

Michela Paganini

Facebook Inc.
MPK 21.MZ9 MQ.9.39E
✉ mickypaganini@berkeley.edu
☎ +1 (510) 423-2136

1 Hacker Way
Menlo Park, CA 94025
🔗 <http://mickypaganini.github.io/>
🐙 [mickypaganini](#)

Education

Yale University

Ph.D., Physics, 2018
M.Phil., Physics, 2016
M.S., Physics, 2014 - student marshal

University of California, Berkeley

B.A., Astrophysics, 2013
B.A., Physics, 2013

University of Cambridge

Pembroke-King's Programme, 2012

Dissertation

Machine Learning Solutions for High Energy Physics: Applications to Electromagnetic Shower Generation, Flavor Tagging, and the Search for di-Higgs Production

Research

FAIR (Facebook Artificial Intelligence Research)

Postdoctoral Researcher
2018 - present

CERN (European Organization for Nuclear Research)

Ph.D. Student, ATLAS Experiment
2013 - 2018

- Designed and implemented location-aware auxiliary-classifier Generative Adversarial Networks for fast detector-level physics simulation. Joined task force to deploy results in ATLAS simulation production code, and conducting cross-talks for integration into GEANT product release.
- Prototyped object permutation selection with pointer network-inspired neural net architectures.
- Developed multi-stream LSTMs for event-level classification for the $hh \rightarrow \gamma\gamma b\bar{b}$ analysis. Coordinated a team of students on this project.
- Designed Recurrent Neural Networks for impact parameter based flavor tagging. Led effort to integrate into live analysis deployment by contributing to [LWTNN](#) code development.
- Using Dark Knowledge to replace the Matrix Element Method (MEM) — a Physics driven, computationally intensive routine — in order to streamline the $t\bar{t}H$ with $H \rightarrow b\bar{b}$ analysis pipeline.
- Refined boosted top-tagging technique using Deep Learning discrimination versus QCD background. Performed in-depth studies of pile-up and p_T dependence. Compared efficiency with substructure taggers.
- Contribution to code testing, maintainability, and documentation.

NERSC (National Energy Research Scientific Computing Center)

High Energy Physics Center for Computational Excellence Graduate Student Intern

May 2017 - present

- Researched, developed, and deployed customized Generative Adversarial Networks to accelerate computationally intensive Physics simulation of particles interacting with matter in heterogeneously segmented 3D detectors.
- Explored and benchmarking deep neural networks training and evaluation in HPC environment on Cori (#6 TOP500) with TensorFlow optimizations for modern Intel architectures.
- Applied Computer Vision solutions for the identification of new Physics events from data in multi-channel, high-resolution sparse image format, using the search for R-parity violating supersymmetry as a case study.

Cambridge Institute of Astronomy

Summer Exchange Student

July-August 2012

- Simulated galactic dynamics, mass-velocity profiles, and anisotropy variation to test modified gravity models.

Università degli Studi di Milano

Summer Research Assistant

June 2012

- Analytical predictions of positronium formation for anti-hydrogen production at the AEGIS experiment at CERN.

SETI Institute, University of California, Berkeley

Undergraduate Research Assistant

2011

- Remote observing for Optical SETI.

Space Sciences Lab, University of California, Berkeley

Undergraduate Research Assistant

2010-2011

- Data collection and analysis for MAVEN, STEREO and VEX missions.
- Catalogs of coronal mass ejections, live monitoring of solar activity.

Teaching

Department of Physics, Yale University

Teaching Fellow, Physics 440 (Quantum Mechanics and Natural Phenomena I), Spring 2015

Teaching Fellow, Physics 180 (University Physics - Mechanics), Fall 2014

Teaching Fellow, Physics 166L (General Physics Laboratory - E&M), Spring 2014




Teaching Fellow, Physics 165L (General Physics Laboratory - Mechanics), Fall 2013

College of Letters and Science, University of California, Berkeley

Undergraduate Student Instructor (UGSI), Sense and Sensibility and Science, 2012-2013

Reader, Physics H7A (Physics for Scientists and Engineers), 2012

Publications

Author of over 200 papers with the ATLAS Collaboration   
Selected publications with substantial personal contribution:

L. de Oliveira, B. Nachman, M. Paganini, *Electromagnetic Showers Beyond Shower Shapes*, (under review), [[arXiv:1806.05667](#)].

HEP Software Foundation, *HEP Software Foundation Community White Paper Working Group - Detector Simulation*, [[arXiv:1803.04165](#)].

HEP Software Foundation, *A Roadmap for HEP Software and Computing R&D for the 2020s*, [[arXiv:1712.06982](#)].

M. Paganini, L. de Oliveira, B. Nachman, *Controlling Physical Attributes in GAN-Accelerated Simulation of Electromagnetic Calorimeters*, in [Proceedings of ACAT 2017](#), *J. Phys. Conf. Ser.* 1085 (2018) no.4, 042017, [[arXiv:1711.08813](#)].

W. Bhimji, S. Farrell, T. Kurth, M. Paganini, Prabhat, E. Racah, *Neural Networks for Physics Analysis on low-level whole-detector data at the LHC*, in [Proceedings of ACAT 2017](#), *J. Phys. Conf. Ser.* 1085 (2018) no.4, 042034, [[arXiv:1711.03573](#)].

M. Paganini, *Machine Learning Algorithms for b-jet tagging at the ATLAS experiment*, in [Proceedings of ACAT 2017](#), *J. Phys. Conf. Ser.* 1085 (2018) no.4, 042031, [[ATL-PHYS-PROC-2017-211](#)].

M. Paganini, L. de Oliveira, B. Nachman, *Accelerating Science with Generative Adversarial Networks: An Application to 3D Particle Showers in Multi-Layer Calorimeters*, *Phys. Rev. Lett.* 120, 042003 (2018), [[arXiv:1705.02355](#)].

