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 – Present[1]
  - Research on 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:
Higgs (exotic decays), dark matter, long-lived particles, QCD and jet physics, fundamental physics with atom interferometry, machine learning applications in physics, novel data-analysis methods

- **Stanford University & SLAC National Accelerator Laboratory**

  ATLAS Experiment @ CERN August 2017 – Present[1]
  - Searching for exotic decays of the Higgs boson into new axion-like, (pseudo-)scalar particles in multi-photon final state ($h \to aa \to \gamma\gamma\gamma\gamma$)
  - Thermal/electrical/DAQ testing 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 mm-scale atom clouds: mechanical system design, rapid prototyping using 3D prints, optical performance optimization, etc.
  - Diagnostic camera system design for atom trajectory calibration sequence and physics measurements
  - Precision quantum measurements, searches for ultra-light, wave-like scalar dark matter

[1] On an official leave of absence from August 2019 until March 2021, serving in the Republic of Korea Army
[2] PHYSICS 166/266 Statistical Methods in Experimental Physics

- **University of Rochester** November 2015 – May 2017
  - Studies of large-scale structures and baryon acoustic oscillations using SDSS-III BOSS 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

Independent publications:

1. **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]
2. 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]

Oral & Poster Presentations

1. **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.
2. **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.
3. **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.
4. **S. Cheong**. "Introduction to Baryon Acoustic Oscillations (BAO)". *University of Rochester Summer REU Presentation*, Rochester, NY, August 5, 2016.

Schools & Workshops Attended

1. *US ATLAS Hadronic Final State Forum 2018*, Berkeley, CA, December 10 - 14, 2018.
2. *APS Bridge Program and National Mentoring Community Conference*, Google & Stanford University, CA, November 16 - 18, 2018.
3. *46th SLAC Summer Institute (The Standard Model at 50: Successes & Challenges)*, Menlo Park, CA, July 30 - August 10, 2018.
4. *From Quarks to Cosmos with AI*, hosted online by Carnegie Mellon University, July 12 - 16, 2021.

Teaching Experiences

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

  Teaching Assistant

  - PHYSICS 152/252 Introduction to Particle Physics — Spring 2019
  - PHYSICS 166/266 Statistical Methods in Experimental Physics[3] — 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

- **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

[3] Designed, developed course materials (problem sets, solutions, tutorial codes, and mini-projects), and taught theoretical and live coding sections

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

Awards and Such

1. 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."
2. Excellence in Undergraduate Teaching, University of Rochester — May 2017
3. 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, JAVA, MATHEMATICA
- UNIX shell (BASH) scripting

Document Editing and Productivity Software
- LaTeX
- GitHub, Microsoft Office, Google Docs
- Basic web-design using HTML, CSS, JAVASCRIPT, and JEKYLL

Hardware Skills
- OPENSCAD, rapid prototyping with 3D prints
- Experience with silicon sensors in clean room

Languages

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

Citizenship

Republic of Korea