

Lawrence Lee, Jr.

Harvard University
Department of Physics
Cambridge, MA, USA, 02138
Email: Lawrence.Lee.Jr@cern.ch
Phone: +1 856 765 4622

CERN CH-1211
Bâtiment 40-1-D11
23 Genève, Switzerland

Professional Experience

Post-Doctoral Fellow, LPPC 2016–Present
Harvard University, Cambridge, MA – *Supervisor: J. Huth*

Research Associate, CoEPP 2014–2016
The University of Adelaide, Adelaide, Australia – *Supervisor: P. Jackson*

Education

Ph.D. Physics, Yale University – *Supervisor: T. Golling* 2014
M.S., M.Phil. Physics, Yale University 2012
B.S. Physics, Rutgers University – *Supervisors: R. Ransome, R. Gilman, R. Tumulka* 2009

Fields of Research Interest

High Energy Collider Physics, Experimental searches for physics Beyond the Standard Model, Supersymmetry, Long-Lived Particles, Foundations of Quantum Mechanics

Research Experience

MEMBER OF THE ATLAS COLLABORATION 2009–Present

NEW SMALL WHEEL MUON SPECTROMETER UPGRADE

Micromegas Trigger Coordinator 2020–Present
Integration of trigger electronics for the micromegas detector of the New Small Wheel (NSW) upgrade for the ATLAS muon spectrometer

Online Software Coordination 2019–Present
Designed, implemented, and/or maintain the readout, configuration, and calibration software systems for the NSW

Micromegas Digitization 2017–2018
Responsible for digitization and simulation of the readout and trigger paths for the micromegas detector for the NSW

PHYSICS ANALYSIS

Convener of SUSY RPV/LL sub-group 2017–2019
Defined standards and direction of searches for long-lived particles and R-parity-violating supersymmetry. Served two terms.

Searches for Long-Lived Particles <i>Led many analysis teams in searches for long-lived particles in a variety of signatures. See Publications.</i>	2016-Present
Common Analysis Software Development <i>Primary developer of common analysis software used by roughly ten analysis teams</i>	2015-Present
Common Result Interpretation <i>Responsible for standards of exclusion interpretation and limit interpolation within the ATLAS SUSY working group, implementing new methods for presentation of results</i>	2018-Present
Inclusive searches for Supersymmetry <i>Led flagship search for supersymmetry in inclusive zero-lepton final states in 2016 including leading the first searches for new physics using “Recursive Jigsaw” variables. Created and commissioned novel triggers for use during Run-2 of the LHC geared toward finding new physics in low-mass-splitting scenarios.</i>	2014-2016
All-Hadronic BSM Signatures <i>Led two searches for new phenomena in the context of R-Parity violating supersymmetry in fully hadronic final states</i>	2011-2014
Quark-vs-Gluon Jet Tagging <i>Developed the first quark- vs. gluon-jet discriminator at a hadron collider</i>	2010-2012
NUCLEON PHYSICS RESEARCH	2007–2009
<i>Developed the prototype trigger and data acquisition systems for Fermilab E-906/SeaQuest</i>	
<i>Assembled a large fraction of the photomultiplier tube units used in MINERvA</i>	
<i>Upgraded control electronics for stabilization of a high-gain Fabry-Perot cavity for use in the JLAB Hall-A Compton polarimeter</i>	

Publications

Over 950 published papers as part of the ATLAS Collaboration with over 29,000 citations [*Inspire*]. Selected publications with significant contributions are listed below. ► *indicates a primary editor or analyzer role.*

Independent Publications

- M. Bauer, O. Brandt, LL, C. Ohm, **ANUBIS: AN Underground Belayed In-Shaft search experiment**, In Revision, arXiv: 1909.13022 2020
Responsible for original idea to instrument service shafts above the ATLAS Experiment for a dedicated long-lived particle experiment. Helped shape technical proposal outlined in paper.
- LL, M. Hance, **ATLAS Pushes the Limits on Supersymmetry**, CERN Courier 2019
Co-author on summary of recent searches for supersymmetry from the ATLAS experiment with particular responsibilities for long-lived particles and strongly-produced particles.
- X. Cid Vidal, et al., **Beyond the Standard Model Physics at the HL-LHC and HE-LHC**, CERN-LPCC-2018-05 2018

Contributed studies of HL-LHC projections for long-lived gluino searches. Responsible for sensitivity projections.

