

# Giordon Stark

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## CONTACT INFORMATION

Giordon Stark  
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## RESEARCH INTERESTS

High Energy Particle Physics, Supersymmetry and Physics Beyond the Standard Model, Electroweak Supersymmetry, Boosted Object Reconstruction, Hadronic Final States, Jet Substructure, Machine Learning, Embedded Hardware, Trigger.

## EDUCATION

<b>University of Chicago</b> , Chicago, Illinois	<b>September 2012 – June 2018</b>
<i>Ph.D. Physics</i> , David Miller	
<b>California Institute of Technology</b> , Pasadena, California	<b>Sep 2008 – June 2012</b>
<i>B.S. Physics</i> , Kenneth Libbrecht and Harvey Newman	

## DISSERTATION

**Ph.D.**  *The search for supersymmetry in hadronic final states using boosted object reconstruction*  
ISBN: [978-3-030-34548-8](#)

**B.S.**  *Optical Coating Brownian Thermal Noise in Gravitational Wave Detectors*

## PROFESSIONAL EXPERIENCE

<b>SCIPP</b> , Santa Cruz, California	<b>August 2018 – present</b>
<i>Post-doctoral Researcher, ATLAS Experiment at CERN</i>	

- Referee for JHEP
- Early Career Scientist Board committee member (2021-present): assist and foster an inclusive environment for the young scientists in the ATLAS collaboration. This work is also coordinated with other ECS groups in ALICE, CMS, and LHCb. The efforts include hosting "ATLAS Induction Day", software tutorials, Career Q&A with CERN alumni, organizing social events, and raising awareness of issues specifically impacting the young scientists to Management.
- Supersymmetry (SUSY) Run-2 Summaries Subconvener (2020-present): identify, advise, and lead the publication of combinations across SUSY Physics subgroups, and define recommendations, standards, and validation procedures for analyses to use as part of a harmonization effort. Topics include: simplified model combinations of Electroweak and 3rd Generation physics, pMSSM scans, RPC-to-RPV reinterpretations, incorporating Dark Matter constraints into searches for new physics, and Higgs to SUSY.
- Common Dark Matter ASG-RECAST Contact (2019-2021): identify, advise, and implement improvements to the analysis preservation effort and liaison between the ATLAS Software Group and the analyses in the Common Dark Matter group
- US ATLAS Diversity and Inclusion Committee (2018-present): advise the US ATLAS organization on how to implement recommendations in the Diversity and Inclusion report, which recommendations to implement, and modify practices and procedures to improve the collaboration environment for everyone
- SUSY Combinations Team Contact (2018-2020): providing recommendations for object identification and selection criteria, developing the toolchains necessary to combine analyses, and performing the statistical combinations
- SUSY Monte Carlo Production Contact (2018-2020): usher all Monte Carlo simulation production requests through to the production system, provide support for defining generator configurations for physics, and identify/resolve any bugs - both physics and technical.
- Core Developer for **pyhf** (Ref. [12]) allowing for preservation and statistical reproduction of likelihoods for searches in ATLAS
- Overseeing module testing and organizing cabling assembly for the ATLAS Detector Inner Tracker (ITk) instrumentation upgrades at SCIPP
- Coordinated the dedicated software efforts and developed a python library to interface with the ATLAS Detector ITk upgrade database: **itkdb**
- Supporting analyzer for new physics search in SUSY with multiple heavy-flavor and large radius jets [13, 14, 18, 19, 20]
- Instructor for various bootcamps and workshops to help develop software expertise in High Energy Physics (HEP) Analysis Preservation [23, 24]

