

John Alison

CONTACT INFORMATION

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CURRENT POSITION

Associate Professor, Carnegie Mellon University
- Assistant Professor, 2018 - 2024
- Joined the CMU group at CMU, Fall 2018

PREVIOUSLY

Fermi/McCormick Fellow, University of Chicago
- Member ATLAS group at Chicago, 2013 - 2018
- Awarded Fermi/McCormick Fellowship
- Advisors: Mel Shochet and Young Kee Kim
- 85th Compton Lecturer: “How and Why to Go Beyond the Discovery of the Higgs Boson”

EDUCATION

University of Pennsylvania

- Ph.D. Physics, December 2012
- Dissertation Title: “The Road to Discovery: TRT Alignment, Electron Identification, Particle Mis-identification, WW Physics, and the Discovery of the Higgs Boson”
 - Adviser: I. J. Kroll
 - Received 2013 ATLAS thesis award
 - Awarded Springer Thesis prize

University of Pittsburgh

- Graduated with Highest Honors, 2006
- B.S. Physics and Astronomy
- B.A. Philosophy
- Received the Peter F. M. Koehler Academic Achievement Award
- Received the Halliday Award for Excellence in Undergraduate Research

CURRENT RESEARCH

The CMS Experiment, CERN

High-Granularity End-cap Calorimeter Upgrade

- CMU will build ~ 5000 silicon modules (half of all hadronic Si-modules)
- Automated module assembly, wire bonding, and testing all done on CMU campus
- Responsible (w/Paulini and Dutta) for Module Assembly Center at CMU
- L3 DOE account manager for Modules Factories and Assembly in the US

Search for New Physics in events with pairs of Higgs bosons

- Focus on searching for new physics in the $HH \rightarrow 4b$ final state
- Near-term: $HH \rightarrow 4b$ sensitive search for new particles or new interactions
- Long-term: goal to measure Higgs self-coupling with upgraded LHC/detectors
- Currently Measuring $ZZ \rightarrow 4b$ and $ZH \rightarrow 4b$ standard candles
- Model independent search for new Higgs bosons produced in pairs

Search for New Physics using soft multi-lepton and missing transverse momentum

- Sensitive to models of dark matter with compressed spectra
- Extending acceptance of electron identification to $p_T > 1$ GeV (Typical CMS analyses have $p_T > 15$ GeV)
- Low p_T experimental techniques closely related to those used in b-tagging

CURRENT
RESEARCH
(CONTINUED)

Convener of CMS b-tagging group (2021 - 2023)
- Group responsible for heavy-flavor tagging within the collaboration
- Critical for much of the CMS physics program, especially Di-Higgs production
- L2 position within the CMS collaboration

Convener of CMS b-jet trigger group (2019 - 2021)
- Group responsible for b-tagging algorithms run in real-time to select data to be recorded

Machine Learning

- Exploiting full granularity of low-level detector data using recent advances in image processing
- Directly applicable now for $4b$ analyses
- Important in future for the High-Granularity Calorimeter upgrade

AWARDS AND
FELLOWSHIPS

85th Arthur H. Compton Lecturer	2017
Fermi/McCormick Fellowship, University of Chicago	2013 - 2016
ATLAS Thesis Award	2013
Springer Thesis Prize	2013
Awarded the Peter F. M. Koehler Academic Achievement Award	2006
Halliday Award for Excellence in Undergraduate Research	2006
Member of Phi Beta Kappa Academic Honor Society	2006 - present

LEADERSHIP
ROLES

DOE account manager (L3) for HGCal Modules Factories/Assembly	2024 - present
Convener CMS b-tagging group	2021 - 2023
Co-organizer of CMU NSF AI planning institute seminars	2020 - 2023
Convener of CMS b-jet trigger group,	2019 - 2021
Convener of ATLAS b-jet trigger group,	2015 - 2018
Convener of ATLAS di-Higgs group,	2016 - 2018
Coordinating low mass di-jet resonances search,	2015 - 2018
Convener of ATLAS Jets and Dark Matter exotics group,	2014 - 2015
Co-led search for TeV black holes with first 13 TeV data,	2015
Led group measuring W +jet background in WW and $H \rightarrow WW$ di-lepton analyses	2010-2013
Led effort to develop Run-1 electron identification algorithms	2009-2011
Led group responsible of alignment of ATLAS Transition Radiation Tracker	2008-2011

SELECTED
PUBLICATIONS

The list of publications for which I am the primary author or have made significant contributions is provided in a separate document.

