

# Michela Paganini

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## Education

### Yale University

*Ph.D.*, Physics, in progress (expected 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

Tentative title: *Machine Learning Solutions for High Energy Physics – applications to Monte Carlo tuning and to the search for Higgs boson pairs in the  $\gamma\gamma b\bar{b}$  final state using pp collision data at  $\sqrt{s} = 13$  TeV with the ATLAS detector* (in progress)

## Research

### CERN (European Organization for Nuclear Research)

*Ph.D. Student, ATLAS Experiment*  
2013 - present

- Building location-aware auxiliary-classifier Generative Adversarial Networks for fast, detector-level physics simulation.
- Prototyping object permutation selection using pointer network-inspired neural net architectures.
- Pushing multi-stream LSTMs for event-level classification into production for the  $hh \rightarrow \gamma\gamma b\bar{b}$  analysis.
- Designed recurrent neural networks for impact parameter based flavor tagging in the ATLAS experiment. Leading effort to integrate into live analysis deployment.
- 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.

**NERSC (National Energy Research Scientific Computing Center)**

*High Energy Physics Center for Computational Excellence Graduate Student Intern*

May 2017 - present

- Researching, developing, and deploying customized Generative Adversarial Networks to accelerate computationally intensive Physics simulation of particles interacting with matter in heterogeneously segmented 3D detectors.
- Exploring and benchmarking deep neural networks training and evaluation in HPC environment on Cori (#6 TOP500) with TensorFlow optimizations for modern Intel architectures.
- Applying 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

- Galactic dynamics, mass-velocity profiles, and anisotropy variation.

**Università degli Studi di Milano**

*Summer Research Assistant*

June 2012

- Neutrino Physics at the Borexino experiment, Gran Sasso National Laboratory.
- Positronium formation studies 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

M. Paganini, L. de Oliveira, B. Nachman, *CaloGAN: Simulating 3D High Energy Particle Showers in Multi-Layer Electromagnetic Calorimeters with Generative Adversarial Networks*, [arXiv:1705.02355].

L. de Oliveira, M. Paganini, B. Nachman, *Learning Particle Physics by Example: Location-Aware Generative Adversarial Networks for Physics Synthesis*, [arXiv:1701.05927].

The ATLAS Collaboration, *Measurements of Higgs Boson Properties in the Diphoton Decay Channel with  $36.1 \text{ fb}^{-1}$   $pp$  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  $bb\gamma\gamma$  final state using  $pp$  collision data at  $\sqrt{s} = 13 \text{ TeV}$  with the ATLAS detector*, [ATLAS-CONF-2016-004].

## Languages and Skills

**Languages:** Italian, English (bilingual), French (intermediate), Spanish (elementary), Latin  
**Computing:** Python, C, C++, Matlab, LabView, IDL, L<sup>A</sup>T<sub>E</sub>X, Docker, Git, Arduino, HTML  
**Libraries:** NumPy, SciPy, Matplotlib, TensorFlow, Keras, scikit-learn, pandas, ROOT  
**Interpersonal Skills:** Management, Event Planning, Effective Communication, Active Listening, Leadership, Flexibility

## 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**  
University of California, Berkeley, 2012

**University of California Undergraduate Grant**  
University of California, Berkeley, 2011-2012

**UC Freshman Scholarship**  
University of California, Berkeley, 2010

## Invited Talks and Posters

18<sup>th</sup> International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT 2017), University of Washington, August 2017  
Women in Computer Vision Workshop (WiCV) at the 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Hawaii Convention Center, May 2017  
Fermilab Machine Learning Group Kick-Off, FNAL, May 2017  
Data Science @ HEP Workshop, FNAL, May 2017  
AI at SLAC Seminar, SLAC, March 2017  
Inter-Experimental Machine Learning Workshop, CERN, March 2017  
2<sup>nd</sup> Developers@CERN Forum, CERN, May 2016  
3<sup>rd</sup> HEP Software Foundation Workshop, LAL Orsay, May 2016

## Outreach and Leadership

### **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 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  
Co-Founder of iUSA (Italian University Societies in America)

### **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

## References

Prof. Paul Tipton  
Department of Physics  
Yale University  
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Prof. Tobias Golling  
Department of Particle and Nuclear Physics  
University of Geneva  
tobias.golling@unige.ch

Prof. Amir Farbin  
Department of Physics  
University of Texas, Arlington  
afarbin@uta.edu

Dr. Wahid Bhimji  
NERSC  
Lawrence Berkeley National Laboratory  
wbhimji@lbl.gov