SEMINARS AND PLENARIES	University of Pennsylvania	February 2022
	The University of Cambridge, UK	January 2022
	The University of Tennessee, Knoxville	October 2021
	ICPS 2021	August 2021
	SUSY2019	May 2019
	The University of Chicago	November 2018
	Columbia College Chicago	November 2018
HONOURS AND AWARDS	Springer Thesis Award [10]	August 2019
	CERN Fellowship (turned down)	April 2018
	Nathan Sugarman Award for Excellence in Graduate Student Research	May 2017
	US ATLAS Outstanding Graduate Student Award	June 2016
	Young Researchers' Symposium Award for Best Poster Presentation	November 2015
	Department of Energy, Office of Science Graduate Student Research	Oct. 2015 - Jan. 2016
	UChicago Excellence in Graduate Teaching nominee	April 2015
	US LHC Users Association Lightning Round winner	November 2014
	UChicago Excellence in Graduate Teaching nominee	April 2014
	UChicago Excellence in Graduate Teaching nominee	April 2013
	Caltech Excellent TA Award	2012
	Edward C. and Alice Stone Fellow	June 2010
PAST PROFESSIONAL EXPERIENCE	<b>UChicago HEP</b> , Chicago, Illinois	<b>November 2013 – July 2018</b>
	<i>Ph.D. Student, ATLAS Experiment at CERN</i>	
	<ul style="list-style-type: none"> <li>Lead analyzer for new physics search in SUSY with multiple heavy-flavor and large radius jets [13, 14, 18, 19, 20]</li> <li>Worked on electronic instrumentation to improve the ATLAS Trigger system in Run 3 and beyond for boosted objects: <a href="#">gFEX: global feature extraction</a> [16, 30]</li> <li>Spearheading the effort for embedded processor design within the ATLAS experiment. This includes developing an OpenEmbedded firmware layer for compiling a linux kernel from scratch to be installed on instrumentation in the ATLAS experiment: <a href="#">meta-l1calo</a></li> <li>Investigating jet-area based pile-up suppression techniques applied to jets in the forward region of the ATLAS detector in high pileup environments at HL-LHC [28]</li> <li>Performing physics studies for the hardware instrumentation as part of the ATLAS detector upgrade work. These studies include identifying subjets from trigger tower information, pileup mitigation techniques, parameterizing trigger efficiency and rates for the online trigger objects I defined, and prototyping a convolutional neural network using the ATLAS calorimeter data as a 2D image to study trigger-level observables [30]</li> <li>Editor of the gFEX Final Design Report describing the technical requirements and needs of gFEX in the ATLAS Calorimeter ecosystem [15]</li> <li>Created and maintain an analysis framework for general physics analyses within ATLAS including Standard Model searches, SUSY, Exotics, Higgs, Trigger-Level analyses, Jet Calibration efforts, and more: <a href="#">xAODAnaHelpers</a> [37]</li> <li>Built a python tool to scan the phase-space of an analysis to identify performant variables to discriminate signal over background: <a href="#">root-optimize</a></li> <li>Developer of a python framework that combines ROOT and NumPy: <a href="#">root_numpy</a> [36]</li> </ul>	
	<b>University of Chicago</b> , Chicago, Illinois	<b>June 2012 – Present</b>
	<i>Graduate Student Teaching Assistant</i>	
	<b>Courses</b> (teaching materials and reviews available on request)	
	<ul style="list-style-type: none"> <li>PHY211 – Advanced Physics Laboratory</li> <li>PHY225 – Advanced Electromagnetism</li> <li>PHY141 – Advanced Mechanics</li> <li>PHY131 – Mechanics</li> <li>PHY132b – Special Relativity and Electromagnetism</li> <li>PHY121 – Introductory Mechanics</li> </ul>	<b>Fall Term 2016-2017</b> <b>Winter Term 2014-2015</b> <b>Fall Term 2013-2014</b> <b>Summer Term 2012-2013</b> <b>Winter Term 2012-2013</b> <b>Fall Term 2012-2013</b>
	<b>University of Chicago</b> , Chicago, Illinois	<b>June 2014 – Present</b>

