Sun Woo (P.) Kim

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Education

PhD in Physics, King's College London **(visiting** University of Cambridge**)** *2023-*
Statistical physics, quantum information, error correction, machine learning.
Working with Curt von Keyserlingk of King's College London and Austen Lamacraft of University of Cambridge

MASt in Physics, University of Cambridge *2018-2019*
Distinction.
Notable courses: Theories of Quantum Matter, Quantum Field Theory, Quantum Information

BSc Physics with Theoretical Physics, Imperial College London *2015-2018*
1st Class (80.7%), Dean's List for all three years.
Notable courses: Foundations of Quantum Mechanics, General Relativity, Complexity and Networks

International Baccalaureate, United World College of South East Asia Dover Campus *2012-2014*
41/45 (91%). Additional Standard Chemistry 6/7.
7 Subjects, Higher Physics 7/7, Higher Mathematics 7/7, Higher Geography 7/7, Standard English 6/7.

Employment/Experience

Research scientist at AIRS Medical (Republic of Korea national service) *2019-2023*
- Part of National service in Republic of Korea as a 'Skilled Industry Personnel', applying machine learning to medical imaging and diagnostic settings.
- Came 1st for all tracks in the 2020 Facebook FastMRI Challenge, see publications for details. Published 7 patents.

Research student at Max Planck Institute of Complex Systems *2019-2022*
- Worked with Markus Heyl and Giuseppe De Tomasi in many-body localization, see publications for details.
- This research project was done part-time during my time in Republic of Korea's national service.

Undergraduate research project: group theoretic analysis of structured elastic plates *2018*
- Worked with Richard Craster, Mehul Makwana. Research in metamaterials using representation theory and topology.
- Awarded the UROP Prize in Mathematics.

Publications

S.W.P. Kim and M. McGinley, Rigorous bounds for thresholds of surface and twisted quantum double codes with general error channels, *In. prep.* (2025)

S.W.P. Kim and G. Pinna, Existence and bounds of growth constants for restricted walks, surfaces, and generalisations, *arXiv preprint arXiv:2509.04568* (2025)

S.W.P. Kim, A. Lamacraft, and C. von Keyserlingk, Quantum inference problems and quantum hidden Markov models, *arXiv preprint arXiv:2504.08888* (2025)

S.W.P. Kim, F. Huebner, J.P. Garrahan and B. Doyon, Circuits as a simple platform for the emergence of hydrodynamics in deterministic chaotic many-body systems, *arXiv preprint arXiv:2503.08788* (2025)

S.W.P. Kim and A. Lamacraft, Planted directed polymer: Inferring a random walk from noisy images, Physical Review E, 111(2), 024135 (2025)

K. Tazi, **S.W.P. Kim**, M. Girona-Mata and R. E. Turner, Refined climatologies of future precipitation over High Mountain Asia using probabilistic ensemble learning, *Environmental Research Letters* (2025)

S.W. Kim, G. De Tomasi and M. Heyl, Real-time dynamics of one-dimensional and two-dimensional bosonic quantum matter deep in the many-body localized phase, *Physical Review B 104 (14), 144205* (2021)

M.J. Muckley, B. Riemenschneider, A. Radmanesh, **S. Kim** et. al., Results of the 2020 fastMRI Challenge for Machine Learning MR Image Reconstruction, *IEEE transactions on medical imaging, 40(9), 2306-2317* (2021)

Awards

EPSRC DTP International Studentship — *2023*
Granted to one international applicant in the department at King's College London. Grant Ref no: EP/W524475/1

E. M. Burnett Prize — *2019*
In recognition for obtaining Distinction in Master of Advanced Studies.

UROP Prize in Mathematics — *2018*
Awarded to students of outstanding performance in the Undergraduate Research Opportunity Programme (UROP), for the project 'Group Theoretic Analysis of Structured Elastic Plates'.

Dean's List for 1st, 2nd and 3rd Years — *2016, 2017, 2018*
Awarded for being the top 10% of students in cohort of 2017/18 of the Physics programme at Imperial College London.

Talks

UBC (Probability group seminar) — *Sep 2025*
Existence and bounds of growth constants for restricted walks, surfaces, and generalisations.