- ▶ LL, C. Ohm, A. Soffer, and T. Yu, **Collider Searches for Long-Lived Particles Beyond the Standard Model**, Progress in Particle and Nuclear Physics JPPNP 3695 2019
Co-responsible for all experimental aspects of this broad review of collider searches for long-lived particles.

Peer-Reviewed Publications from the ATLAS Collaboration

- ▶ **Search for long-lived, massive particles in events with a displaced vertex and a muon with large impact parameter in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector**, Phys. Rev. D 102 032006 2020
Co-coordinator of analysis. Responsible for all aspects of the analysis, including background estimation scheme, physics targets, and analysis software.

- ▶ **Search for long-lived, massive particles in events with displaced vertices and missing transverse momentum in 13 TeV pp collisions with the ATLAS detector**, Phys. Rev. D 97 052012 2018
Co-coordinator of analysis. Particularly responsible for background estimation methods and their validation, limit-setting, and data-flow model.

Search for new phenomena in high-mass diphoton final states using 37 fb^{-1} of proton-proton collisions collected at $\sqrt{s} = 13$ TeV with the ATLAS detector, Phys. Lett. B 775 105 2017
Responsible for creation and validation of BSM signals and Higgs EFT models.

Search for new phenomena in events containing a same-flavour opposite-sign dilepton pair, jets, and large missing transverse momentum in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector, Eur. Phys. J. C 77 144 2017
Responsible for studies of the jet system dynamics.

- ▶ **Search for squarks and gluinos in final states with jets and missing transverse momentum at $\sqrt{s} = 13$ TeV with the ATLAS detector**, Eur. Phys. J. C 76: 392 2016
Co-coordinator of search. Responsible for all aspects of limit-setting. Responsible for background estimation design and implementation for RJR analysis.

- ▶ **Search for massive supersymmetric particles decaying to many jets using the ATLAS detector in pp collisions at $\sqrt{s} = 8$ TeV**, Phys. Rev. D 91, 112016 2015
Co-coordinator of search. Responsible for all aspects of the search from background estimation, signal simulation, and limit-setting.

- ▶ **Light-quark and Gluon Jet Discrimination in pp Collisions at $\sqrt{s} = 7$ TeV with the ATLAS Detector**, Eur. Phys. J. C 74: 3023 2014
Responsible for analysis design, data-driven template determination and validation.

- ▶ **Search for pair production of massive particles decaying into three quarks with the ATLAS detector in $\sqrt{s} = 7$ TeV pp collisions at the LHC**, Journal of High Energy Physics 12, 1–42 2012
Responsible for signal simulation and limit-setting.

Selected Public Documents from the ATLAS Collaboration

Generation and Simulation of R -Hadrons in the ATLAS Experiment, ATL-PHYS-PUB-2019-019 2019

- ▶ **Supersymmetry Summary Plots**, Main overview and RPV plots Since March 2018
- Performance of vertex reconstruction algorithms for detection of new long-lived particle decays within the ATLAS inner detector** , ATL-PHYS-PUB-2019-013 2019
- Reinterpretation of searches for supersymmetry in models with variable R-parity-violating coupling strength and long-lived R-hadrons**, ATLAS-CONF-2018-003 2018
- First look at pp collisions data at $\sqrt{s} = 13$ TeV in preparation for a search for squarks and gluinos in final states with jets and missing transverse momentum with the ATLAS detector**, ATL-PHYS-PUB-2015-028 2015

Additional public documents supporting the publications described above.