### Bridge Program Tutor

- Tutored participants in the program upon request in all currently offered graduate-level Physics courses at University of Chicago
- Bridge program helps enhance diversity in the physics graduate education and also provides a bridge to the *Ph.D* effort

### University of Chicago, Chicago, Illinois

June 2012 – May 2013

Graduate Student Research Assistant in Ultracold Atomic Physics, **Supervisor:** Cheng Chin

- Started a project on trapping of water droplets using temperature gradients at room pressure

### Adaptly, New York City, New York

June 2012 – September 2012

Developer, **Supervisors:** Sean Shillo, Will Highducheck

- <https://adaptly.com>
- Developed projects and implemented infrastructure for the Adaptly Self-Serve platform
- Worked with “Big Data” for a large portion of my time at Adaptly

### Laser Interferometer Gravitational Observatory, Caltech

Sep 2011 – June 2012

Research Assistant, **Advisor:** Rana Adhikari

- Researching the effects of Brownian Thermal Noise and how it relates to the Quality Factors and Loss Angles of thin-film coated mirrors used in LIGO

### Laser Interferometer Gravitational Observatory, MIT

June 2011 – Sep 2011

Research Assistant, **Advisors:** Sam Waldman, Rai Weiss, Hugo Paris

- Developed control systems for monitoring the state of the LIGO system via multiple physical chassis setups and software collaborations
- Developed software to analyze noise levels in LIGO hardware (capacitive position sensors and various chassis), analyzed noise levels in the hardware to verify its quality before sending it to other LIGO labs in the country
- Worked on the feed-forward systems to minimize mechanical vibrations in the system

### Computational Physics Lab, Caltech

March 2011 – June 2011

Research Assistant and Computational Specialist, **Advisor:** Frank Rice

- Developed a new version of the Caltech’s Sophomore Physics Laboratory Mathematica CurveFit program (program is still being developed; **code/demonstration available upon request**)

### Information Systems and Technology, Caltech

March 2011 – June 2011

Teaching Assistant, **Course Instructor:** Shuki Bruck

- Provided 2-hour Office Hour session once a week to assist with homework, answer questions about lectures, and improve students’ understanding
- Attended lectures, structured and graded homework assignments for  $\sim 140$  students

### Submillimeter Wave Observatory, Caltech

June 2010 – Aug 2010

Edward C. and Alice Stone Fellow, **Advisors:** Simon Radford and David Miller

- Designed an optical system that couples the beams from a Fourier Transform Spectrometer to a Bolometer, collimated through a sample, to determine the submillimeter transmittivity of optical materials in broadband wavelengths (500 Gigahertz to 3.5 Terahertz)
- Results are employed in the design of more efficient submillimeter instruments around the world

## PUBLICATIONS, TALKS, AND WORKS

### SELECTED PAPERS

- [1] G. Stark et al., *Muon Collider Physics Summary*, 2022. [arXiv:2203.07256 \[hep-ph\]](#).
- [2] G. Stark et al., *Jets and Jet Substructure at Future Colliders*, 2022. [arXiv:2203.07462 \[hep-ph\]](#).

