

# Mariel Pettee

Physicist, AI researcher, and artist

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[mariel-pettee.github.io](https://mariel-pettee.github.io)

## Education

2021	YALE UNIVERSITY PhD in Physics	New Haven, CT
2015	UNIVERSITY OF CAMBRIDGE • Trinity College MASt in Physics, Commendable Performance Lt. Charles H. Fiske III Harvard-Cambridge Scholar	Cambridge, UK
2014	HARVARD UNIVERSITY AB in Physics and Mathematics (Cum Laude, High Honors in Field) Dramatic Arts Secondary	Cambridge, MA

## Research Positions

2022 - Now	GUEST RESEARCHER • <i>Flatiron Institute Center for Computational Astrophysics</i> <ul style="list-style-type: none"><li>Building foundation models for science with the Polymathic AI Collaboration</li><li><b>Supervisor:</b> Prof. Shirley Ho</li></ul>
2021 - Now	CHAMBERLAIN POSTDOCTORAL FELLOW • <i>Lawrence Berkeley National Lab</i> <ul style="list-style-type: none"><li>Identifying stellar streams in the Gaia dataset with weakly-supervised anomaly detection</li><li>Performing an unbinned measurement of <math>24 Z</math>+jets observables in the ATLAS detector</li><li>Developing GNNs for particle reconstruction in the ATLAS detector</li><li>Exploring best practices for learning likelihood ratios in physics datasets with AI</li><li><b>Supervisor:</b> Dr. Benjamin Nachman</li></ul>
2020	AI INTERN • <i>Intel AI Lab</i> <ul style="list-style-type: none"><li>Using recurrent VAEs to learn latent graph representations of the human body</li><li><b>Supervisor:</b> Dr. Hanlin Tang</li></ul>
2016 - 2021	GRADUATE RESEARCHER • <i>Yale University &amp; CERN</i> <ul style="list-style-type: none"><li>Searching for <math>V \rightarrow</math> leptons, <math>H \rightarrow \tau\tau</math> in Run 2 with the ATLAS Experiment</li><li>Identifying tau leptons in the ATLAS trigger with Recurrent Neural Networks</li><li>Optimizing trigger &amp; data acquisition for the Muze Experiment at Fermilab</li><li><b>Supervisor:</b> Prof. Sarah Demers</li></ul>

## Publications

[Full list](#) of papers with the ATLAS Collaboration. (**Note:**  $\triangleright$  indicates alphabetical author ordering.)

2023 The ATLAS Collaboration. Evidence of the  $VH, H \rightarrow \tau\tau$  process with the ATLAS detector in Run 2. [HIGG-2018-20](#). (Submitted to Phys. Rev. B).

The ATLAS Collaboration. A Simultaneous Unbinned Differential Cross Section Measurement of  $24 Z$ +jets Kinematic Observables with the ATLAS Detector. (In preparation).

S. Golkar, **M. Pettee**, M. Eickenberg, A. Bietti, M. Cranmer, G. Krawezik, F. Lanusse, M. McCabe, R. Ohana, L. Parker, B. Régalo-Saint Blancard, T. Tesileanu, K. Cho, S. Ho. [xVal: A Continuous Number Encoding for Large Language Models](#). (In review at ICLR; accepted to NeurIPS AI for Science Workshop).

**M. Pettee**, S. Thanvantri, B. Nachman, D. Shih, M. R. Buckley, J. H. Collins. [Weakly-Supervised Anomaly Detection in the Milky Way](#). *MNRAS*. [arXiv:2305.03761] [astro-ph.GA].

S. Rizvi, **M. Pettee**, B. Nachman. [Learning Likelihood Ratios with Neural Network Classifiers](#). (In review at JHEP; accepted to NeurIPS ML for the Physical Sciences Workshop). [arXiv:2305.10500] [hep-ph].

V. Mikuni, **M. Pettee**, B. Nachman. [Fast Point Cloud Generation with Diffusion Models in High Energy Physics](#). *Phys. Rev. D*. [arXiv:2304.01266] [hep-ph].

▷ A. Huang, X. Ju, J. Lyons, D. Murnane, **M. Pettee**, L. Reed. [Heterogeneous Graph Neural Network for Identifying Hadronically Decayed Tau Leptons at the High Luminosity LHC](#). *JINST*. [arXiv:2301.00501] [physics.ins-det].

