

Sanha Cheong | Curriculum Vitae

Stanford University & SLAC National Accelerator Laboratory

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Education

Stanford University

Stanford, CA

- Ph.D. in Physics (Adviser: Prof. Ariel Schwartzman) September 2017 – Present¹
 - Research with the ATLAS Experiment and the MAGIS Experiment
 - Teaching activities including designing, developing, and teaching a new course ²

University of Rochester

Rochester, NY

- B.S. in Physics & Astronomy (Highest Distinction), B.A. in Mathematics Class of 2017

Yew Chung International School of Shanghai

Shanghai, China

- International Baccalaureate (IB) Diploma Class of 2013

Research Activities

Current research interests:

Beyond Standard Model (BSM) Physics; exotic signatures, silicon tracking detector (ATLAS ITk); long-baseline atom interferometry; fundamental physics with quantum sensors; machine learning applications

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ATLAS Experiment @ CERN

August 2017 – Present¹

- Searching for exotic decays of the Higgs boson into low-mass (pseudo-)scalar particles in boosted hadronic final states ($h \rightarrow aa \rightarrow c\bar{c}c\bar{c}$ and $h \rightarrow aa \rightarrow gggg$)
- Machine learning techniques within ATLAS—transformers and graph neural networks for reconstruction/tagging of exotic signatures, data calibration using neural networks, etc.
- Use of calorimeter timing information for 4D reconstruction of events
- Thermal/electrical/DAQ tests of the ITk Inner System prototypes @ SLAC
- Development of distributed YARR DAQ and YARR GUI software for ITk

MAGIS-100 Experiment @ Fermilab

March 2021 – Present

- Novel 3D-imaging system for cold atom clouds: optical & mechanical design, rapid prototyping using 3D prints, optical performance optimization, etc.
- Design and development of the MAGIS-100 Distributed Imaging System (DIS) for atom trajectory tracking and broadening possible physics measurements

¹On an official leave of absence from August 2019 until March 2021, serving in the Republic of Korea Army

²PHYSICS 166/266 Statistical Methods in Experimental Physics

○ **University of Rochester**

November 2015 – May 2017

- Studies of large-scale cosmological structures and baryon acoustic oscillations using SDSS-III data
- Development of a novel analysis algorithm accelerating the computation of galaxy 2-point correlation functions with an alternative background-subtraction method

Research Publications

ATLAS publications with significant contributions:

1. **ATLAS Collaboration**. “Simultaneous Jet Energy and Mass Calibrations with Neural Networks.” *ATLAS PUB Note*, ATL-PHYS-PUB-2020-001. [\[CDS Link\]](#)

Non-ATLAS Publications:

1. **S. Cheong**, J. C. Frisch, S. Gasiorowski, J. M. Hogan, M. Kagan, M. Safdari, A. Schwartzman, M. Vandegar. “Novel Light Field Imaging Device with Enhanced Light Collection for Cold Atom Clouds”. *Journal of Instrumentation*, **17** P08021, August 2022. [arXiv:2205.11480 \[physics.ins-det\]](#)³
2. D. Antypas, et al. “New Horizons: Scalar and Vector Ultralight Dark Matter”. *Snowmass 2021 CF2 Whitepaper*, March 2020. [arXiv:2203.14915 \[hep-ex\]](#)
3. **S. Cheong**, A. Cukierman, B. Nachman, M. Safdari, A. Schwartzman. “Parametrizing the Detector Response with Neural Networks”. *Journal of Instrumentation*, **15** P01030, January 2020. [arXiv:1910.03773 \[physics.data-an\]](#)
4. R. Demina, **S. Cheong**, S. BenZvi, O. Hindrichs. “A Computationally Efficient Approach for Calculating Galaxy Two-point Correlations”. *Monthly Notices of the Royal Astronomical Society*, Vol. 480, Issue 1, p. 49-56, sty1812, October 2018. [arXiv:1611.09892 \[astro-ph.CO\]](#)