- [3] G. Stark, K. A. Assamagan, C. Bonifazi, J. S. Bonilla, P. A. Breur, M. C. Chen, A. Roepe-Gier, Y. H. Lin, S. Meehan, M. E. Monzani, and E. Novitski, *Accessibility in High Energy Physics: Lessons from the Snowmass Process*, [arXiv:2203.08748 \[physics.ed-ph\]](#).
- [4] G. Stark, S. Bailey, C. Bierlich, A. Buckley, J. Butterworth, K. Cranmer, M. Feickert, L. Heinrich, A. Huebl, S. Kraml, A. Kvellestad, C. Lange, A. Lessa, K. Lassila-Perini, C. Nattrass, M. S. Neubauer, S. Sekmen, and G. Watt, *Data and Analysis Preservation, Recasting, and Reinterpretation*, [arXiv:2203.10057 \[hep-ph\]](#).
- [5] S. Malik et al., *Software Training in HEP*, *Computing and Software for Big Science* **5** (2021) 22, <https://doi.org/10.1007/s41781-021-00069-9>.
- [6] ATLAS Collaboration, *Implementation of simplified likelihoods in HistFactory for searches for supersymmetry*, ATL-PHYS-PUB-2021-038, 9, 2021, <http://cdsweb.cern.ch/record/2782654>.
- [7] K. Cranmer et al., *Publishing statistical models: Getting the most out of particle physics experiments*, *SciPost Phys.* **12** (2022) 37, [arXiv:2109.04981 \[hep-ph\]](#), <https://scipost.org/10.21468/SciPostPhys.12.1.037>.
- [8] ATLAS Collaboration, *Search for chargino–neutralino pair production in final states with three leptons and missing transverse momentum in  $\sqrt{s} = 13$  TeV pp collisions with the ATLAS detector*, [arXiv:2106.01676 \[hep-ex\]](#).
- [9] Feickert, Matthew, Heinrich, Lukas, and Stark, Giordon, *Likelihood preservation and statistical reproduction of searches for new physics*, *EPJ Web Conf.* **245** (2020) 06017, <https://doi.org/10.1051/epjconf/202024506017>.
- [10] G. Stark, *The Search for Supersymmetry in Hadronic Final States Using Boosted Object Reconstruction*. Springer International Publishing, 2020. <https://doi.org/10.1007/978-3-030-34548-8>.
- [11] LHC Reinterpretation Forum Collaboration, W. Abdallah et al., *Reinterpretation of LHC Results for New Physics: Status and Recommendations after Run 2*, [arXiv:2003.07868 \[hep-ph\]](#).
- [12] ATLAS Collaboration Collaboration,, *Reproducing searches for new physics with the ATLAS experiment through publication of full statistical likelihoods*, Tech. Rep. ATL-PHYS-PUB-2019-029, CERN, Geneva, Aug, 2019. <http://cds.cern.ch/record/2684863>.
- [13] ATLAS Collaboration, *Search for Supersymmetry in final states with missing transverse momentum and multiple b-jets in proton–proton collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector*, [arXiv:1711.01901 \[hep-ex\]](#).
- [14] ATLAS Collaboration, *Search for pair production of gluinos decaying via stop and sbottom in events with b-jets and large missing transverse momentum in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector*, *Phys. Rev. D* **94** (2016) 032003, [arXiv:1605.09318 \[hep-ex\]](#).
- [15] ATLAS Collaboration, *Global Feature Extractor of the Level-1 Calorimeter Trigger: ATLAS TDAQ Phase-I Upgrade gFEX Final Design Report*, Geneva, Nov, 2016, <https://cds.cern.ch/record/2233958>.
- [16] ATLAS Collaboration, *gFEX, the ATLAS Calorimeter Level-1 Real Time Processor*, Tech. Rep. ATL-DAQ-PROC-2015-059, CERN, Geneva, Nov, 2015. <https://cds.cern.ch/record/2104248>.
- [17] ATLAS Collaboration, *Search for pair production of higgsinos in final states with at least three b-tagged jets using the ATLAS detector in  $\sqrt{s} = 13$  TeV pp collisions*, ATL-CONF-2017-081, 2017, <https://cds.cern.ch/record/2297400>.
- [18] ATLAS Collaboration, *Search for production of supersymmetric particles in final states with missing transverse momentum and multiple b-jets at  $\sqrt{s} = 13$  TeV proton-proton collisions with the ATLAS detector*, ATL-CONF-2017-021, 2017, <https://cds.cern.ch/record/2258143>.
- [19] ATLAS Collaboration, *Search for pair production of gluinos decaying via top or bottom squarks in events with b-jets and large missing transverse momentum in pp collisions at  $\sqrt{s} = 13$  TeV*