2022 ▷ A. Bogatskiy, S. Ganguly, T. Kipf, R. Kondor, D. W. Miller, D. Murnane, J. T. Offermann, **M. Pettee (co-editor)**, P. Shanahan, C. Shimmin, and S. Thais. [Symmetry Group Equivariant Architectures for Physics](#). *Snowmass 2021 White Paper*. [arXiv:2203.06153] [cs.LG].

The ATLAS Collaboration. [Point Cloud Deep Learning Methods for Pion Reconstruction in the ATLAS Experiment](#). [ATL-PHYS-PUB-2022-040].

M. Papillon, **M. Pettee**, N. Miolane. [PirouNet: Creating Dance through Artist-Centric Deep Learning](#). *EAI ArtsIT 2022 (Best Paper Award)*. [arXiv:2207.12126] [cs.LG].

M. Papillon, **M. Pettee**, N. Miolane. [Intentional Choreography with Semi-Supervised Recurrent VAEs](#). *NeurIPS 2022 Workshop on Machine Learning for Creativity and Design*. [arXiv:2209.10010] [cs.LG].

▷ G. Kasieczka, R. Mastandrea, V. Mikuni, B. Nachman, **M. Pettee**, D. Shih. [Anomaly Detection Under Coordinate Transformations](#). [arXiv:2209.06225] [hep-ph].

2021 **M. Pettee**. [Interdisciplinary Machine Learning for Particle Physics](#). *PhD Thesis, Yale University*.

2020 **M. Pettee**, S. Miret, S. Majumdar, and M. Nassar. [Choreo-Graph: Learning Latent Graph Representations of the Dancing Body](#). *NeurIPS 2020 Workshop on Machine Learning for Creativity and Design*.

2019 **M. Pettee**, C. Shimmin, D. Duhaime, and I. Vidrin. [Beyond Imitation: Generative and Variational Choreography via Machine Learning](#). *Proceedings of the 10th International Conference on Computational Creativity*. [arXiv:1907.05297] [cs.LG].

The ATLAS Collaboration (**co-editor**). [Expected Performance of the ATLAS Detector at the High-Luminosity LHC](#). [ATL-PHYS-PUB-2019-005].

## Talks

### Invited Talks

2024 TOWARDS FOUNDATION MODELS FOR FUNDAMENTAL PHYSICS

- AI-Driven Discovery in Physics and Astrophysics Workshop, University of Tokyo
- ML for HEP Workshop, KEK, Japan

- 2023 xVAL: A CONTINUOUS NUMBER ENCODING FOR LARGE LANGUAGE MODELS
- IBM Research Seminar
- INTERDISCIPLINARY AI FOR FUNDAMENTAL PHYSICS
- Hammers & Nails (Swiss Edition) – *Ascona, Switzerland*
  - Workshop on Data-Driven Galaxy Evolution – *KITP & CCA*
- WEAKLY-SUPERVISED ANOMALY DETECTION IN THE MILKY WAY
- University of Chicago Data Science Institute & James Franck Institute Seminar
  - Rutgers University High-Energy Physics Theory Seminar
- EQUIVARIANCE MEETS INVARIANCE: PHYSICS-INFORMED MACHINE LEARNING *Minneapolis, MN*
- American Physical Society (APS) April Meeting
- 2022 MACHINE LEARNING FOR HIGH-ENERGY PHYSICS *University of Alabama*
- Departmental Colloquium: Physics & Astronomy
- DANCING WITH MYSELF *University of Alabama*
- Departmental Colloquium: Theatre & Dance
- PANEL DISCUSSION: CREATIVITY, SCIENCE, AND ETHICS *Ballet Des Moines*
- Y-EXCHANGE FEATURED ARTIST *Kinetech Arts*
- 2021 - 2022 INTERDISCIPLINARY MACHINE LEARNING FOR CHOREOGRAPHY & PARTICLE PHYSICS *Online*
- Stanford Linear Accelerator (SLAC) AI Seminar
  - UC Irvine Physics & Astronomy Machine Learning Seminar Series
  - Imperial College London, DataLearning Working Group Seminar
  - Amherst College, Artificial Intelligence in the Liberal Arts Seminar Series
  - Cornell Laboratory for Elementary Particle Physics Journal Club
  - Berkeley Institute for Data Science (BIDS) ML + Science Forum
  - Physics Dept. Colloquium at Seattle University
  - HEP Seminar Speaker at University of Tennessee, Knoxville
  - University of Alabama, Machine Learning Graduate Course Guest Seminar
  - Flatiron Institute Center for Computational Astrophysics ML Forum
- 2020 CHOREO-GRAPH: LEARNING LATENT GRAPH REPRESENTATIONS OF THE DANCING BODY *Online*  
Kinetech Arts (San Francisco, CA)
- BEYOND IMITATION: GENERATIVE CHOREOGRAPHY WITH AI *Brown University*  
Conference for Research on Choreographic Interfaces (CRCI)

