Mariel Pettee

Physicist, AI researcher, and artist

mariel.pettee@gmail.com

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 • *Flatiron Institute Center for Computational Astrophysics*

- Building foundation models for science with the Polymathic AI Collaboration
- **Supervisor:** Prof. Shirley Ho

2021 - Now CHAMBERLAIN POSTDOCTORAL FELLOW • *Lawrence Berkeley National Lab*
- Identifying stellar streams in the Gaia dataset with weakly-supervised anomaly detection
- Performing an unbinned measurement of 24 Z+jets observables in the ATLAS detector
- Developing GNNs for particle reconstruction in the ATLAS detector
- Exploring best practices for learning likelihood ratios in physics datasets with AI
- **Supervisor:** Dr. Benjamin Nachman

2020 AI INTERN • *Intel AI Lab*
- Using recurrent VAEs to learn latent graph representations of the human body
- **Supervisor:** Dr. Hanlin Tang

2016 - 2021 GRADUATE RESEARCHER • *Yale University & CERN*
- Searching for $V \to$ leptons, $H \to \tau\tau$ in Run 2 with the ATLAS Experiment
- Identifying tau leptons in the ATLAS trigger with Recurrent Neural Networks
- Optimizing trigger & data acquisition for the Mu2e Experiment at Fermilab
- **Supervisor:** Prof. Sarah Demers

Publications

Full list of papers with the ATLAS Collaboration. (**Note:** ▷ *indicates alphabetical author ordering.*)

2023 The ATLAS Collaboration. Evidence of the VH, H→ττ 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. (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. *JHEP*. [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

- NASA Science Mission Directorate AI Workshop, Huntsville, AL
- 1st Large Language Models in Physics Symposium, DESY/Hamburg
- Physics Division Research Progress Meeting, Lawrence Berkeley National Laboratory

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

What Do Language Models Have to Say About Fundamental Physics?

- UC Berkeley Bakar Institute of Digital Materials for the Planet Seminar
- SLAC AI Seminar

Dancing With Myself

- CreAI: Creativity in the Age of AI, Foothill College

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	
	• Inter-experiment Machine Learning Workshop	*CERN*
	• 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	*Online*
	NeurIPS Workshop on ML for Creativity and Design	

	RUN 3 TRIGGERS FOR HLEPTONS ANALYSES	*Online*
	ATLAS Tau & HLeptons Workshop	

2019	EXPECTED ATLAS PERFORMANCE AT THE HL-LHC	*UMass Amherst*
	US ATLAS Workshop	

	OVERVIEW OF TAU VS. JET IDENTIFICATION	*Prague, Czech Republic*
	ATLAS Tau & HLeptons Workshop	

	BEYOND IMITATION: GENERATIVE CHOREOGRAPHY VIA MACHINE LEARNING	*Charlotte, NC*
	International Conference on Computational Creativity (ICCC)	

2018	RNN TAU IDENTIFICATION WITHIN THE ATLAS HLT	*Fermilab*
	US LHC Users Association Meeting	

	RNN TAU IDENTIFICATION IN THE ATLAS HLT	*CERN*
	ATLAS Machine Learning Workshop	

	THE 2018 ATLAS TAU TRIGGER & COMBINED PERFORMANCE	*Pittsburgh, PA*
	US ATLAS Workshop	

	TAU TRIGGER & CP PERFORMANCE AT HIGH μ	*CERN*
	ATLAS P&P Physics Plenary	

	FTK & THE TAU TRIGGER	*CERN*
	ATLAS TDAQ Week	

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*
	• PBS Chicago Interview Clip	
	Poster Award for *Trigger Studies for the Mu2e Experiment*	*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

Featured on Women+ Art AI

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 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 ATLAS Trigger & Data Acquisition Week 2020	*CERN*
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*

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*

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

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

Leadership *&* Service

2019 - 2023   Reviewer for NeurIPS Physical Sciences Workshop

2017 - 2021   HLeptons Trigger Liaison: Trigger Studies for the ATLAS $H \rightarrow \tau\tau$ Analysis Group

2020   Session Co-Convener, PyHEP 2020 (Conference for Python in High-Energy Physics)

2019   Reviewer for Women in Machine Learning (WiML) Workshop

2014   President, *The Signet Society of Arts & Letters*, Harvard University

Arts

AI *&* Art

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)

Studio fellow, *Yale Center for Collaborative Arts & Media*
- Year-long paid fellowship to develop work across art *&* technology

2019   SIGMA: a short film of AI-generated choreography
- Featured in the NeurIPS 2019 Workshop on ML for Creativity *&* Design's AI Art Gallery

Live Performance

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.

2020   Dancer *&* Coordinator, *Transpositions*

- Dancer in virtual pieces by Brian Seibert, Renee Robinson, and Elm City Dance Collective

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   Bill T. Jones/Arnie Zane Dance Company Intensive, *Yale Dance Theater*
- Dancer in a restaging of *D-Man in the Waters*

Featured performer, *Learning Film (working title)*
- Interviewed for a documentary by the Derek Jarman Lab, co-produced by Tilda Swinton

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*

2015   Actor, *Attempts on Her Life*, dir. Tania Clarke, Corpus Playroom, *University of Cambridge*

Dancer, *Evolution*, ADC Theatre, *University of Cambridge*

2014   Director/Writer/Choreographer: *Symmetry Breaking*, Farkas Hall, *Harvard University*
- My senior physics thesis: an immersive multimedia performance about the Higgs boson

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, Harvard University

Dancer, *On The Run*, Harvard Dance Center

2012   Vice-President & Mainstage Coordinator, *The Harvard-Radcliffe Dramatic Club*

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, *Harvard University Freshman Arts Program* (2011-2014)