- with the ATLAS detector, ATLAS-CONF-2016-052, 2016, <https://cds.cern.ch/record/2206134>.
- [20] ATLAS Collaboration, *Search for pair-production of gluinos decaying via stop and sbottom in events with b-jets and large missing transverse momentum in  $\sqrt{s} = 13$  TeV pp collisions with the ATLAS detector*, ATLAS-CONF-2015-067, 2015, <https://cds.cern.ch/record/2114839>.
- [21] ATLAS Collaboration, *Expected Performance of Boosted Higgs ( $\rightarrow b\bar{b}$ ) Boson Identification with the ATLAS Detector at  $\sqrt{s} = 13$  TeV*, ATL-PHYS-PUB-2015-035, 2015, <https://cds.cern.ch/record/2042155>.

A full list of publications is available in INSPIRE: <https://inspirehep.net/authors/1319078>.

#### SELECTED TALKS

- [22] G. Stark, *PARTY CALL PHYSICS: when access and physics collide*, August, 2021. <https://events.iaps.info/event/9/page/5-keynote-speakers>. A Keynote Speaker for the International Conference of Physics Students, 2021.
- [23] G. Stark, *Analysis Preservation Bootcamp*, February, 2020. <https://indico.cern.ch/e/awesome>. One of the core instructors for the analysis preservation workshop at CERN.
- [24] G. Stark, *USATLAS/FIRST-HEP Computing Bootcamp*, August, 2019. <https://indico.cern.ch/event/816946/>. One of the core instructors for the USATLAS Software Bootcamp at LBNL.
- [25] G. Stark, *PARTY CALL PHYSICS: when access and physics collide*, August, 2019. <https://indico.cern.ch/event/782953/contributions/3454898/>. 2019 Meeting of the Division of Particles & Fields of the American Physical Society.
- [26] G. Stark, *SUSY in ATLAS Experiment*, May, 2019. <https://cds.cern.ch/record/2675305>. XXVIIth International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2019).
- [27] G. Stark, *Searches in High Pile-up Environment*, February, 2018. <https://indico.cern.ch/event/698458/>. ATLAS P & P Week, Topical Physics Plenary: Physics with high pile-up.
- [28] G. Stark, *Forward jet shapes in high pile-up*, December, 2017. <https://indico.cern.ch/event/666007/>. Hadronic Final State Forum 2017.
- [29] G. Stark, *Search for production of supersymmetric particles in final states with missing transverse momentum and multiple b-jets at  $s=\sqrt{13}$  TeV proton-proton collisions with the ATLAS experiment*, November, 2017. <https://indico.fnal.gov/event/15068/>. US LHC Users Association Annual Meeting, 2017.
- [30] G. Stark, *The Calorimeter Global Feature Extractor (gFEX) for the Phase-I Upgrade of the ATLAS experiment*, August, 2017. <https://indico.fnal.gov/event/11999/session/21/contribution/192>. APS Division of Particles and Fields 2017.
- [31] G. Stark, *SUSY using boosted techniques at ATLAS*, August, 2016. <https://indico.cern.ch/event/439039>. BOOST 2016.

#### SELECTED WORKS

- [32] Feickert, Matthew, Heinrich, Lukas, Stark, Giordon, and Galewsky, Ben, *Distributed statistical inference with pyhf enabled through funcX*, *EPJ Web Conf.* **251** (2021) 02070, <https://doi.org/10.1051/epjconf/202125102070>.
- [33] S. Malik et al., *Software Training in HEP*, in *25th International Conference on Computing in High-Energy and Nuclear Physics*. 2, 2021. [arXiv:2103.00659](https://arxiv.org/abs/2103.00659) [hep-ex].