Talks & Posters

1. **S. Cheong** (on half of the ATLAS Collaboration). “System-level Tests of Large-scale Multi-module Prototype Structures of the ATLAS ITk Pixel Detector”. *Topical Workshop on Electronics for Particle Physics (TWEPP)*, Geremeas, Sardinia, Italy, October 3, 2023. [\[Poster\]](#)
2. **S. Cheong** (on behalf of SLAC MAGIS Group). “MAGIS: Extending High-Energy Physics with Atom Interferometry”. *Quantum Sensors for HEP Workshop*, New Haven, CT, April 27, 2023. [\[Slides\]](#)
3. **S. Cheong** (on behalf of SLAC ATLAS ITk Team). “ITk Inner System System Test: Status Update”. *ATLAS ITk Week*, CERN, March 6, 2023. [\[Slides\]](#)
4. **S. Cheong**, J. C. Frisch, S. Gasiorowski, J. M. Hogan, M. Kagan, M. Safdari, A. Schwartzman, M. Vandegar. “Novel Light-Field Imaging Device with Enhanced Light Collection for Cold Atom Clouds”. *CPAD Workshop 2022*, Stony Brook, NY, November 30, 2022. [\[Slides\]](#)
5. **S. Cheong**, Ben Nachman, Murtaza Safdari, Ariel Schwartzman. “Tagger for $a \rightarrow gg/q\bar{q}$ Jets”. *ATLAS HDBS Workshop*, Uppsala, Sweden, September 6, 2022. [\[Slides\]](#)
6. **S. Cheong**. “Introduction to Machine Learning”. *US ATLAS Machine Learning Training Event*, Berkeley, CA, July 27, 2022. [\[Slides\]](#)

³This work has also been approved for a provisional patent under the United States Patent and Trademark Office, application number 63/364,799.

7. **S. Cheong**, A. Schwartzman. “Teaching Statistics to Physics Students”. *APS Data Science Education Community of Practice (DSECOP) Workshop*, College Park, MD, June 22, 2022. [Slides]
8. **S. Cheong** (on behalf of ATLAS ITk Inner System Community). “Thermal & Electrical Testing of of ITk Inner System Prototypes”. *ATLAS Upgrade Week*, CERN, May 12, 2022. [Slides]
9. **S. Cheong** (on behalf of SLAC ATLAS ITk Team). “Thermal Testing of p19-0 ITk Inner System Prototypes”. *US ATLAS ITk Pixel Workshop*, Virtual, November 9, 2021. [Slides]
10. **S. Cheong**. “Introduction to Deep Learning for Mathematicians by a Physicist (Capabilities of Neural Networks: Mathematical and Empirical Perspectives)”. *Department of Mathematics Graduate Seminars*, Sogang University, Seoul, South Korea, July 16, 2018.
11. **S. Cheong**, J. Pearkes, A. Cukierman. “Merged Di-photon Identification for the ATLAS Experiment at the Large Hadron Collider”. *CS 231N Project Poster Session, Spring 2018*, Stanford, CA, June 12, 2018.
12. **S. Cheong**. “Modification to the Calculation of a Two-point Correlation Function”. *APS April Meeting 2017 (Q2C: Quarks to Cosmos)*, Washington, DC, January 28-31, 2017.
13. **S. Cheong**. “Introduction to Baryon Acoustic Oscillations (BAO)”. *University of Rochester Summer REU Presentation*, Rochester, NY, August 5, 2016.

Awards and Such

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| 1. Paul H. Kirkpatrick Award, Stanford University | August 2022 |
| “This Award was established to recognize those graduate students who have demonstrated a talent for and commitment to the teaching of physics to undergraduates , thereby exemplifying the dual commitment to teaching and research characteristic of Paul Kirkpatrick’s own scientific life.” | |
| 2. Janet Fogg Prize, University of Rochester | May 2017 |
| “Annual prize awarded to one student of the graduating class in recognition of his or her dedicated service, inside or outside the classroom, to the well-being of all students served by the Department of Physics and Astronomy.” | |
| 3. Excellence in Undergraduate Teaching, University of Rochester | May 2017 |
| 4. IB Scholarship (\$16k / year) – University of Rochester | August 2013 – May 2017 |

