

# Mariel Pettee

Particle 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

2021 - Now	MACHINE LEARNING FOR FUNDAMENTAL PHYSICS Chamberlain Postdoctoral Fellow. Developing generic ML techniques in likelihood-free and label-free learning for applications across particle physics, astrophysics, and more. Dr. Ben Nachman	Lawrence Berkeley National Lab
2017 - Now	GENERATIVE CHOREOGRAPHY WITH MACHINE LEARNING I lead multiple independent research groups of artists and scientists using AI to generate and perform novel choreography based on 3D motion capture of my own movements. <ul style="list-style-type: none"><li>2022 - 2023: Brooklyn, NY &amp; Amherst College</li><li>2021 - 2022: University of California, Santa Barbara</li><li>2020: Intel AI Lab</li><li>2017 - 2020: Yale Center for Collaborative Arts &amp; Media</li></ul>	
2016 - 2021	ATLAS EXPERIMENT Search for $V \rightarrow \text{leptons}$ , $H \rightarrow \tau\tau$ in Run 2 with the ATLAS Experiment Prof. Sarah Demers	CERN
2016 - 2018	ATLAS EXPERIMENT Tau Identification with Recurrent Neural Networks in the ATLAS Trigger Prof. Sarah Demers	CERN

## Publications

[Full list](#) of papers with the ATLAS collaboration.

2023	<b>M. Pettee</b> , S. Thanvantri, B. Nachman, D. Shih, M. R. Buckley, J. H. Collins. <a href="#">Weakly-Supervised Anomaly Detection in the Milky Way</a> . [arXiv:2305.03761] [astro-ph.GA].  V. Mikuni, <b>M. Pettee</b> , B. Nachman. <a href="#">Fast Point Cloud Generation with Diffusion Models in High Energy Physics</a> . [arXiv:2304.01266] [hep-ph].  A. Huang, X. Ju, J. Lyons, D. Murnane, <b>M. Pettee</b> , L. Reed. <a href="#">Heterogeneous Graph Neural Network for Identifying Hadronically Decayed Tau Leptons at the High Luminosity LHC</a> . [arXiv:2301.00501] [physics.ins-det].
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- 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 (**Co-writer & editor**). [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-writer & editor**). [Expected Performance of the ATLAS Detector at the High-Luminosity LHC](#). [ATL-PHYS-PUB-2019-005].

## Awards

- |      |  |   |
|------|--|---|
| 2021 | Owen Chamberlain Postdoctoral Fellowship                             | <i>Lawrence Berkeley National Laboratory</i>    |
| 2018 | Lightning Round Talk Winner  | <i>US LHC Users Association</i>                 |
|      | Women's Faculty Forum Seed Grant                                     | <i>Yale University</i>                          |
| 2016 | Winner, Windy City Physics Slam                                      | <i>ICHEP</i>                                    |
|      | • <a href="#">PBS Chicago Interview Clip</a>                         |   |
|      | Poster Award for <i>Trigger Studies for the Muze Experiment</i>      | <i>ICHEP</i>                                    |
| 2015 | Leigh Page Prize   | <i>Yale University</i>                          |
|      | • For potential contributions to the field of physics                |   |
|      | Honorable Mention  | <i>NSF Graduate Research Fellowship Program</i> |
| 2014 | Harvard-Cambridge Scholarship  | <i>Harvard University</i>                       |
|      | • Full tuition for a master's program at the University of Cambridge |   |
|      | Julia Shaffner Memorial Prize  | <i>Harvard University</i>                       |
|      | • Honoring an outstanding woman in science                           |   |

2013	President's Challenge Finalist	<i>The Harvard Innovation Lab</i>
	15 Most Interesting Seniors	<i>The Harvard Crimson</i>
2012	Judges' Award for Acting	<i>The International Student Drama Festival</i>
	Certificate of Distinction in Teaching	<i>Harvard University</i>
	The Caroline Isenberg and Elizabeth Cary Agassiz Fellowships	<i>Harvard University</i>
2011	Best Lead Actress in a Play	<i>Harvard Theater Award</i>