- [34] L. Heinrich, M. Feickert, G. Stark, and K. Cranmer, *pyhf: pure-Python implementation of HistFactory statistical models*, *Journal of Open Source Software* **6** (2021) 2823, <https://doi.org/10.21105/joss.02823>.
- [35] G. Stark, L. Heinrich, and M. Feickert, *diana-hep/pyhf: v0.1.2*, July, 2019. <https://doi.org/10.5281/zenodo.3334365>.
- [36] E. N. Dawe, P. Ongmongkolkul, and G. Stark, *root\_numpy: The interface between ROOT and NumPy*, *The Journal of Open Source Software* **2** (2017) 307, <https://doi.org/10.21105/joss.00307>.
- [37] G. Stark, M. Milesi, J. Alison, G. Facini, K. Krizka, J. Dandoy, T. Novak, J. Bossio, F. Scutti, M. LeBlanc, L. Schaefer, B. Tuan, M. Feickert, W. Kalderon, A. Tuna, M. Muskinja, J. Olsson, L. L. Jr, B. Tong, T. H. Park, M. Swiatlowski, T. Lazovich, B. Carlson, C. Doglioni, R. Hankache, M. Frate, V. Pascuzzi, S. Sekula, R. Newhouse, M. Perego, M. Toscani, L. Henkelmann, L. McClymont, K. Pachal, C. Shimmin, C. Nelson, B. Amadio, B. Stanislaus, W. Balunas, N. Hartman, J. Roloff, J. Geisen, D. Abbott, C. Ohm, C. Helling, C. Antel, A. Emerman, A. Cukierman, and A. Cocco, *xAODAnaHelpers, v1.0.0*, Apr., 2020. <https://doi.org/10.5281/zenodo.3743307>.

OUTREACH	<p>I am actively involved in many outreach activities for which I donate my time. These activities vary from working at non-profits, to hobbies where I develop free and open-sourced tools, to actual outreach where I describe the work I do in a public setting.</p> <ul style="list-style-type: none"> <li>Recorded videos for <a href="#">CERN Microcosm exhibit</a> in American Sign Language. One of the videos is on <a href="#">YouTube</a></li> <li>Lobbied Senators and Congressmen to support strong funding for U.S. Particle Physics programs, based on the P5 report, in Washington D.C. <a href="https://www.usparticlephysics.org/strategy.html">https://www.usparticlephysics.org/strategy.html</a></li> <li>Working on SignsFive, an online dictionary for Science, Tech, Engineering, and Math sign language videos to be stored, uploaded, and searched through: <a href="http://survey.signsfive.com">http://survey.signsfive.com</a></li> <li>Developed an application that allows small-budget and non-profit theaters to provide free captioning services for their patrons: <a href="https://github.com/kratsg/captionator">https://github.com/kratsg/captionator</a></li> <li>Organizing and advocating for accessible theater in Chicago: <a href="http://www.chicagoplays.com/access.html">http://www.chicagoplays.com/access.html</a> (2013-present)</li> <li>Volunteered my time to other activists in Chicago who need technical expertise: <a href="https://chihacknight.org/">https://chihacknight.org/</a> (2015-2018)</li> </ul>
LANGUAGES	American Sign Language, English (bilingual), French Sign Language (elementary), British Sign Language (elementary), Italian Sign Language (elementary), Spanish (elementary), French (elementary)
</> PROGRAMMING	<i>Full Stack Developer</i> , C, C++, Perl, Python, L <sup>A</sup> T <sub>E</sub> X 2 <sub>ε</sub> , MySQL, PHP, JavaScript, JSON, HTML, XHTML, XML, CSS, VHDL, Continuous Integration, Version Control, GitHub/GitLab
COMPUTING LIBRARIES	Mathematic, Matlab, COMSOL, ROOT, Keras, scikit-learn, TensorFlow, NumPy, SciPy, pyhf, up-root, root_numpy, rootpy, PyROOT, Matplotlib, pandas, BitBake/OpenEmbedded, Docker, Git, NodeJS, React, jQuery, Bootstrap, pybind11
SKILLS	Effective communication, public speaking, collaboration, project management, mentoring, adaptability, flexibility, baking