### Contributed Talks

- 2023 WEAKLY-SUPERVISED ANOMALY DETECTION IN THE MILKY WAY *New York, NY*  
Flatiron-Wide Machine Learning Meeting
- 2022 POINT CLOUD METHODS FOR PION RECONSTRUCTION IN THE ATLAS DETECTOR *CERN*  
• Inter-experiment Machine Learning Workshop  
• APS April Meeting *New York, NY*
- 2021 [DANCING WITH MYSELF](#) *St. Louis, MO*  
Strange Loop

2020	CHOREO-GRAPH: LEARNING LATENT GRAPH REPRESENTATIONS OF THE DANCING BODY NeurIPS Workshop on ML for Creativity and Design	Online
	RUN 3 TRIGGERS FOR HLEPTONS ANALYSES ATLAS Tau & HLeptons Workshop	Online
2019	EXPECTED ATLAS PERFORMANCE AT THE HL-LHC US ATLAS Workshop	UMass Amherst
	OVERVIEW OF TAU VS. JET IDENTIFICATION ATLAS Tau & HLeptons Workshop	Prague, Czech Republic
	BEYOND IMITATION: GENERATIVE CHOREOGRAPHY VIA MACHINE LEARNING International Conference on Computational Creativity (ICCC)	Charlotte, NC
2018	RNN TAU IDENTIFICATION WITHIN THE ATLAS HLT US LHC Users Association Meeting	Fermilab
	RNN TAU IDENTIFICATION IN THE ATLAS HLT ATLAS Machine Learning Workshop	CERN
	THE 2018 ATLAS TAU TRIGGER & COMBINED PERFORMANCE US ATLAS Workshop	Pittsburgh, PA
	TAU TRIGGER & CP PERFORMANCE AT HIGH $\mu$ ATLAS P&P Physics Plenary	CERN
	FTK & THE TAU TRIGGER ATLAS TDAQ Week	CERN

## Awards

2021	Owen Chamberlain Postdoctoral Fellowship	Lawrence Berkeley National Laboratory
2018	Lightning Round Talk Winner	US LHC Users Association
	Women's Faculty Forum Seed Grant	Yale University
2016	Winner, Windy City Physics Slam	ICHEP
	• <a href="#">PBS Chicago Interview Clip</a>	
	Poster Award for <i>Trigger Studies for the Muze Experiment</i>	ICHEP
2015	Leigh Page Prize (for potential contributions to the field of physics)	Yale University
	Honorable Mention	NSF Graduate Research Fellowship Program
2014	Harvard-Cambridge Scholarship	Harvard University
	• Full tuition for a master's program at the University of Cambridge	
	Julia Shaffner Memorial Prize (outstanding woman in science)	Harvard University
2013	President's Challenge Finalist	The Harvard Innovation Lab
	15 Most Interesting Seniors	The Harvard Crimson
2012	Judges' Award for Acting	The International Student Drama Festival
	Certificate of Distinction in Teaching	Harvard University
	The Caroline Isenberg and Elizabeth Cary Agassiz Fellowships	Harvard University
2011	Best Lead Actress in a Play	Harvard Theater Award

## Press

- 2023 [ATLAS measures rare Higgs boson interaction with tau leptons](#), *ATLAS Briefing*  
“Scientists Begin Building AI for Scientific Discovery Using Tech Behind ChatGPT”
  - [Simons Foundation Press Release](#)
  - [Berkeley Lab Article](#)
- 2022 Interviewee on the Cognicast podcast
  - [A wide-ranging discussion of my research trajectory across AI, physics, and art](#)
  - [Episode webpage](#)
  - [Listen on Apple Podcasts](#)
- 2021 [Mariel Pettee successfully defends PhD thesis](#), *Yale Physics*
- 2020 [Advice to Women in STEM: Mariel Pettee](#), *Yale Scientific Magazine*
- 2019 [Feature on Yale’s Instagram page](#)
- 2016 [Scientists Battle for Physics Slam Crown](#), *PBS Chicago*
- 2013 [15 Most Interesting Seniors: Mariel N. Pettee](#), *The Harvard Crimson*

