# ANDREW CARNES

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## Education

**PhD in Particle Physics - University of Florida** (Expected May 2018)

- Cumulative GPA: 3.7/4.0
- In progress. Masters Acquired.

**Bachelor of Science in Physics - University of Florida** (Fall 2010)

- Graduated Cum Laude
- Cumulative GPA: 3.8/4.0
- Physics GPA: 4.0/4.0
- Comp Sci GPA: 4.0/4.0

## Research Experience

**Particle Physics Research at the Large Hadron Collider (LHC) at CERN** (2012 - 2018)
*under Professors Paul Avery and Darin Acosta for the CMS Detector*

- Developed the first machine learning based hardware trigger at CERN, reducing the rate of false positives in muon data by 3x
- Developed a Boosted Decision Tree (BDT) package from scratch and implemented it in hardware to run evaluations within 25ns, yielding the 3x improved trigger above
- Advanced CERN's machine learning software by parallelizing the BDTs and adding a variety of Loss Functions (C++)
- Improved the search for the Higgs decay to two muons by a factor of 1.3 by developing a new machine learning algorithm to minimize the expected p-value of the experiment
- Invited speaker for the LHC's Inter-experimental Machine Learning Forum
- Speaker at the artificial intelligence and computing methods conference, ACAT, in Seattle, Washington (August 2017)

**Quantum Turbulence Research at the Univeristy of Florida** (Summer 2012)
*under Professor Gary Ihas*

- Measured the density of quantum vortices in liquid helium
- Coded analysis tools in Python to process the data collected from temperature and sound waves in liquid helium
- Created 3D models of the experimental apparatus and its parts in Solidworks, machined parts, and soldered circuits

**Semiconductor Research at the University of Florida** (2010)
*under Professor Kevin Jones*

- Programmed Boltzmann Theory of Electron Transport simulations in Java to predict the conductivity of different semiconductors
- Used various chemical techniques to create silicon nanowires to prototype the design of lithium batteries with longer lifetimes
- Performed Hall Effect experiments to determine the charge carriers in semiconductors
- Cut out transistor cross-sections with the Focused Ion Beam for Transmission Electron Microscope analysis in order to diagnose their failure

## Teaching Experience

**Teaching Assistant at the Univeristy of Florida** (2011 - 2016)
*under Dr. Robert Deserio, Professor Pradeep Kumar, and Professor Darin Acosta*

- Physics 1 Lab (2011). Led the experiments and graded lab assignments
- Physics 2 Discussion (2012). Made lesson plans and quizzes, graded quizzes, lectured, and held office hours
- Physics 1 Discussion (2016). Made lesson plans and quizzes, graded quizzes, lectured, and held office hours

**Tutor at the University of Florida's Tutoring Center** (2010)

- Tutored students three times a week in Physics, Calculus, and Differential Equations
- Gave televised lectures on Physics twice a week

## Technical Skills

**Programming Languages:** C++ and Python for the past 5 years,
some MATLAB and Java back in 2010

**Miscellaneous:** Machine Learning Development in C++ and Python,
Quantum Field Theory, Statistical Mechanics, Differential Equations, Statistics, and Linear Algebra,
Numpy, Sci-kit Learn, Pandas, Keras (Neural Nets), Apache Spark, ROOT, UNIX,
Object Oriented Programming, git

## Honors and Awards

Graduated with honors (Cum Laude), DIANA Fellowhsip, Grinter Fellowship, IHEPA Fellowship,
Presidential Scholar, Florida Opportunity Scholar, Florida Medallion Scholar, Dean's List

## Relevant Coursework

Machine Learning, Data Structures and Algorithms, Quantum Field Theory, Linear Algebra, Differential Equations, Calculus, Statistical Mechanics