Samuel S. Y. Wong

Stanford Institute for Theoretical Physics

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Education

2020 – present **PhD, Physics**, Stanford Institute for Theoretical Physics, Stanford University, Stanford, CA.
Advisor: Peter W. Graham.

2016 – 2020 **HBSc, Mathematics and Physics Specialist**, University of Toronto, Toronto, ON, Canada.
Beatrice Evelyn Rodgers Scholarship for top senior mathematics and physics specialist.
GPA: 3.96/4.00.

Research Experience

Sep 2020 – present **Graduate Research Assistant**, Stanford Institute for Theoretical Physics, Stanford University.
- Supervisor: Peter W. Graham.
- Study the quantum mechanical description of ion traps as millicharged dark matter detectors [1].
- Research new search strategies for long-lived gluinos at the LHC [2].
- Developed new strategies to enhance the sensitivity of Higgsino dark matter detection using heavy elements and accounting for high-velocity dark matter contributions [4].
- Proposed and demonstrated a one-electron quantum cyclotron detector for meV dark photons [5].
- Improved the above technique by using highly excited cyclotron states and an optimized cavity design to probe both QCD axions and dark photons [3].
- Investigated novel methods to search for dark photon via Coulomb's law tests.

May 2019 – Aug 2020 **Undergraduate Research Assistant**, Department of Physics, University of Toronto.
- Supervisor: Erich Poppitz.
- Studied color confinement in 4D supersymmetric SU(N) Yang-Mills theory in compactified space.
  - Identified the spectrum of BPS domain walls and discovered magnetless solitons [7].
  - Large-scale computation of string tensions using the Niagara supercomputer [6].

Sep 2018 – Apr 2019 **Undergraduate Research Assistant**, Department of Physics, University of Toronto.
- Supervisor: Robert S. Orr.
- Designed and built a laser system for measuring the charge collection efficiency of radiation-damaged ITk detectors for the ATLAS experiment.

May 2018 – Aug 2018 **Undergraduate Research Assistant**, Department of Astronomy & Astrophysics, University of Toronto.
- Supervisor: Jo Bovy.
- Employed machine-learning methods to study the structure of the third integral using Gaia telescope data.
  - Contributor of galpy, a Python library for galactic dynamics.

Publications

Note that authors are ordered alphabetically in high energy physics.

[1] P. W. Graham, H. Ramani, **S. S. Y. Wong**, and Y. Xiao, *Ion traps as quantum detectors for millicharged dark matter*, (in preparation).

[2] J. L. Gonski, P. W. Graham, S. Rajendran, H. Ramani, and **S. S. Y. Wong**, *Search for long-lived gluinos at the LHC*, (in preparation).

[3] X. Fan, G. Gabrielse, P. W. Graham, H. Ramani, **S. S. Y. Wong**, and Y. Xiao, *Highly excited electron cyclotron for QCD axion and dark photon search,* [arXiv:2410.05549 [hep-ph]].

[4] P. W. Graham, H. Ramani, and **S. S. Y. Wong**, *Enhancing Direct Detection of Higgsino Dark Matter*, *Phys. Rev. D* (under Review), [arXiv:2409.07768 [hep-ph]].

[5] X. Fan, G. Gabrielse, P. W. Graham, R. Harnik, T. G. Myers, H. Ramani, B. A. D. Sukra, **S. S. Y. Wong**, and Y. Xiao, *One-electron quantum cyclotron as a milli-eV dark-photon detector, Phys. Rev. Lett.* **129** (2022) 261801, [arXiv:2208.06519 [hep-ex]].

[6] M. W. Bub, E. Poppitz, and **S. S. Y. Wong**, *Confinement on $\mathbb{R}^3 \times \mathbb{S}^1$ and double-string collapse, JHEP* **01** (2021) 044, [arXiv:2010.04330 [hep-th]].

[7] A. A. Cox, E. Poppitz, and **S. S. Y. Wong**, *Domain walls and deconfinement: a semiclassical picture of discrete anomaly inflow, JHEP* **12** (2019) 011, [arXiv:1909.10979 [hep-th]].

Presentations

Seminars

[S1] *Electron trap as a dark-photon detector*, THEP Seminars, University of Toronto, Toronto, ON, Canada. Nov 27, 2023.

[S2] *Hidden-photon search with Coulomb's law tests*, SITP Wine & Cheese Seminars, Stanford University, Stanford, CA. Nov 12, 2021.

[S3] *Domain walls and deconfinement: a semiclassical picture of discrete anomaly inflow*, THEP Seminars, University of Toronto, Toronto, ON, Canada. Jan 15, 2020.