INVITED TALKS AT WORKSHOPS AND CONFERENCES	LHCP2024: <i>Di-Higgs production at LHC</i> (Summary of the LHC Di-Higgs physics program)	06/2024 Boston
	Lake Louise Winter Institute: <i>Status of the LHC experimental program</i> (Summary of the LHC physics program)	02/2024 Alberta, Canada
	CMS B-tagging Workshop <i>B-tagging in CMS Status and Future Plans</i>	07/2023 Brussels, Belgium
	MelFest <i>Open Questions in Particle Physics</i>	05/2023 Chicago
	European Committee for Future Accelerators Workshop <i>Flavor tagging at (HL-)LHC</i>	04/2022 CERN
	PITT PACC workshop LHC physics for Run 3 <i>Di-Higgs: Hadronic Trigger Limitations and Ways to Improve</i>	04/2021 Virtual
	PHYSTAT-Systematics Workshop <i>Transfer Learning for data-driven background modeling</i>	11/2021 Virtual (Speaker: Tudor Manole)
	Di-Higgs 2018 <i>B-Jet Trigger: Status and Future Plans,</i>	09/2018 Fermilab
	La Thuile 2018 <i>Searches for Di-Boson and Di-Lepton Resonances at the LHC</i> (First public presentation of the 2015-2016 $HH \rightarrow 4b$ results.)	03/2018 La Thuile, Italy
	PHENO 2016 <i>Searches for New Physics at the LHC</i> (Plenary summarizing 1st 13 TeV ATLAS/CMS searches for new physics.)	May 2016 Pittsburgh
	DPF 2015 <i>Searches for New Physics at the Energy Frontier</i> (Plenary summarizing LHC Run-1 searches for new physics.)	08/2015 Ann Arbor
	LHC Higgs Exotic Decay Working Group <i>New Trigger Capabilities with FTK</i> (Review of FTK capabilities and potential applications for exotic Higgs decays.)	05/2015 CERN
	Higgs Couplings 2014 <i>Experimental studies of HH production.</i> (Status and prospects of di-Higgs production in ATLAS and CMS.)	10/2014 Torino, Italy
	ASPEN 2013 <i>H \rightarrow WW Results from ATLAS</i> (First public presentation of the $H \rightarrow WW$ results with the full Run-1 dataset.)	03/2013 Aspen
Rencontres de Moriond on Electroweak Interactions <i>Standard Model Measurements at ATLAS</i> (First public presentation of the ATLAS WW cross section measurement.)	03/2011 La Thuile, Italy	
COLLOQUIA AND SEMINARS	STAMPS Seminar <i>Systematic Uncertainties from Synthetic Datasets</i> A case study with the search for Higgs boson pair production at the LHC	04/2024 STAMPS@CMU
	Colloquium University of Cincinnati <i>Physics at the LHC</i>	02/2024

COLLOQUIA AND
SEMINARS
(CONTINUED)

		Cincinnati
	Colloquium Texas Tech University <i>Physics at the LHC</i>	11/2022 Lubbock
	Colloquium Rowan University <i>Why and How to Go Beyond the Higgs Discovery</i>	04/2021 Glassboro, NJ
	MIT LNS Seminar <i>Di-Higgs Physics: Current Status and Future Perspectives</i> (Summary of recent di-Higgs results and projected sensitivities.)	04/2019 Boston
	PITT-PACC Seminar <i>Di-Higgs Physics at the LHC</i>	10/2018 Pittsburgh
	Lawrence Berkeley National Lab (RPM) <i>Di-Higgs Production at the LHC</i>	01/2018 Berkeley
	Harvard Experimental Particle Physics Seminar <i>Di-Higgs at the LHC: Current Status and Future Prospects</i>	03/2017 Boston
	Colloquium University of Colorado Bolder <i>Physics at the LHC: Why and How to go Beyond the Higgs Discovery</i>	02/2017 Bolder
	Brookhaven National Lab Particle Physics Seminar <i>Di-Higgs at the LHC: Current Status and Future Prospects</i>	02/2017 BNL
	UMass ACFi Seminar <i>Di-Higgs Physics at the LHC</i>	02/2017 Amherst
	University of Oxford Experimental Particle Physics Seminar <i>Di-Higgs Physics at the LHC</i>	10/2016 Oxford
	Rutherford Appleton Laboratory Particle Physics Seminar <i>Di-Higgs Physics at the LHC</i>	10/2016 Rutherford Appleton Laboratory
	University of Pennsylvania Experimental Particle Physics <i>Fast Track Finding at the LHC: How and Why</i>	03/2015 Philadelphia
	Argonne National Laboratory High-Energy Physics Seminar <i>Fast Track Finding at the LHC: How and Why</i>	04/2015 Argonne
	University of Chicago High-Energy Physics Seminar <i>Higgs Physics Post-Discovery: What we know and where we are going</i>	09/2013 Chicago
	PITT-PACC Seminar <i>Higgs Physics Post-Discovery: What we know and where we are going</i>	10/2013 Pittsburgh
	Lawrence Berkeley National Lab (RPM) <i>H → WW Search and WW Cross Section Measurement</i>	01/2012 Berkeley