## Talks

### Invited Talks

2023	EQUIVARIANCE MEETS INVARIANCE: PHYSICS-INFORMED MACHINE LEARNING	<i>Minneapolis, MN</i>
	• American Physical Society (APS) April Meeting	
	INTERDISCIPLINARY MACHINE LEARNING FOR FUNDAMENTAL PHYSICS	<i>Flatiron CCA</i>
	• Kavli Institute for Theoretical Physics & CCA Workshop on Data-Driven Galaxy Evolution	
2022	MACHINE LEARNING FOR HIGH-ENERGY PHYSICS	<i>University of Alabama</i>
	• Departmental Colloquium: Physics & Astronomy	
	DANCING WITH MYSELF	<i>University of Alabama</i>
	• Departmental Colloquium: Theatre & Dance	
	PANEL DISCUSSION: CREATIVITY, SCIENCE, AND ETHICS	<i>Ballet Des Moines</i>
	Y-EXCHANGE FEATURED ARTIST	<i>Kinetech Arts</i>
2021 - 2022	INTERDISCIPLINARY MACHINE LEARNING FOR CHOREOGRAPHY & PARTICLE PHYSICS	<i>Online</i>
	• 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	<i>Online</i>
	Kinetech Arts (San Francisco, CA)	
	BEYOND IMITATION: GENERATIVE CHOREOGRAPHY WITH AI	<i>Brown University</i>
	Conference for Research on Choreographic Interfaces (CRCI)	

### Contributed Talks

2022	POINT CLOUD METHODS FOR PION RECONSTRUCTION IN THE ATLAS DETECTOR	
	• Inter-experiment Machine Learning Workshop	<i>CERN</i>
	• APS April Meeting	<i>New York, NY</i>

2021	<a href="#">DANCING WITH MYSELF</a> Strange Loop	St. Louis, MO
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

## Press

2022	Interviewee on the Cognicast podcast <ul style="list-style-type: none"> <li>A wide-ranging discussion of my research trajectory across AI, physics, and art</li> <li><a href="#">Episode webpage</a></li> <li><a href="#">Listen on Apple Podcasts</a></li> </ul>	
2021	<a href="#">Mariel Pettee successfully defends PhD thesis, Yale Physics</a>	
2020	<a href="#">Advice to Women in STEM: Mariel Pettee, Yale Scientific Magazine</a>	
2019	<a href="#">Feature on Yale's Instagram page</a>	
2016	<a href="#">Scientists Battle for Physics Slam Crown, PBS Chicago</a>	
2013	<a href="#">15 Most Interesting Seniors: Mariel N. Pettee, The Harvard Crimson</a>	

## Posters

2022	POINT CLOUD METHODS FOR PION RECONSTRUCTION IN THE ATLAS DETECTOR LHCP 2022	Online
2020	CHOREO-GRAPH: LEARNING LATENT GRAPH REPRESENTATIONS OF THE DANCING BODY Women in Machine Learning (WiML) at NeurIPS 2020	Online
	RNN TAU IDENTIFICATION IN THE ATLAS HIGH-LEVEL TRIGGER	CERN

	ATLAS Trigger & Data Acquisition Week 2020	
2019	GENERATIVE & VARIATIONAL CHOREOGRAPHY VIA MACHINE LEARNING Women in Machine Learning (WiML) at NeurIPS 2019	Vancouver, Canada
	MACHINE WOMAN: PRESERVATION, MEMORY, FORGETTING, AND AI Women's Faculty Forum at Yale	New Haven, CT
2017	PERFORMANCE OF THE ATLAS TAU TRIGGER IN RUN 2 Advanced Computing & Analysis Techniques in Physics Research (ACAT)	Seattle, WA
2016	TRIGGER STUDIES FOR THE MU2E EXPERIMENT International Conference on High Energy Physics (ICHEP)	Chicago, IL

## 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
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### 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 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

### Solo & Directorial Work

- 2023 *mememormee*: an evening-length work featuring AI-generated choreography set on six dancers, following a residency at Amherst College
- 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](#)

## Recent Performances

### 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)

## Writing

- 2018 [Theories of Everything](#), *Sightline Arts*
- [Now or Never: The Case for a Larger Hadron Collider](#), *Yale Distilled Magazine*