

OHKYUNG KWON

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ACADEMIC POSITIONS

UNIVERSITY OF CHICAGO | Researcher • Associate Fellow, Kavli Institute for Cosmological Physics
April 2017 — present | Chicago, IL

FERMILAB HOLOMETER COLLABORATION | Collaboration Member • Visiting Scientist
October 2011 — June 2021 | Batavia, IL

REPUBLIC OF KOREA ARMY | Specialized Research Personnel
KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY | Institute of Natural Science
July 2015 — July 2018 | Daejeon, Republic of Korea

- Academic affiliation maintained via a restricted appointment, in fulfillment of compulsory national service duties.
- Principal Investigator of a research project on Planckian quantum space-time phenomenology, under the Basic Science Research Program of the National Research Foundation of Korea funded by the Ministry of Education.

UNIVERSITY OF CHICAGO | Research Assistant, Department of Astronomy and Astrophysics
October 2012 — June 2015 | Chicago, IL

EDUCATION

UNIVERSITY OF CHICAGO | Ph.D. in Physics, M.S. in Physics
August 2015 | Chicago, IL

Dissertation: “Interferometric Probes of Planckian Quantum Geometry”

Committee: Craig J. Hogan (chair), Stephan S. Meyer (departmental advisor), Emil J. Martinec, Dam T. Son

Robert G. Sachs Fellow — A merit fellowship typically awarded to top theoretical physics students after the candidacy exam.

HARVARD UNIVERSITY | B.A. in Physics
March 2008 | Class of 2007 | Cambridge, MA

High Honors in Field • Advisor: Howard M. Georgi

Weissman International Program (in support of research at CERN) • Harvard College Research Program

GRANTS AND AGREEMENTS

NATIONAL RESEARCH FOUNDATION OF KOREA | Basic Science Research Program
November 2016 | Grant No. NRF-2016R1D1A1B03934333 • Funded by the Ministry of Education

O. Kwon. *The Statistical Covariance Structure and Inertial Frames of Quantum Space-Time: A Phenomenological Study on Planckian Geometric Correlations Soon to be Experimentally Tested at a Laser Interferometer.*

FERMILAB | Center for Particle Astrophysics • **KAIST** | Institute of Natural Science
January 2017 | Collaborative Research Agreement

Led KAIST to become a Fermilab user institution under the U.S. Department of Energy’s non-proprietary agreement.

Established a sub-agreement between KAIST INS and FCPA to support synergistic activities for the Holometer Collaboration.

COUNTRIES

Republic of Korea — Citizenship (Born September 1985)

U. S. A. — Permanent residence (March 2019)

— No employer restrictions (National Interest Waiver)

LANGUAGES

English, Korean

Native proficiency

AWARDS AND HONORS

Samsung Foundation Scholar

Autumn 2003 — Spring 2007 | Merit Scholarship • USD 200,000

Korea Science and Engineering Foundation Scholar

Autumn 2003 — Spring 2006 | Merit Scholarship

Gold Medal — 33rd International Physics Olympiad • 1st Place — Korean Physics Olympiad

July 2002 | Bali, Indonesia

CONFERENCE PRESENTATIONS AND INVITED TALKS

Colloquium at Northwestern University Center for Fundamental Physics

October 2023 | Evanston, IL

Quantum 2023

September 2023 | Torino, Italy • University of Torino & INRiM

13th Conference on Relativistic Quantum Information (North)

July 2023 | Chania, Greece • Technical University of Crete

American Physical Society March Meeting 2023

March 2023 | Las Vegas, NV

20th Lomonosov Conference

August 2021 | Online • Moscow State University & JINR

Cosmic Controversies Conference

October 2019 | Chicago, IL • Kavli Institute for Cosmological Physics

Seminar at Institute for Quantum Optics and Quantum Information

June 2019 | Vienna, Austria

Seminars at Paul Scherrer Institut, ETH Zürich, and Universität Zürich

February 2019 | Zürich, Switzerland

XXXIX International Conference on High Energy Physics

July 2018 | Seoul, Republic of Korea • International Union of Pure and Applied Physics

American Physical Society April Meeting 2018

April 2018 | Columbus, OH

American Physical Society April Meeting 2017

January 2017 | Washington, D.C.

2nd Durham-KEK-Kavli IPMU-KIAS Joint Workshop

October 2016 | Seoul, Republic of Korea

Simplicity II Theory Workshop

September 2016 | Fermilab • Princeton University & Perimeter Institute

International Conference on General Relativity: Centennial Overviews and Future Perspectives

December 2015 | Seoul, Republic of Korea • Asia Pacific Center for Theoretical Physics

Plenary Review — *Towards a New Era of Quantum Gravity: Phenomenological and Experimental Approaches.*

12th International Symposium on Cosmology and Particle Astrophysics

October 2015 | Daejeon, Republic of Korea • Asia Pacific Organization for Cosmology and Particle Astrophysics

All publications are in alphabetical authorship, with the exception of [1], [2], and [10].
Corresponding authors are denoted with [*].

