

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 on the ATLAS Experiment and the MAGIS Experiment
 - Teaching activities including designing, developing, and teaching a new course²

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:

Higgs (exotic decays); low-mass, boosted resonances; QCD and jet physics; silicon pixel detector (ATLAS ITk); fundamental physics with atom interferometry; machine learning applications in physics

Stanford University & SLAC National Accelerator Laboratory

ATLAS Experiment @ CERN

August 2017 – Present¹

- Searching for exotic decays of the Higgs boson into low-mass (pseudo-)scalar particles in boosted final states ($h \rightarrow aa \rightarrow q\bar{q}q\bar{q}$ and $h \rightarrow aa \rightarrow \gamma\gamma\gamma\gamma$)
- Thermal/electrical/DAQ tests of the ITk Inner System prototypes @ SLAC
- Development of distributed YARR DAQ and YARR GUI software for ITk
- Machine learning techniques within ATLAS—reconstruction of exotic signatures, jet calibration using neural networks (Generalized Numerical Inversion), etc.
- Simulation & trigger studies for long-lived particle searches using timing information

MAGIS-100 Experiment @ Fermilab

March 2021 – Present

- Novel 3D-imaging system for cold atom clouds: mechanical system design, rapid prototyping using 3D prints, optical performance optimization, etc.
- Diagnostic imaging system design for atom trajectory calibration sequence and 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

o **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*. [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**. “Introduction to Machine Learning”. *US ATLAS Machine Learning Training Event*, Berkeley, CA, July 27, 2022. [[Slides](#)]
2. **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](#)]
3. **S. Cheong** (on behalf of ATLAS ITk Inner System Community). “Thermal & Electrical Testing of ITk Inner System Prototypes”. *ATLAS Upgrade Week*, CERN, May 12, 2022. [[Slides](#)]
4. **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](#)]
5. **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.
6. **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.

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.** “Modification to the Calculation of a Two-point Correlation Function”. *APS April Meeting 2017 (Q2C: Quarks to Cosmos)*, Washington, DC, January 28-31, 2017.
8. **S. Cheong.** “Introduction to Baryon Acoustic Oscillations (BAO)”. *University of Rochester Summer REU Presentation*, Rochester, NY, August 5, 2016.

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 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 |

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

Physics GRE Tutor, Society of Physics Students (SPS)

August 2016 – May 2017

Leadership & Representative Positions

- **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

- **Stanford University** **Stanford, CA**
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

Awards and Such

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

Professional Memberships

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

Computer & Hardware Skills

Data Analysis

- Experiences in big data analysis for physics & astronomy research
- Developing new statistical analysis algorithms and applying machine learning techniques

Programming Languages

- PYTHON, C, C++, ROOT, UNIX shell (BASH) scripting

Document Editing and Productivity Software

- L^AT_EX
- GitHub, Microsoft Office, Google Docs
- Basic web-design using HTML, CSS, JAVASCRIPT, and JEKYLE

Hardware

- OPENS CAD, rapid prototyping with 3D prints
- Experience with silicon chips in clean room

Languages

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

Citizenship

Republic of Korea