## Posters

- 2022 POINT CLOUD METHODS FOR PION RECONSTRUCTION IN THE ATLAS DETECTOR *Online*  
LHCP 2022
- 2020 CHOREO-GRAPH: LEARNING LATENT GRAPH REPRESENTATIONS OF THE DANCING BODY *Online*  
Women in Machine Learning (WiML) at NeurIPS 2020
- RNN TAU IDENTIFICATION IN THE ATLAS HIGH-LEVEL TRIGGER *CERN*  
ATLAS Trigger & Data Acquisition Week 2020
- 2019 GENERATIVE & VARIATIONAL CHOREOGRAPHY VIA MACHINE LEARNING *Vancouver, Canada*  
Women in Machine Learning (WiML) at NeurIPS 2019
- MACHINE WOMAN: PRESERVATION, MEMORY, FORGETTING, AND AI *New Haven, CT*  
Women’s Faculty Forum at Yale
- 2017 PERFORMANCE OF THE ATLAS TAU TRIGGER IN RUN 2 *Seattle, WA*  
Advanced Computing & Analysis Techniques in Physics Research (ACAT)
- 2016 TRIGGER STUDIES FOR THE MU2E EXPERIMENT *Chicago, IL*  
International Conference on High Energy Physics (ICHEP)

## Writing

- 2023 [LLMs and the Language of Science](#), *APS Topical Group on Data Science Newsletter*  
[xVal: A Continuous Number Encoding for LLMs](#), *Polymathic AI Collaboration Blog Post*
- 2018 [Theories of Everything](#), *Sightline Arts*  
[Now or Never: The Case for a Larger Hadron Collider](#), *Yale Distilled Magazine*

## Leadership & Service

- 2017 - 2021 HLeptons Trigger Liaison: Trigger Studies for the ATLAS  $H \rightarrow \tau\tau$  Analysis Group  
2019 - 2020 Reviewer for NeurIPS Physical Sciences Workshop  
2020 Session Co-Convener, PyHEP 2020 (Conference for Python in High-Energy Physics)  
2019 Reviewer for Women in Machine Learning (WiML) Workshop

## Teaching

### Guest Lectures

- 2023 THE LANGUAGE OF MOVEMENT *Amherst College*

### Training

- 2016 PHYSICS 530: Theory and Practice of Scientific Teaching for Physical Scientists *Yale University*  
2014 ASTRO 302: Scientists Teaching Science *Harvard University*

### Yale University

- 2018 Physics 115: The Physics of Dance  
American Studies 349: Technologies for Movement Research  
2017 Physics 171: University Physics for the Life Sciences  
Physics 115: The Physics of Dance  
2016 Physics 205L: Modern Physical Measurement  
Physics 115: The Physics of Dance  
2015 Physics 165L: General Physics Laboratory

### Harvard University

- 2013 Math 110: Vector Space Methods for Differential Equations  
2012 - 2013 Math 121: Linear Algebra and Applications

## Inclusion & Outreach Efforts

- 2022 - 2023 QuarkNet Speaker & Interviewee
- Presented a talk on physics, art, and ML to high school students
  - Answered their questions in a separate hour-long interview
- 2020 Member of the American Physical Society's Inclusion, Diversity, and Equity Alliance (APS-IDEA)
- 2019 - 2021 Member of the Yale Physics Climate & Diversity Committee
- Advocated for a department-wide discussion of discrimination in our community
  - Contributed to the design of our department's Code of Conduct
- 2018 - 2020 US LHC Users Association advocacy trip to Capitol Hill

- Met with the offices of around 15 representatives from Congress each year to ask for their support for high-energy physics research and STEM funding in general
- 2017 - 2018 Speaker, *Science in the News*, delivering scientific talks to the New Haven public Girls' Science Investigations at Yale
- 2016 Winner, Windy City Physics Slam at ICHEP  
Choreographer: *Form Factors*, a dance intervention with physicists at ICHEP
- 2015 - 2020 Yale Women in Physics Mentor