OUTREACH

- Lecturer for Pennsylvania Governor’s School for the Sciences** 2019 - present
- Lectures for advanced high-school students
 - Taught Relativity and “The Physics Behind the Discovery of the Higgs Boson”
 - Relativity is a PGSS core course: Series 16 hour-long lectures
 - The Higgs course is a PGSS elective: Series of 7 hour-long lectures
 - More information: <http://sciences.pa-gov-schools.org/>
- Lecturer for Osher Lifelong Learning Institute** Fall 2024
- Lectures for older adults interested in continuing their education after retirement
 - Course Title: “Particle Physics: Are We Done?”
 - Series 6 hour-long lectures
 - More information: <https://www.cmu.edu/osher/index.html>
- CMU High-School Physics Teachers Training Program** 2021 - present
- In 2021, I started an annual high-school physics teachers training program. The program aims to build lasting connections with Pittsburgh-area high-school physics teachers. It will allow us to tap into local talent that may otherwise overlook – or be overlooked by – CMU. The program provides teachers with educational development and continuing education credits required by the state and has opened a direct line of communication to CMU researchers and among teachers from different school districts. The program brings high-school physics teachers – from a broad mix of schools: both public and private, urban and suburban – to the CMU’s campus for four-day workshops. The teachers tour labs, are shown demonstrations used in introductory CMU courses, and are given overviews of research in various physics sub-disciplines. We also hold discussion sessions on how we can help teachers to better motivate high-school students to pursue careers in physics. The programs have included software-focused “hack-a-thon” sessions, during which the teachers learn to create interactive python programs which can be integrated into their lessons and hardware-based “make-and-take” sessions, during which the teachers build demo they can use in their classrooms.
- Pine Richland High-School Physics Curriculum Advising** 2023
- Pittsburgh Public Schools Science Teachers In-Service Training** 2021 - present
- Mentor in CMS mentors program** 2019 - present
- Allegheny Observatory Public Lecture, “Beyond the Higgs Boson”** 2019
- Google Tech Talk, “Big data at the LHC: *How and Why*”** 2019
- Astronomy on Tap, “Dark Matter and the Large Hadron Collider”** 2019
- Invisible Jazz Labs, “The jazz of science, the science in jazz”** 2018
- 85th Compton Lecturer, University of Chicago** Spring 2017
- Series of nine hour-long lectures for the general public
 - Series title: *How and Why to Go Beyond the Discovery of the Higgs Boson*
 - Slides and videos: www.cmu.edu/physics/alison-group/ComptonLectures
 - More information: efi.uchicago.edu/events/compton-lecture-series/about-the-compton-lectures
- “Quark Net” University of Pennsylvania, Lectures to high school students** 2017,2012
- “Rent a scientist for the day” fund-raising auction for Chicago Science & Arts Academy** 2015
- Career Day for 3rd/5th graders Greenfield Elementary School, Philadelphia** 2013-2014

CONFERENCE ORGANIZATION	Local organizing committee for DPF-Pheno	2024
	Local organizing committee for US CMS annual meeting	2023
	CMS flavor tagging workshop, Brussels Belgium	2023
	US CMS Collaboration meeting, CMU Pittsburgh	2023
	Session chair at PHENO conference, PITT-PACC Pittsburgh	2019 - present
	Di-Higgs Workshop, Fermilab	2018
REVIEWS AND EDITORIAL BOARD MEMBERSHIP	Referee Journal of Instrumentation (JINST)	2018
	Referee Physics Letters B	2017
	National Science Foundation, panelist	2016
	Editorial Boards:	2012 - present
	- <i>Search of non-resonant $HH \rightarrow bbWW$ in the fully-hadronic final state</i>	
	- <i>Search for long-lived heavy neutral leptons in b-quark initiated decays</i>	
	- <i>Search for Higgs boson pairs in the $bb\tau\tau$ final state</i>	
	- <i>Search for leptoquarks coupling to third-generation fermions with the CMS detector</i>	
	- <i>Properties of $g \rightarrow bb$ at small opening angles in pp collisions with the ATLAS detector</i>	
	- <i>Search for production of an excited b-quark decaying into Wt in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector</i>	
- <i>Search for third generation squarks with the ATLAS detector in final states with b-jets and missing energy at in pp collisions $\sqrt{s} = 13$ TeV</i>		
- <i>A measurement of the ratio of the production cross sections for W and Z bosons in association with jets with the ATLAS detector.</i>		
- <i>Measurement of the production cross section for W-bosons in association with jets in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector.</i>		
- <i>Precision measurement and interpretation of inclusive W^+, W^- and Z/γ^* production cross sections with the ATLAS detector.</i>		
PROFESSIONAL SERVICE	CMU contact to Future Circular Collider International Forum of Institutional contacts	
	Member of the European Committee for Future Accelerators focus group on $h \rightarrow ss$	
	CMS Phase-II Tracking Validation (Chuyuan Liu)	
	Member of American Physical Society (APS)	
	Member of the American Association for the Advancement of Science (AAAS)	
POSTDOCTORAL FELLOWS	Dr. Alejandro Gomez:	2023-present
	Di-Higgs Physics and High-Throughput Analysis Tools	
	Dr. Patrick Bryant:	2018-2023
	Di-Higgs Physics and High-Granularity Calorimeter module production. Started in the DOE office of science as an AAAS fellow in 2023.	