Schools & Workshops Attended

1. *50th SLAC Summer Institute (Golden Opportunities: Puzzles & Surprises—Past & Future)*, hosted virtually by SLAC National Accelerator Laboratory, August 8 - 19, 2022.
2. *APS Data Science Education Community of Practice (DSECOP) Workshop*, College Park, MD, June 22 - 24, 2022.
3. *49th SLAC Summer Institute (The Higgs State Fair)*, hosted virtually by SLAC National Accelerator Laboratory, August 16 - 27, 2021.
4. *From Quarks to Cosmos with AI*, hosted virtually by Carnegie Mellon University, July 12 - 16, 2021.
5. *US ATLAS Hadronic Final State Forum 2018*, Berkeley, CA, December 10 - 14, 2018.
6. *APS Bridge Program and National Mentoring Community Conference*, Google & Stanford University, CA, November 16 - 18, 2018.

7. *46th SLAC Summer Institute (The Standard Model at 50: Successes & Challenges)*, Menlo Park, CA, July 30 - August 10, 2018.

Teaching Experiences

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| ○ Stanford University | Stanford, CA |
| Teaching Assistant | |
| – PHYSICS 166/266 Statistical Methods in Experimental Physics ⁴ | Winter 2023 |
| – PHYSICS 166/266 Statistical Methods in Experimental Physics ⁴ | Winter 2022 |
| – PHYSICS 152/252 Introduction to Particle Physics | Spring 2019 |
| – PHYSICS 166/266 Statistical Methods in Experimental Physics ⁴ | Winter 2019 |
| – PHYSICS 41 Mechanics | Winter 2018 |
| Teaching Mentor, Vice Provost for Teaching & Learning | June 2018 – June 2019 |
| ○ University of Rochester | Rochester, NY |
| Teaching Assistant | |
| – PHY 227 Thermodynamics & Statistical Mechanics | Spring 2017 |
| – PHY 142 Electricity & Magnetism (Honors) | Fall 2016 |
| – PHY 143 Waves and Modern Physics (Honors) | Spring 2016 |
| – PHY 122 Electricity & Magnetism | Fall 2015 |
| – MTH 172 Honors Calculus II | Spring 2015 |
| – MTH 171 Honors Calculus I | Fall 2014 |
| Physics GRE Tutor, Society of Physics Students (SPS) | August 2016 – May 2017 |

Leadership & Representative Positions

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| ○ Stanford University | Stanford, CA |
| Recruitment Chair & First-year Mentoring Chair,
Graduate Students in Applied Physics & Physics (GSAPP) | June 2018 – June 2019 |
| SASS Czar (Organizer), SLAC Association for Student Seminars | June 2018 – June 2019 |
| ○ University of Rochester | Rochester, NY |
| Business Manager, SPS UR Chapter | June 2016 – May 2017 |
| Student Representative, Physics & Astronomy Undergraduate Curriculum Committee | September 2016 – May 2017 |

Advising, Outreach, and Other Services

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| ○ Stanford University | Stanford, CA |
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⁴Designed, developed course materials (problem sets, solutions, tutorial codes, and mini-projects), and taught theoretical as well as computational sections

Graduate Coordinator, **Physics Undergraduate Summer Research** June 2018 – August 2018

Graduate Research Mentor, **Stanford Undergraduate Research Association** January 2018 – June 2019

○ **University of Rochester** **Rochester, NY**

Alumni Interviewer, Office of Admissions November 2017 – May 2019

Peer Adviser, **College Center for Advising Services** August 2016 – May 2017

Professional Memberships

American Physical Society (APS), Phi Beta Kappa (ΦBK), Society of Physics Students (SPS), Sigma Pi Sigma (ΣΠΣ)

Languages

English (fluent), Korean (fluent), Mandarin (conversational)

Citizenship

Republic of Korea