- [1] L. Aiello*, J. W. Richardson, S. M. Vermeulen, H. Grote, C. J. Hogan, **O. Kwon**, and C. Stoughton. **Constraints on Scalar Field Dark Matter from Colocated Michelson Interferometers.** *Phys. Rev. Lett.* **128** 121101 (2022)
- [2] J. W. Richardson, **O. Kwon***, H. R. Gustafson, C. J. Hogan, B. L. Kamai, L. McCuller, S. S. Meyer, C. Stoughton, R. Tomlin, and R. Weiss. **Interferometric Constraints on Spacelike Coherent Rotational Fluctuations.** *Phys. Rev. Lett.* **126** 241301 (2021)
- [3] C. J. Hogan and **O. Kwon***. **Models of Exotic Interferometer Cross-Correlations in Emergent Space-Time.** *Class. Quantum Grav.* **35** 204001 (2018) — *Focus Issue on Gravity in the Lab*
- [4] C. J. Hogan, **O. Kwon***, and J. W. Richardson. **Statistical Model of Exotic Rotational Correlations in Emergent Space-Time.** *Class. Quantum Grav.* **34** 135006 (2017)
- [5] A. S. Chou, H. Glass, H. R. Gustafson, C. J. Hogan, B. L. Kamai, **O. Kwon**, R. Lanza, L. McCuller, S. S. Meyer*, J. W. Richardson, C. Stoughton, R. Tomlin, and R. Weiss. **Interferometric Constraints on Quantum Geometrical Shear Noise Correlations.** *Class. Quantum Grav.* **34** 165005 (2017)
- [6] C. J. Hogan and **O. Kwon***. **Statistical Measures of Planck Scale Signal Correlations in Interferometers.** *Class. Quantum Grav.* **34** 075006 (2017)
- [7] A. S. Chou, H. Glass, H. R. Gustafson, C. J. Hogan, B. L. Kamai, **O. Kwon**, R. Lanza, L. McCuller, S. S. Meyer, J. W. Richardson*, C. Stoughton, R. Tomlin, and R. Weiss. **The Holometer: An Instrument to Probe Planckian Quantum Geometry.** *Class. Quantum Grav.* **34** 065005 (2017) — *CQG Highlights of 2017*
- [8] A. S. Chou, H. R. Gustafson, C. J. Hogan, B. L. Kamai*, **O. Kwon**, R. Lanza, S. L. Larson, L. McCuller, S. S. Meyer, J. W. Richardson, C. Stoughton, R. Tomlin, and R. Weiss. **MHz Gravitational Wave Constraints with Decameter Michelson Interferometers.** *Phys. Rev. D* **95** 063002 (2017)
- [9] A. S. Chou*, H. R. Gustafson, C. J. Hogan, B. L. Kamai, **O. Kwon**, R. Lanza, L. McCuller, S. S. Meyer, J. W. Richardson, C. Stoughton, R. Tomlin, S. Waldman, and R. Weiss. **First Measurements of High Frequency Cross-Spectra from a Pair of Large Michelson Interferometers.** *Phys. Rev. Lett.* **117** 111102 (2016)
- [10] **O. Kwon*** and C. J. Hogan. **Interferometric Tests of Planckian Quantum Geometry Models.** *Class. Quantum Grav.* **33** 105004 (2016)

MANUSCRIPTS IN PREPARATION

- [11] **O. Kwon.** **Phenomenology of Holography via Quantum Coherence on Causal Horizons.** *Preprint available at:* arxiv.org/abs/2204.12080
- [12] C. J. Hogan, **O. Kwon***, and N. Selub. **Angular Spectrum of Quantum Fluctuations in Causal Structure.** *Preprint available at:* arxiv.org/abs/2303.06563
- [13] H. Yu, **O. Kwon**, H. Grote, and D. Martynov. **Photon Counting for Axion Interferometry.** *Preprint available at:* arxiv.org/abs/2309.03394
- [14] C. J. Hogan, **O. Kwon**, S. S. Meyer, N. Selub, and F. Wehlen. **Causal Bounds on Cosmological Angular Correlation.** *To appear in 2023 at:* arxiv.org/a/kwon_o_1
- [15] **O. Kwon.** **Tests of Quantum Foundations Must Include Holography in the Background Space-Time.** *To appear in 2023 at:* arxiv.org/a/kwon_o_1