Eight ATLAS Editorial Boards

Journal Referee for Physical Review Letters

Work in Progress

Studies of muon collider environments

▶ *Future collider projections for photon-induced production of charged BSM particles*

▶ *A search for very late-decaying, long-lived BSM particles*

Multijet search applications of recurrent neural networks in large-dimensional kinematic spaces

A search for displaced decays of long-lived sleptons

▶ *Measuring quantum entanglement and nonlocality at future lepton colliders*

▶ *A comment on the structure of space-time and the axioms of special relativity*

Conference and Seminar Presentations

ColliderScope: Reaching New Audiences with Electronic(s) Music

18th International Particle Physics Outreach Group meeting, CERN 2019

International Conference on New Frontiers in Physics, Kolymbari, Crete 2019

APS Division of Particles and Fields Meeting, Boston, MA 2019

Searches for Long-Lived Particles with the ATLAS Detector

On behalf of the ATLAS Collaboration

International Conference on New Frontiers in Physics, Kolymbari, Crete 2019

Long-Lived Particles and the Higgs

Higgs Cross-Section Working Group Meeting, CERN, Geneva 2018

How SUSY Can Still Save The Day / The SUSY Swindle

Lund University, Sweden 2020

Michigan State University, East Lansing, MI 2019

University of Illinois, Urbana-Champaign, IL 2018

Fermilab *Topic of the Week*, Batavia, IL 2018

SLAC, Palo Alto, CA 2018

University of Oregon, Eugene, OR 2018

University of Pennsylvania, Philadelphia, PA 2018

Rutgers University, Piscataway, NJ 2018

On the Higgs Branching Ratios

LPPC Seminar, Harvard University, Cambridge, MA	2018
SUSY and Exotics Overview – “Headliner” Talk USATLAS Workshop, University of Pittsburgh, Pittsburgh, PA	2018
The SUSY Paradox & A Toy Entropic Explanation for the Hierarchy Problem Oskar Klein Centre, Stockholm, Sweden	2018
Searches for squarks and gluinos in scenarios with R-parity violating sparticle decays, or long-lived sparticles with ATLAS <i>On behalf of the ATLAS Collaboration</i> SUSY2017, Mumbai, India	2017
Searches for Sneaky SUSY at the ATLAS Experiment & A Toy Entropic Explanation for the Hierarchy Problem Lawrence Berkeley National Laboratory, Berkeley, CA	2017
SUSY Searches in the ATLAS Experiment – Plenary Talk <i>On behalf of the ATLAS Collaboration</i> IHEP-T2E, Kuala Lumpur, Malaysia	2017
The Recursive Jigsaw Reconstruction Technique SUSY2016, Melbourne, Victoria, Australia	2016
New Searches for Strongly-Produced SUSY at the ATLAS Experiment CoEPP Annual Workshop, Torquay, Victoria, Australia	2016
Searches for R-Parity Violating SUSY at the ATLAS Experiment Harvard University - LPPC Seminar, Cambridge, MA	2015
Applications of the Recursive Jigsaw Technique SUSY2015, Lake Tahoe, CA	2015
SUSY Searches in the ATLAS Experiment – Plenary Talk <i>On behalf of the ATLAS Collaboration</i> Kruger2014, Kruger Gate, South Africa	2014
A Search for B-Violating Supersymmetry in Multijet Signatures and Light-quark vs. Gluon Jet Tagging University of Adelaide, Australia University of Melbourne, Australia	2014 2014
...But What If I Like Naturalness? 2nd International Spring School on Particle Physics and Philosophy Wuppertal, Germany	2014
A Search for B-Violating Supersymmetry in Multijet Signatures at the ATLAS Experiment Institut de Física d’Altes Energies (IFAE), Barcelona, Spain Santa Cruz Institute of Particle Physics Seminar, Geneva, Switzerland	2014 2013
RPV Stops at the LHC LPC Workshop on Exotic Top Partners Fermi National Accelerator Laboratory, LHC Physics Center, Batavia, IL	2013

Search for supersymmetry in resonant production and R-parity violating signatures with the ATLAS detector

On behalf of the ATLAS Collaboration

SUSY2012, Peking University, Beijing, China 2012

Conference and Workshop Organization

ATLAS SUSY and Exotics Workshop – Co-organizer of session on reinterpretation materials
Virtual Workshop 2020

ATLAS Reaching New Heights Workshop – Convener of Unconventional Signatures Session
CERN, Geneva, Switzerland 2019

ATLAS SUSY Workshop – Critical Review of SUSY Analysis Software and Best Practices
Lecce, Italy 2019

APS Division of Particles and Fields Meeting – BSM Session Co-convener
Northeastern University, Boston, MA 2019