M. Paganini, L. de Oliveira, B. Nachman, *CaloGAN: Simulating 3D High Energy Particle Showers in Multi-Layer Electromagnetic Calorimeters with Generative Adversarial Networks*, *Phys. Rev. D* 97, 014021 (2018), [[arXiv:1712.10321](#)].

L. de Oliveira, M. Paganini, B. Nachman, *Learning Particle Physics by Example: Location-Aware Generative Adversarial Networks for Physics Synthesis*, *Comput. Softw. Big Sci.* (2017) 1: 4, [[arXiv:1701.05927](#)].

The ATLAS Collaboration, *Measurements of Higgs Boson Properties in the Diphoton Decay Channel with 36.1 fb^{-1} pp Collision Data at the Center-of-Mass Energy of 13 TeV with the ATLAS Detector*, [[ATLAS-CONF-2017-045](#)].

The ATLAS Collaboration, *Optimisation and Performance Studies of the ATLAS b-Tagging Algorithms for the 2017-18 LHC Run*, [[ATL-PHYS-PUB-2017-013](#)].

The ATLAS Collaboration, *Identification of Jets Containing b-Hadrons with Recurrent Neural Networks at the ATLAS Experiment*, [[ATL-PHYS-PUB-2017-003](#)].

The ATLAS Collaboration, *Search for Higgs boson pair production in the $b\bar{b}\gamma\gamma$ final state using pp collision data at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS detector*, [[ATLAS-CONF-2016-004](#)].

Invited Talks, Posters, and Panels

3rd Inter-experimental Machine Learning workshop, CERN, Apr 2018
Machine Learning for Phenomenology workshop, Durham University, Apr 2018
NVIDIA GTC 2018, Silicon Valley, Mar 2018
Machine Learning for Jet Physics workshop, LBNL, Dec 2017
Women in Machine Learning (WiML) workshop, NIPS, Dec 2017
Deep Learning for Physical Sciences workshop, NIPS, Dec 2017
Mitchell Institute for Fundamental Physics and Astronomy, TAMU, Nov 2017
Rice University seminar series, Nov 2017
NASA Ames workshop on Radiation Characterization from Earth to Moon,
Mars, and Beyond, Nov 2017
LUX Collaboration week, LBNL, Oct 2017
NERSC Data Day, LBNL, Sep 2017
18th International Workshop on Advanced Computing and Analysis Techniques
in Physics Research (ACAT 2017), University of Washington, Aug 2017
Women in Computer Vision (WiCV) workshop, CVPR, Hawaii Convention Center, Jul 2017
Workshop on Machine Learning and *b*-Tagging in ATLAS, SLAC, May 2017
Fermilab machine learning group kick-off, FNAL, May 2017
Data Science @ HEP workshop, FNAL, May 2017
Berkeley Institute for Data Science faire, UC Berkeley, May 2017
AI at SLAC seminar, SLAC, March 2017
2nd Inter-experimental Machine Learning workshop, CERN, Mar 2017
2nd Developers@CERN forum, CERN, May 2016
3rd HEP Software Foundation workshop, LAL Orsay, May 2016

Awards and Fellowships

**High Energy Physics Center for Computational Excellence Summer
Fellowship**, NERSC and Lawrence Berkeley National Laboratory, 2017
Leigh Paige Prize, Yale Physics Department, 2013
UC Summer Grant, UC Berkeley, 2012
University of California Undergraduate Grant, UC Berkeley, 2011-2012
UC Freshman Scholarship, UC Berkeley, 2010

Service to the Profession

Track convener & reviewer, SUSY 2019
Track convener & reviewer, CHEP 2018
Organizer, Generative Modeling in Physics workshop at PASC 2018
Reviewer, JINST
Reviewer, IEEE Access
Reviewer, ACAT 2017
Organizer & reviewer, Deep Learning for Physical Sciences workshop at NeurIPS 2017
Reviewer, WiML 2017

Languages and Skills

Languages: Italian, English (bilingual), French (intermediate), Spanish (elementary)
Computing: Python, C, C++, Git
Libraries: PyTorch, Keras, sklearn, TensorFlow, NumPy, SciPy, Matplotlib, pandas, ROOT
Interpersonal Skills: project management, leadership, effective communication,
knowledge sharing, mentoring, active listening, flexibility

Summer Schools

Scaling to Petascale Institute 2017
Thematic CERN School of Computing 2017
SLAC Summer Institute 2016

Outreach and Leadership

Lawrence Berkeley National Laboratory

US LUA delegate at annual meeting with Congress in Washington, DC
Exploratorium volunteer

CERN

S'Cool Lab tutor
Open Geneva hackathon, *Preventing Suicide with Social Media Data*
DiploHack, *Extracting Sensitive Human Rights Data from Inaccessible Countries*
TEDxCERN volunteer
THEPort CERN hackathon, *Integrating Humanitarian Data*
POP Science, Nuit des Chercheurs
CERN tour guide

Yale University

Graduate Student Assembly - Representative for Department of Physics
Graduate School of Arts and Science Executive Committee
Academics and Professional Development Committee secretary
McDougal Graduate Student Life Fellow
Yale Minority Advisory Council - graduate representative
Board member of Italian Society of Yale Students and Affiliates
Graduate affiliate at Pierson residential college

University of California, Berkeley

Society of Physics Students (SPS) officer
SWPS Physics undergraduate coordinator
Member of Order of Omega Leadership Honor Society
Academic tutor at Athletic Study Center
Founder of Italian Society at Berkeley
Team Manager - Div I Women's tennis team
Emerging Leaders Institute at Butler University

Last updated: November 27, 2018