

Etienne Dreyer

Applied Machine Learning | Physics & Simulation | R&D Leadership

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KEY PROJECTS

Ongoing research

🔗 <https://github.com/etiennedreyer/hypergraphflow>

- Developing recurrent reasoning models for hypergraph prediction
- Simulating stochastic particle energy loss with neural operators

Transforming tau lepton classification

🔗 atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PLOTS/TAUP-2026-01/

Led team developing new transformer-based classifier in ATLAS

- Increased background rejection by 1.2x-3.5x
- Tested model robustness and deployed into production via ONNX
- Status: fully implemented and endorsed as default algorithm

HGPflow: Particle reconstruction with ML

🔗 <https://doi.org/10.1140/epjc/s10052-025-14443-z>

Pioneered hypergraph representation for particle-sensor relations

- Physics-informed design consistently outperformed ML baselines and enhanced explainability
- Demonstrated 30-40% improvement in experimental resolution in ATLAS prototype

Super-resolution for calorimeters

🔗 ml4physicalsciences.github.io/2025/files/NeurIPS_ML4PS_2025_103.pdf

- Trained CFM model to upsample low-resolution voxels by 16x
- Improved angular resolution of reconstructed objects by 20-40%

Self-supervised learning for particle jets

🔗 <https://doi.org/10.1088/2632-2153/ae1100>

- Designed data augmentation and contrastive loss for pre-training
- Fine-tuned foundation model for downstream regression, classification, and anomaly detection

Teaching Practical Deep Learning for Science

🔗 <https://github.com/WeizmannMLcourse>

- Created tutorials & homework on CNNs, GNNs, policy gradient
- Set up autograding GitHub CI for 50+ students
- Supported grad students applying ML to scientific research

Generative AI for fast particle simulation

🔗 <https://doi.org/10.1103/PhysRevLett.133.211902>

- Built pipeline to process over 5 TB of CERN Open Data samples
- Trained CFM model to replace expensive physics simulation
- Currently developing production version for ATLAS experiment

Data analysis team lead at CERN

🔗 <https://doi.org/10.1016/j.physletb.2019.07.016>

- Co-coordinated team of ~10 researchers
- Built scalable Python/C++ pipelines to process ~20 TB of data
- Wrote fully configurable statistical fitting package in C++
- Published 1st paper on 2015-2018 ATLAS dataset (500+ citations)

SUMMARY

Applied machine learning researcher with 10 years of experience building large-scale data pipelines, designing neural network architectures, and deploying production-ready models for complex physical systems. Teamwork and interpersonal skills honed through collaborative research, coordination, and mentorship roles. Creative and self-motivated problem solver with a passion for transformative solutions.

EXPERIENCE

Postdoctoral researcher

Weizmann Institute of Science

📅 08/2021 - Present

- Developed ML models to reconstruct data from sensor arrays
- Simulated detector response with fast ML surrogate models
- Identified and solved bugs in large C++ simulation frameworks
- Co-convened ATLAS working group of ~20 physicists driving R&D for tau reconstruction algorithms
- Coauthored 11 peer-reviewed papers; gave 6 conference talks
- Co-taught 3 semesters of Practical Deep Learning for Science

EDUCATION

PhD, Experimental Particle Physics

Simon Fraser University

GPA

4.04 / 4.33

📅 06/2015 - 07/2021

- Awarded 4 years of full scholarship by NSERC

BSc, Physics Major, Math Minor

University of the Fraser Valley

GPA

4.10 / 4.33

📅 09/2011 - 04/2015

- Awarded Dean's Medal (5 per graduating class)

SKILLS

Machine Learning

PyTorch, Transformers, GNNs, CFM, Neural Operators, Self-supervised learning, ViT, VAEs, Gym, Comet.ml

Data & Scientific Computing

NumPy, Pandas, hdf5, ROOT, Visualization, Monte Carlo methods, Statistical inference, Uncertainty estimation

Systems & Infrastructure

Linux, Git, CI, Singularity, Docker, Slurm, Ray

Programming

Python (advanced), C++ (proficient)