ATLAS SUSY Workshop – Organizer and Presenter
Stockholm, Sweden 2018

ATLAS SUSY and Exotics Workshop – Organizer
Bucharest, Romania 2017

Recursive Jigsaw Workshop – Convener of two sessions
Harvard University, Cambridge, MA 2015

Workshop on LHC Searches – Jet Tagging and Substructure Session Co-convener
Lawrence Berkeley National Laboratory, Berkeley, CA 2014

Outreach Activities

ColliderScope – Particle-Physics-Inspired Electronic Music Project 2019-Present

Music with sound waves that show particle physics images in Lissajous figures

Live performances:

ICHEP2020 and YouTube, Live from the CERN Control Centre 2020

Lund, Sweden 2020

Aeronaut Brewing, Somerville, MA 2019

ATLAS Experiment Party, Geneva, Switzerland 2019

CERN Open Days, Geneva, Switzerland 2019

Pohoda Music Festival, Trenčín, Slovakia 2019

Featured in Symmetry Magazine and other publications

Presentations to Grade School Students

Tel Aviv University – Future Scientists CERN Tour 2017-2019

Five presentations to NJ and NY schools 2011-2016

Harvard NSW Activities at CERN - Video (YouTube)

Fully produced video for recruitment 2018

In Particular - Podcast 2015-2016

Audio and original music production
 Production of “Video Shorts”
 Web development, graphic design, and episode production
 Tens of thousands of downloads (~ 11 TB served) since the first episode 2 June 2015
 Featured by CERN, iTunes, The Guardian Science Blogs, Ars Technica, Vice, and others

Interviews

Interview for article for Symmetry Magazine on naturalness	2019
Interview for Swedish-language podcast <i>Professor Magenta</i> about science and art	2016
Public screening of film Particle Fever	2014

Visiting Scholar, Dharma Drum Buddhist College

Jinshan, Taiwan	2014
-----------------	------

Advising

Harvard University, Students:

Brendon Bullard (PhD Candidate)	[w/M. Morii]
Jennifer Roloff (2019 PhD)	[w/J. Huth]
Karri Folan DiPetrillo (2019 PhD)	[w/M. Franklin]
Adriana Rotaru (2019 Summer Undergraduate)	[w/J. Huth]
Madeline Bernstein (2017 Summer Undergraduate)	[w/M. Franklin]

Uppsala University, Students:

Andreas Gillgren (2018-2019 Visiting Engineering Physics Student)	[w/J. Huth]
---	-------------

Columbia University, Students:

Russell Smith (2016 PhD)	[w/E. Hughes]
--------------------------	---------------

University of Adelaide, Students:

Jason Oliver (2019 PhD)	[w/P. Jackson]
Anum Qureshi (2019 PhD)	[” ”]
Damir Duvnjak (2014 Honours, 2019 PhD)	[” ”]
Jens Kröger (2015 Visiting)	[” ”]
Finley Borgas (2014 Honours)	[” ”]

Yale University, Five Undergraduate Honors Students

Teaching

Yale University

<i>Fundamentals of Physics</i> , lecturing assistant for Prof. P. Tipton	Spring 2011
<i>Physics for the Life Sciences</i> , lecturing assistant for Prof. S. Mochrie	Fall 2010
<i>Modern Physical Measurement</i> , assistant for Prof. J. Harris	Spring 2010
<i>General Physics Laboratory</i> , assistant for Prof. K. Baker	Fall 2009

References

Prof. Melissa Franklin - *Mallinckrodt Professor of Physics* - Harvard University

Franklin@Physics.Harvard.edu

Prof. Tobias Golling - *Associate Professor* - University of Geneva

Tobias.Golling@unige.ch

Dr. Andreas Hoecker - *Senior Research Physicist, ATLAS Spokesperson-Elect* - CERN

Andreas.Hoecker@cern.ch

Prof. John Huth - *Donner Professor of Science* - Harvard University

Huth@g.Harvard.edu

Prof. Paul Jackson - *Associate Professor* - University of Adelaide

P.Jackson@adelaide.edu.au

Dr. Zachary Marshall - *Senior Scientist* - Lawrence Berkeley National Lab

Zach.Marshall@cern.ch

Last updated: September 6, 2020