## Arts

### Directorial Work

- 2023 *mememormee*: an evening-length work featuring AI-generated choreography set on six dancers, following a residency at Amherst College
- Spotlight Presentation at the 2023 NeurIPS Workshop on ML for Creativity & Design
- 2021 *Untitled Bird Project*: a 1 hour pop-up exhibit featuring AI-generated bird calls situated in nature
- 2020 *Mirror Exercise*: an AI-generated duet with myself
- Featured in *Le Mérite*, at the Comédie de Caen, Théâtre des Cordes, France.
  - Highlighted in the NeurIPS Workshop on ML for Creativity and Design's *AI Art Gallery*
  - Digital exhibition at *Level Up: The Dramaturgy of Digital Performance & Design*
  - Selected by the AI Transparency Institute & featured at the 2020 AI Governance Forum
  - Boston Cyberarts Gallery exhibition *Perceptions / Distortions* (cancelled due to COVID-19)
- 2019 *SIGMA*: a short film of AI-generated choreography
- Featured in the NeurIPS 2019 Workshop on ML for Creativity & Design's *AI Art Gallery*

### Performance Work

#### BAY AREA

- 2022 Dancer, *Sublimation*
- By Kinetech Arts.
  - Supported by the Djerassi Resident Artists Program and Creative Work Fund.
  - Performed at David Ruth Glass Studio, Oakland, CA.
- Dancer, *Detour*
- By Kinetech Arts, commissioned by the Berkeley Dance Project.
  - Performed at Zellerbach Playhouse, Berkeley, CA.

#### YALE UNIVERSITY

- 2020 Studio fellow, *Yale Center for Collaborative Arts & Media*
- Year-long paid fellowship to develop collaborative work across art & technology
- Dancer & Coordinator, *Transpositions*
- Dancer in virtual performances by Brian Seibert and Elm City Dance Collective
- Women+ Art AI*: Part of a global collective of women working at the intersection of art & AI
- Choreographer, *Elon Musk and the plan to Blow Up Mars the musical*
- Yale Cabaret, dir. Liam Bellman-Sharpe

- Dancer, Coordinator, & Rehearsal Director, *Yale Dance Lab*
- New work by choreographer Vicky Shick: “*everywhere*”
- 2019 Featured performer, *Learning Film (working title)*
- Interviewed for a documentary by the Derek Jarman Lab, co-produced by Tilda Swinton
- Bill T. Jones/Arnie Zane Dance Company Intensive, *Yale Dance Theater*
- Dancer in a restaging of *D-Man in the Waters*
- 2018 Dancer, *Dance Drawings (For Jock)*
- Choreography by Emily Coates located at the Yale Art Gallery’s Sol LeWitt exhibit
- Paul Taylor Dance Company Intensive, *Yale Dance Theater*
- Leading role as “The Hostess” in the first restaging of Taylor’s *Party Mix* in four decades
- Featured performer, *Machine Woman*
- An experiential short film documenting my AI-generated choreography research
- 2017 Choreographer: “La Mort du Chorégraphe”, *A Different Drum Dance Company*
- Urban Bush Women Intensive, *Yale Dance Theater*
- 2016 Gaga Intensive with Saar Harari & Lee Sher, *Yale Dance Theater*
- Choreographer: “Rang Cherries”, *A Different Drum Dance Company*
- UNIVERSITY OF CAMBRIDGE
- 2015 Actor, *Attempts on Her Life*, dir. Tania Clarke, Corpus Playroom
- Dancer, *Evolution*, ADC Theatre
- HARVARD UNIVERSITY
- 2014 Director/Writer/Choreographer: [Symmetry Breaking](#)
- My creative physics thesis: an immersive multimedia performance about the Higgs boson
- President, *The Signet Society of Arts & Letters*
- Choreographer-in-Residence, *Harvard Dance Center*
- Dancer, *Paper Wing*, chor. Jill Johnson, Farkas Hall
- 2013 Arts@CERN Internship
- Eurydice, *Antigonick*, dir. Ianthe Demos, American Repertory Theater Mainstage
- Isabelle & Executive Producer, *The Edge of the Map*, dir. Calla Videt (Sightline Theater Company)
- Dancer, *At Last*, Loeb Experimental Theater
- Dancer, *On The Run*, Harvard Dance Center
- 2012 Vice-President & Mainstage Coordinator, *The Harvard-Radcliffe Dramatic Club*
- 35+ productions as a performer, director, producer, designer, & choreographer
- Lucy, *CryHurtFood*, Loeb Experimental Theater & Crucible Mainstage (Sheffield, UK)
- Director: *for the purpose of catching ourselves in the act of being the most*
- Set the Guinness World Record for the longest telephone conversation between two people
- 2011 Co-founder and collaborator, *The Harvard Generalist* artistic collective



Drama & Dance Proctor, *Freshman Arts Program* (2011-2014)