ENGINEERS	Jessica Parshook: High-Granularity Calorimeter module production.	2019-present
	Eva Klobier: High-Granularity Calorimeter module production.	2023-2024
GRADUATE STUDENTS	Soheun Yi: (CMU Statistics and Data Science) Model-Agnostic Detection of New Physics Using Data-Driven Anomaly Detection	expected 2026
	Sindhu Murthy: Anomaly detection for a model independent search for new physics in the four b-quark jet final state.	expected 2026
	Wesley Terrill: Search for new physics with compressed spectra using soft multi-leptons and missing transverse momentum	expected 2025
	Chuyuan Liu: Search D-Higgs production in association with a vector boson.	expected 2025
	Tudor Manole: (CMU Statistics and Data Science) Statistical Inference for Optimal Transport	2024
COURSES TAUGHT	Modern Physics Laboratory (33-340)	Fall, Spring 2024
	Physics III: Modern Essentials (33-211)	Spring 2023
	Quantum Physics and Structure of matter (33-225)	Fall 2020, 2021
	Introduction to Nuclear and Particle Physics (33-444)	Spring 2020, 2019, 2022
	Experimental Physics (33-104)	Fall 2019
THESIS COMMITTEES	Andrew Roberts “Search for Z to four-b-jets with the CMS detector”	(expected 2026)
	Wenjie Huang “Explorations of Physics Beyond the Standard Model”	(expected 2025)
	Tianping Gu “Search for Baryon-Number-Violating B Decay’s with the Belle-2 detector” (University of Pittsburgh)	(2024)
	Laurisa Thorne , “Neutrino mass analysis and systematics of the KATRIN experiment”	2022
	Micheal Andrews , “Search for exotic Higgs boson decays to merged photons employing a novel deep learning technique at CMS”	2021
	Rauri Brett , “The Scalar Glueball and K-pi Scattering from Lattice QCD”	2019

DEPARTMENTAL COMMITTEES	Outreach committee, chair	(2021 - present)
	Faculty search sub-committee, member	(2021)
	Outreach committee, member	(2020 - 2021)
	Science @ CMU, member	(2019)
	Staff planning committee, member	(2019)
	Colloquium committee, member	(2018 - present)

COLLEGE COMMITTEES	Guy Berry (MSC) committee, member	(2020-2021)
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POSTDOCTORAL RESEARCH		The ATLAS Experiment, CERN
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Member of the ATLAS collaboration from 2008 until joining CMS in 2018.

Coordinated di-Higgs analyses across ATLAS (2016 - 2018)

Coordinated development, implementation and maintenance of ATLAS b-jet triggers (2015 - 2018)

Fast TracKer (FTK): A hardware-based track-trigger upgrade: (2013 - 2018)

- Led prototype board testing and firmware design
- Led firmware development through design and production readiness reviews

Coordinated and executed first searches for new physics with 13 TeV data (2014 - 2015)

Lead roles in analyses searching for new physics: (2013 - 2018)

- Search for di-Higgs production in 4b final state:
- Search for low mass di-jet resonances (below one TeV) using di-jet + ISR production:
- Search for resonant di-b-quark production:
- Multi-jet search for TeV Black Holes

GRADUATE RESEARCH		The ATLAS Experiment, CERN
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Higgs analyses and Standard Model measurements:

- Higgs Boson Search and Discovery: $H \rightarrow WW \rightarrow l\nu l\nu$:
- Standard Model: $WW \rightarrow l\nu l\nu$ production:
- Standard Model: $W \rightarrow e\nu$, $Z \rightarrow ee$ measurements:
- Awarded the ATLAS Thesis Award and the Springer Thesis Prize

Led effort to develop electron identification algorithms in Run 1 and 2

Responsible for alignment of the Transition Radiation Tracker

Commissioned Inner Detector tracking with cosmic rays prior to LHC collisions.

UNDERGRADUATE
RESEARCH

CDF, Fermilab

Research at the Tevatron with Professor Joe Boudreau

Estimated a systematic uncertainty in B lifetime measurement in the mode $B^0 \rightarrow J/\psi K_S^0$

Awarded the Halliday Award for Excellence in Undergraduate Research