Christ's College, Cambridge (Quantum computation through the lens of many-body physics workshop) — *Sep 2025*
Measurement-induced phase transitions in quantum inference problems.

KCL (Probability group seminar) — *Sep 2025*
Existence and bounds of growth constants for restricted walks, surfaces, and generalisations.

Budapest Integrability Seminar — *Jul 2025*
Circuits as a simple platform for the emergence of hydrodynamics in deterministic chaotic many-body systems.

BME, Budapest (Tibor Rakovszky's group) — *Jun 2025*
Circuits as a simple platform for the emergence of hydrodynamics in deterministic chaotic many-body systems.

University of Cambridge (CPGM at TCM) — *May 2025*
Circuits as a simple platform for the emergence of hydrodynamics in deterministic chaotic many-body systems.

Harvard University (Norman Yao's group) — *Apr 2025*
Measurement-induced phase transitions in quantum inference problems.

NYU (Dries Sel's group) — *Apr 2025*
Measurement-induced phase transitions in quantum inference problems.

Princeton University (Sarang Gopalakrishnan's group) — *Apr 2025*
Measurement-induced phase transitions in quantum inference problems.

KCL (Disorderd Systems seminar) — *Apr 2025*
Planted directed polymer: inferring a random walk from noisy images.

University of Cambridge (TCM Journal Club) — *Dec 2024*
Topological quantum memory and quantum error correction as a Bayesian inference problem.

Institute of Physics (Advances in Quantum Transport in Low Dimensional Systems workshop) — *Sept 2024*
Measurement-induced phase transitions in quantum inference problems.

SNU (Yongjoo Baek's Group) — *May 2024*
Planted directed polymer: inferring a random walk from noisy images.

KIAS (Statistical physics seminar) — *May 2024*
Planted directed polymer: inferring a random walk from noisy images.

Imperial College London (Theory of Topological Matter group seminar with Frank Schindler's group) — *Apr 2024*
Bayesian inference and statistical physics.

KCL (Many Body Circle seminar) — *Mar 2024*
Polarons.

Other Experiences

Organiser for Many Body Circle Seminar Series/Journal Club *2023-*
- Collaborated PhD students from condensed matter theory and disordered systems groups at KCL. Invited external speakers (Imperial, UCL)
- Past events at sites.google.com/view/kclmanybodycircle/events

Teaching *2023-*
- **Fall 2025 (KCL):** Wrote problem sheet questions for Classical Physics, a 1st year course.
- **Spring 2025 (Cambridge):** TA for Computational Physics, a 3rd year (Part II) course.
- **Spring 2025 (KCL):** TA for Mathematical Methods for Theoretical Physics, a 2nd year course.
- **Fall 2024 (Cambridge):** TA for Theories of Quantum Matter, a master's (Part III) course.
- **Spring 2024 (KCL):** TA for Mathematical Methods for Theoretical Physics, a 2nd year course.
- **Spring 2024 (KCL):** TA for Symmetry in Physics, a 2nd year course.
- **Fall 2023 (KCL):** TA for Mathematical Methods for Physics, a 2nd year course at KCL. Worked through example questions in lecture theatre of 40+ students.

OUTREACH Mentoring Scheme *2016-2017*
- Mentored students and prospective students on various areas such as Physics, Maths, and Computing. Worked with a group of mentors organising activities and demonstrations for 20 students.
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Skills

Computing
- Scientific programming. In python: NumPy, SciPy, Numba, and ML using PyTorch, PyTorch Lightning, TensorFlow, Stim in Python. In Julia: iTensor. Experience in MATLAB, Mathematica, Fortran, C++. git, LaTeX, Slurm.

Languages
- English (native fluency), Korean (native fluency)

Further Interests

Jazz Guitar
- Straight-ahead (bebop, hard-bop, latin), fusion, and contempory. Played in small band (Duo, Trio, Quartet) and big band (Churchill Jazz Band, Jesus College Big Band) gigs. Attending jams in Seoul, London.

Map Designer for Starcraft II *2013-2014*
- Created official maps, such as Frost, Bridgehead, and Fruitland for real time strategy game, Starcraft II.
- Combined game knowledge with critical thinking to create effective, balanced, and fun maps, that were used for over 4 years in the competitive scene, played in over 3000+ competitive matches.

Details are available upon request