[S4] *The search for I_3 in Gaia*, SURP 2018, University of Toronto, Toronto, ON, Canada. Aug 22, 2018.

Conference Talks

[C1] *Electron trap as an axion dark matter detector*, Parallel talk, IDM 2024, L'Aquila, Italy. Jul 10, 2024.

[C2] *Electron trap as a dark-matter detector*, Parallel talk, PLANCK 2024, Lisbon, Portugal. Jun 6, 2024.

[C3] *Electron trap as a dark-photon detector*, Contributed talk, Dark Matter 2023, Santander, Spain. May 29, 2023.

[C4] *Electron trap as a dark-photon detector*, Parallel talk, PLANCK 2023, Warsaw, Poland. May 23, 2023.

[C5] *Domain walls and confinement*, Parallel talk, CUPC 2019, Montreal, QC, Canada. Nov 8, 2019.

Posters

[P1] *One-electron quantum cyclotron as a milli-eV dark-photon detector*, School on Table-Top Experiments for Fundamental Physics, Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada. Sep 20-21, 2022.

[P2] *Domain walls and confinement*, Undergraduate Research Fair 2019, University of Toronto, Toronto, ON, Canada. Sep 26, 2019.

Teaching Experience

Teaching Assistant, Department of Physics, Stanford University.
Graduate courses:

- **Physics 352: Physics Beyond the Standard Model of Particle Physics**, spring 2024 (grader).
- **Physics 262: General Relativity**, fall 2023.

Undergraduate courses:

- **Physics 43: Electricity and Magnetism**, winter 2023.
- **Physics 61: Mechanics and Special Relativity**, fall 2022.
- **Physics 23: Electricity, Magnetism, and Optics**, winter 2022.
- **Physics 41: Mechanics**, spring 2021.

Awards and Honors

2023 - 2024 **J.J., L.P., and A.J. Smortchevsky Fellowship**, School of Humanities and Sciences, Stanford University.

2021 - 2022 **Clark Fellowship**, Stanford Institute for Theoretical Physics, Stanford University.

2020 **The Beatrice Evelyn Rodgers Scholarship**, Department of Physics, University of Toronto.
Awarded to the top senior mathematics and physics specialist.

2019 **George Luste Scholarship**, Department of Physics, University of Toronto.
Awarded for excellence in physics in third year.

2018, 2019 **The Class of 1930 and Associates Scholarship in Mathematics and Physics**, Department of Physics, University of Toronto.
Awarded for academic excellence to a mathematics and physics specialist in second or third year.

2018, 2019 **Undergraduate Student Research Awards (USRA)**, Natural Sciences and Engineering Research Council of Canada (NSERC).
Nationally competitive summer research funding. Declined in 2019.

2018 **The Coxeter Scholarship in Mathematics**, Department of Mathematics, University of Toronto.
Awarded for excellence in mathematics in second year.

2018 **New College Alumni Association In-Course Scholarship**, New College, University of Toronto.
Awarded for academic excellence.

2017 **George Luste Prize in First Year Physics**, Department of Physics, University of Toronto.
Awarded to the top first-year physics student.

2016 - 2020 **Robert Bruce Scholarship**, New College, University of Toronto.
Entrance scholarship for academic excellence. Four years of tuition support.

2016 **University of Toronto Scholar**, University of Toronto.
Entrance scholarship for academic excellence.

2016 **Governor General's Academic Medal**, Markham District High School.
Awarded to the top graduate from a Canadian high school.

2014 **Shad Valley Scholarship**, Shad Canada.
Nationally competitive high school science program.

Computing skills

- Mathematica
- Python
- Java
- High-Performance Computing

Department Service

2023 - 2024 **SITP Phenomenology Group Journal Club Organizer**, Stanford Institute for Theoretical Physics, Stanford University.

2021 - 2022 **SITP Graduate Students Journal Club Co-Organizer**, Stanford Institute for Theoretical Physics, Stanford University.

2021 - 2022 **SITP Mentorship Program Organizer**, Stanford Institute for Theoretical Physics, Stanford University.

Outreach

Panelist, Open House Student Q&A Session, Department of Physics, Stanford University. Mar 13, 2024.

Moderator and Panelist, Physics Graduate Admission Q&A Session, Physics Recruiting Committee, Department of Physics, Stanford University. Nov 29, 2022.

Panelist, Physics Graduate Admission Q&A Session, Physics Student Union, Department of Physics, University of Toronto. Nov 10, 2020.