion framework of the full Run-2 dilepton and lepton + E_T^{miss} analyses into the Heavy Vector Triplet benchmark model.

2017 [link] **Technical Design Report for the ATLAS Inner Tracker Pixel Detector** *ATLAS collaboration* ATLAS-TDR-030
The scoping document for the future ATLAS inner detector replacement. The figures in section 3.1.3 are from my studies on the impact of misaligned pixel detector modules.

Presentations

Conferences

11/2023 [link] **Generic representations of jets at detector-level with SSL** ML4Jets (DESY)

11/2023 [link] **Aspects of deep learning in particle flow** Hammers & Nails (Ascona)

04/2023 **Configurable Calorimeter for AI applications** IPS annual meeting (Tel Aviv)

11/2022 [link] **Particle reconstruction in jets with set transformer and hypergraph prediction architectures** ML4Jets (Rutgers)

08/2022 **Particle reconstruction in jets with object condensation** Hammers & Nails (WIS)

06/2019 [link] **The search for exotic dilepton signatures in the full LHC Run-2 dataset collected with the ATLAS detector** Canadian Association of Physicists Congress (SFU), ★ 1st-place in division

04/2019 [link] **The search for high mass dilepton resonances in Run II data from ATLAS** ALPS (Obergurgl)
Presentation of our newly public results.

09/2018 [link] **Z' & Contact interactions searches at the LHC: Experiment overview** CKM (Heidelberg)
A survey of the latest published results from the ATLAS and CMS collaborations.

2016, 2017 **Assessing global significance in the Z' boson search at ATLAS** WNPPC (Banff), ★ 3rd-place

Seminars

11/2022 [link] **Reconstructing particles in jets using deep learning on graphs and hypergraphs** Particles and Fields Seminar (Ben Gurion U.)
Also presented at SFU (09/2022) and WIS (03/2023).

11/2020 **Searching for new physics with ATLAS in the dilepton spectrum and beyond: latest implications and outlook for future LHC runs** TRIUMF theory seminar (Zoom)
Overview of full Run-2 dilepton results, reinterpretation, and HL-LHC prospects.

Workshops

09/2022 [link] **Hands-on anomaly detection with ML** ATLAS Exotics Workshop (NIKHEF)
Tutorial session I co-led with another postdoc.

12/2018 [link] **Early Exotics analyses in leptonic final states** ATLAS Physics & Performance Week (CERN)
An overview of the strategy and status of five different analysis teams.

05/2018 [link] **Fitting smoothly falling backgrounds** ATLAS Exotics Workshop (Rome)
Hands-on technical session that I co-led and prepared the underlying tutorial for.

Outreach talks

10/2020 **Quarks, leptons, and the Z in between: particle physics at the high energy frontier** UFV
Invited lecture on my research and graduate school experience for physics undergraduate students.

2018 [link] **Ideas in collision: physics at the high energy frontier** Saturday Morning Lecture (TRIUMF)
Also presented to high school audiences at the following:

- Campus des Nations Geneva Secondary, October 2018
- Kings Community School, March 2018
- Robert Bateman Secondary, March 2018

2018 **From collision to data: identifying particles with ATLAS** ATLAS Masterclass (SFU)
A pedagogical intro to particle reconstruction for high school students.

Posters

2019, 2020 **Searching for high-mass dilepton resonances in the full Run-2 ATLAS dataset**
- Physics Dept. poster session (SFU) ★ 1st-place
- Dark Matter @ LHC (Seattle)
- Lepton-Photon (Toronto)

Summer 2017 **Searching for resonances in the ATLAS Run II dilepton mass spectrum**
- ATLAS Week (CERN)
- ATLAS Exotics and SUSY Joint Workshop (Bucharest)

Graduate course project papers

[link] 12/2019 **Foundations of Gravitational Waves** General Relativity
[link] 04/2017 **String Theory at First Glance** Quantum Field Theory II
[link] 04/2016 **The Higgs as a Pseudo Nambu Goldstone Boson** Particle Physics

Schools & programs attended

04/2022 **Learning to Discover** *Institut Pascal, Orsay*
06/2019 **Graduate Instrumentation and Detector School (GRIDS)** *TRIUMF*
06/2018 **European School of High-Energy Physics** *Maratea*
05/2017 **The Building Blocks of Science Writing** *CERN*
06/2016 **TRISEP Summer School** *TRIUMF*
07/2014 **London International Youth Science Forum** *London UK*
04/2011 **Canada-Wide Science Fair** *Toronto*

Volunteering

- Virtual tutor, *ATLAS Software Tutorial* — Feb 2021
- Tour guide of Phys. Dept., *Discover Physics @ SFU* — Oct 2015, 2016, 2017, 2019
- CERN tour guide — Spring 2019
- Virtual visits moderator, *CERN International Masterclass* — Mar 2019
- Volunteer, SFU annual *ATLAS Masterclass* — Apr 2016, 2017, 2018
- Student mentor, *What Can YOUth Do?* workshop for gifted high school students — Apr 2017
- Volunteer, *SFU Faculty of Science Research Open House* — Nov 2015
- Tour guide of Phys. Dept. *SFU 50th event* — Sep 2015
- Divisional judge, *Fraser Valley Regional Science Fair* — Apr 2012, 2014
- Volunteer, *Math Mania* and *Math Challengers* Fraser Valley Regional Competitions — 2014, 2015
- Helped organize student tours of *D-Wave Systems* and *General Fusion* — Dec 2014, Feb 2015
- Represented Physics Students Association at campus welcome events, *UFV* — Sep 2012, 2013, 2014