Donghae Seo

Postdoctoral Researcher / KAIST

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Current Position

Postdoctoral Researcher Sep 2026 – Present
Natural Science Research Institute, Korea Advanced Institute of Science and Technology (KAIST)
Daejeon, South Korea | Alternative Military Service (Expected completion: Aug 2027)

Education

Ph.D. in Physics Mar 2021 – Aug 2026
Pohang University of Science and Technology (POSTECH), Pohang, South Korea
Advisors: Prof. Gil Young Cho (Co-advised by Prof. Hee-Cheol Kim)
Thesis: *Classification of Topological Orders and Its Applications*

B.S. in Physics Mar 2017 – Feb 2021
Pohang University of Science and Technology (POSTECH), Pohang, South Korea

Research Experience

Visiting Graduate Researcher Jun 2024 – Jul 2024
Cavendish Laboratory, University of Cambridge, Cambridge, UK
Host: Prof. Robert-Jan Slager
Conducted collaborative research on noninvertible duality [Physical Review B **111**, 115112 (2025)].

Publications & Preprints

∗ Equal contributions † Corresponding author

Preprints

[9] Theory of High-Temperature Fractional Chern Phases in Monolayer van der Waals Kagome Materials $A_2T_3X_4$
S. Oh, J. Han, J. Choi, **D. Seo**, M. Kang†, and G. Y. Cho†, arXiv:2610.24633

[8] Wavefunctions for Anyon Superconductors
D. Seo∗, T. Lee∗, and G. Y. Cho†, arXiv:2609.04187

[7] A Unified Categorical Description of Quantum Hall Hierarchy and Anyon Superconductivity
D. Seo, T. Lee, G. Y. Cho†, arXiv:2602.03848

Published Papers

[6] U(2) Chern-Simons-Ginzburg-Landau theory of fractional quantum Hall hierarchies
T. Lee, G. Y. Cho†, **D. Seo**†, Physical Review B **114**, L231116 (2026)

[5] Superconductivity proximate to non-Abelian fractional spin Hall insulator in twisted bilayer $MoTe_2$
C.-E. Ahn∗, **D. Seo**∗, G. Lee, Y. Kim, G. Y. Cho†, Nature Communications **17**, 7005 (2026)

[4] Most Two-Dimensional Bosonic Topological Orders Forbid Sign-Problem-Free Quantum Monte Carlo Simulation: Nonpositive Gauss Sum as an Indicator
D. Seo, M. You, H.-C. Kim†, and G. Y. Cho†, Physical Review Letters **135**, 146602 (2025)

[3] Noninvertible duality and symmetry topological order of one-dimensional lattice models with spatially modulated symmetry
D. Seo, G. Y. Cho†, and R.-J. Slager, Physical Review B **111**, 115112 (2025)

[2] Modular extension of topological orders from congruence representations
D. Seo∗, M. You∗, G. Y. Cho†, and H.-C. Kim†, Physical Review B **109**, 155105 (2024)

[1] Classification of fermionic topological orders from congruence representations
G. Y. Cho†, H.-C. Kim†, **D. Seo**†, M. You†, Physical Review B **108**, 115103 (2023)

Talks & Presentations

Seminars

[7] *A Unified Approach to Anyon Superconductivity and Quantum Hall Hierarchy*
Department of Physics, Harvard University — Oct 2026
Department of Physics, Princeton University — Oct 2026
Quantum Matter Seminar, The Ohio State University — Oct 2026
Department of Physics, University of California, Berkeley — Oct 2026

[6] *A Unified Approach to Quantum Hall Hierarchy and Anyon Superconductivity*
Condensed Matter Theory Group, Massachusetts Institute of Technology — Jul 2026
Department of Physics, Yale University — Jul 2026

[5] *Classification of Topological Orders and Its Applications*
Cavendish Laboratory, University of Cambridge — Jun 2024

Conference Presentations

[4] *Classification of Fermionic Topological Orders using Congruence Representations*
2023 KPS Spring Meeting, Daejeon, South Korea — Apr 2023
Outstanding Presentation Award

[3] *Classification of Fermionic Topological Orders from Congruence Representations*
APS March Meeting 2023, Las Vegas, NV, USA — Mar 2023

[2] *Algebraic Theory of Anyons*
Frontiers of Theoretical Physics 2022, Seogwipo, South Korea — Nov 2022

[1] *Classification of Non-Unitary MTC and Topological Phases*
APS March Meeting 2022, Chicago, IL, USA — Mar 2022

Awards & Fellowships

Byung Il Min Solid State Theory Paper Award, POSTECH — 2026
One recipient per year, selected from among all graduate students and postdoctoral researchers

Outstanding Paper Award, POSTECH — 2026
Awarded for the year's top graduate student publications

POSTECHIAN Fellowship, POSTECH — 2025
University-wide fellowship

Outstanding Presentation Award, The Korean Physical Society — 2023
Awarded for an outstanding oral presentation at the 2023 KPS Spring Meeting

BK21 Interdisciplinary Scholar Fellowship, POSTECH — 2021–2024
One recipient in the annual physics cohort; provides a full stipend

Teaching & Mentoring

Undergraduate Research Supervision — 2025 – Present
Supervise Taegon Lee's research on quantum Hall hierarchy field theory. The project led to a Letter published in Physical Review B, with Lee as first author and me as a corresponding author

Teaching Assistant, Department of Physics, POSTECH — 2021 – 2022
Introduction to Relativity; Physics Laboratory I; Quantum Mechanics I

Undergraduate Peer Mentor, POSTECH — 2019 – 2020
General Physics I, General Physics II

Residential Advisor, POSTECH — 2019 – 2020

Academic Service

Referee *SciPost Physics* and *Physical Review B*

Organizer Condensed Matter Physics Journal Club at POSTECH