TEACHING AND ADVISING

UNIVERSITY OF CHICAGO | Teaching Assistant, Department of Physics & Department of Mathematics

September 2008 — June 2014 | Chicago, IL

- **Gregor Wentzel Teaching Prize**
- Mechanics • Electricity and Magnetism • Waves, Optics, and Heat — *introductory, honors level, and intermediate*
- Mathematical Methods in Physics • Advanced Laboratory (*worked extensively with the director of instructional labs*)

UNIVERSITY OF CHICAGO | Chicago Academic Achievement Program • College Core Tutor Program

January 2010 — June 2015 | Chicago, IL

- **College Core Tutor Award**
- Served in a highly selective tutorship position working with incoming students from underserved backgrounds, often minorities from low-income communities and first-generation college students.
- Facilitated collaborative learning as an on-demand tutor for core physics courses at the main undergraduate library.

HARVARD CHICAGO SCHOOLS COMMITTEE | Alumni Interviewer and School Liaison

January 2009 — present | Chicago, IL

- Serving as a liaison to an under-resourced school district on the south side of Chicago for the admissions office.
- College application guidance and counseling for talented, hardworking students from low-income minority families.

INTERNATIONAL PHYSICS OLYMPIAD | Coach of the Korean National Team • Official Events Staff

January 2003 — July 2004 | Seoul, Republic of Korea • Pohang, Republic of Korea

- Led the design and implementation of a new training program. Commissioned instructional apparatus for the new experimental curriculum. The 2003 team placed 1st, and over five years, the median rank improved from 9th to 2nd.
- Hosted official events to foster cross-cultural community among young physicists and supervised interpreters.

SEOUL SCIENCE HIGH SCHOOL | Student Guide on Science and Research Exploratory Programs

August 2001 — December 2005 | Seoul, Republic of Korea

- Supervised student research projects, moderated talks and panels, and led recitation and laboratory sections in physics at a school for gifted students that places 10~20 medalists in the international math and science olympiads every year.
- Mentored and advised younger students as a former valedictorian of the science and research program.
- Led excursions to major U. S. universities and research institutes, administered by the Korean Ministry of Education.
- Partnered with the Seoul Education Research Institute in science outreach at its exhibitions and experimental demos.

PROFESSIONAL SERVICE 2015 — present

Journal referee and reviewer

- IOP Publishing: Journal of Physics
- American Physical Society: Physical Review

Science outreach and frequent public talks

- Public lecturer for Fermilab's "Ask-a-Scientist" outreach program.
- Q&A sessions with high school student groups visiting Fermilab.
- Speaker at a transdisciplinary academic retreat hosted by the Samsung Foundation: "A history of reality."
- Invited panelist at Harvard's alumni reunion forums: "The future of science and humanity."
- March for Science volunteer: Activism for evidence-based policy, science funding, and acceptance of empiricism.
- Diversity and inclusion events for young scientists from different backgrounds.
- Volunteer work with science museums and public demos.
- Early college awareness events for underserved middle school students — "*Exploring College Majors*"
- Many other informal talks engaging the public on science. Climate change outreach.

RESEARCH PROJECTS

QUANTUM GRAVITY INTERFEROMETRY WITH QUANTUM METROLOGY | Cardiff University

October 2019 — present | Cardiff, United Kingdom

- Working with Hartmut Grote's team to design a next-gen research program probing signatures of quantum space-time with laser interferometers using state-of-the-art quantum metrology. Commissioning ongoing.

HOLOMETER COLLABORATION | Fermilab • University of Chicago • KAIST

October 2011 — June 2021 | Batavia, IL • Chicago, IL • Daejeon, Republic of Korea

- Quantum space-time phenomenology: Theoretical research program in conjunction with parallel experimental work. Actively involved in all aspects of the experiment, including commissioning, operations, and data interpretation.
- Background degrees of freedom consistent with the Holographic Principle in a flat macroscopic 4-volume lead to non-local correlations measurable in an interferometer of sub-Planckian strain spectral density at superluminal frequencies.

CENTER FOR AXION AND PRECISION PHYSICS RESEARCH | Institute for Basic Science

July 2016 — October 2016 | Daejeon, Republic of Korea

- Research assistance on axion phenomenology and haloscope detector theory.

ATLAS MUON SPECTROMETER | CERN (European Organization for Nuclear Research)

June 2006 — September 2006 | Meyrin, Switzerland

- Commissioning of the endcap Monitored Drift Tubes with the George W. Brandenburg group.

ANTIHYDROGEN TRAP | Harvard University

June 2005 — September 2005 | Cambridge, MA

- Assistance on Penning-Ioffe trap construction and the commissioning of a He/N₂ cryogenic exhaust control system.