SangEun **Han**

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Education

KAIST (Korea Advanced Institute of Science and Technology) — *Daejeon, S. Korea*

Doctor of Philosophy in Physics, August 2020 — *March 2013 - August 2020*

Advisor: Prof. Eun-Gook Moon

Thesis: *Renormalization group study on Strongly correlated system*

KAIST (Korea Advanced Institute of Science and Technology) — *Daejeon, S. Korea*

Bachelor of Science, Magna Cum Laude, February, 2013 — *February 2010 - February 2013*

Double major in Physics and Mathematical Sciences

Hankuk University of Foreign Studies — *Seoul, S. Korea*

in Department of Physics — *March 2006 - January 2008*

Academic Affiliation

Department of Physics and Astronomy, Stony Brook University — *September 2025 - Present*

Postdoctoral Fellow

Department of Physics, Simon Fraser University — *September 2023 - August 2025*

Postdoctoral Fellow

Department of Physics, University of Toronto — *November 2020 - August 2023*

Postdoctoral Fellow

School of Computational Sciences, KIAS (Korea Institute for Advanced Study) — *August 2020 - October 2020*

Visiting Scholar

Department of Physics, KAIST (Korea Advanced Institute of Science and Technology) — *March 2013 - August 2020*

Candidate of Integrated Master's and Ph.D. Program

Honors

Awards

2018	**Outstanding Poster Award**, Workshop on Spin-orbit Coupled Topological states	*October 2018*
2018	**Pre-doctoral Fellow of Physics at KAIST**, Department of Physics, KAIST	*August 2018*
2014	**Spring Outstanding Teaching Assistant Awards**, Department of Physics, KAIST	*September 2014*
2011	**Presidential Design Award**, Fall Semester's Freshmen Design Course Award, KAIST	*February 2012*

Scholarships

2014 - 2015	**Scholarship**, Center for Theoretical Physics, Institute for Basic Science	*March 2014 - May 2015*
2006 - 2008	**Scholarship**, Hankuk University of Foreign Studies	*2006 Fall - 2008 Spring*

Services

Reviewer — *August 2022 - Present*

of Nature Communications

Referee — *January 2020 - Present*

of Physical Review Research

Referee — *April 2019 - Present*

of Physical Review Letters

Referee *September 2018 - Present*

of Physical Review B

Sergeant *February 2008 - January 2010*

at Military service at Army in Republic of Korea

Publication list

"Optical Magnetic Switching in Odd-Parity Magnets with Spin-Orbit Coupling"

SangEun Han and Qiang Li

Phys. Rev. B **114**, 254422 (2026). arXiv:2607.19483 [cond-mat.str-el] [cond-mat.mes-hall] [cond-mat.mtrl-sci]

"Beyond one-loop calculation: Higher-order effects on Gross-Neveu-Yukawa tensorial criticality"

SangEun Han and Igor F. Herbut

Phys. Rev. B **112**, 155161 (2025). arXiv:2506.20710 [cond-mat.str-el] [hep-th] [cond-mat.stat-mech]

"Fermi Surface Bosonization for Non-Fermi Liquids"

SangEun Han, Félix Desrochers, and Yong Baek Kim

Phys. Rev. B **112**, 165116 (2025). arXiv:2306.14955 [cond-mat.str-el] [hep-th]

"Gross-Neveu-Yukawa SO(2) and SO(3) tensorial criticality"

SangEun Han, Shouryya Ray, and Igor F. Herbut

Phys. Rev. B **111**, 115131 (2025). arXiv:2411.16842 [cond-mat.str-el] [hep-th] [cond-mat.stat-mech]

"Gross-Neveu-Yukawa theory of SO(2N)→SO(N)×SO(N) spontaneous symmetry breaking"

SangEun Han and Igor F. Herbut

Phys. Rev. B **110**, 125131 (2024). arXiv:2406.01681 [cond-mat.str-el] [hep-th] [cond-mat.stat-mech]

"Spontaneous breaking of the SO(2N) symmetry in the Gross-Neveu model"

SangEun Han and Igor F. Herbut

Phys. Rev. D **109**, 096026 (2024). arXiv:2403.09627 [hep-th] [cond-mat.str-el] [cond-mat.stat-mech]

"Quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction"

SangEun Han, Daniel J. Schultz, and Yong Baek Kim

Phys. Rev. B **108**, L060401 (2023). arXiv:2207.07661 [cond-mat.str-el]

"Complex fixed points of the non-Hermitian Kondo model in a Luttinger liquid"

SangEun Han, Daniel J. Schultz, and Yong Baek Kim

Phys. Rev. B **107**, 235153 (2023). arXiv:2302.07883 [cond-mat.str-el]

"Non-Fermi liquid behavior and quantum criticality in cubic heavy fermion systems with non-Kramers multipolar local moments"

SangEun Han, Daniel J. Schultz, and Yong Baek Kim

Phys. Rev. B **106**, 155155 (2022). arXiv:2206.02808 [cond-mat.str-el]

"Non-Fermi liquid induced by Bose metal with protected subsystem symmetries"

SangEun Han and Yong Baek Kim

Phys. Rev. B **106**, L081106 (2022). arXiv:2102.05052 [cond-mat.str-el]

"Realization of fractonic quantum phases in the breathing pyrochlore lattice"

SangEun Han, Adarsh S. Patri, and Yong Baek Kim

Phys. Rev. B **105**, 235120 (2022). arXiv:2109.03835 [cond-mat.str-el]

"Lattice vibration as a knob on exotic quantum criticality"

SangEun Han, Junhyun Lee, and Eun-Gook Moon

Phys. Rev. B **103**, 014435 (2021). arXiv:1911.01435 [cond-mat.str-el]

"Emergent Anisotropic Non-Fermi Liquid at a Topological Phase Transition in Three Dimensions"

SangEun Han, Changhee Lee, Hongki Min, and Eun-Gook Moon

Phys. Rev. Lett. **122**, 187601 (2019). arXiv:1809.10691 [cond-mat.str-el]

"Quantum Criticality with Infinite Anisotropy in Topological Phase Transitions between Dirac and Weyl Semi-metals"

SangEun Han, Gil Young Cho, and Eun-Gook Moon

Phys. Rev. B **98**, 085149 (2018). arXiv:1804.01547 [cond-mat.str-el]

"Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators"

SangEun Han and Eun-Gook Moon

Phys. Rev. B **97**, 241101(R) (2018). arXiv:1802.05727 [cond-mat.str-el]

"Topological Phase Transitions in Line-nodal Superconductors"

SangEun Han, Gil Young Cho, and Eun-Gook Moon

Phys. Rev. B **95**, 094502 (2017). arXiv:1601.00975 [cond-mat.str-el]

"Explaining the lepton non-universality at the LHCb and CMS within a unified framework"

Sanjoy Biswas, Debtosh Chowdhury, **SangEun Han**, and Seung J. Lee

JHEP **02**, 142 (2015). arXiv:1409.0882 [hep-ph]

Presentation

Oral presentation

APS Global Physics Summit 2026 — *Denver, USA*

Beyond one-loop: higher-order effects on Gross-Neveu-Yukawa tensorial criticality — *Mar. 16, 2026*

APS Global Physics Summit 2025 — *Anaheim, USA*

Gross-Neveu-Yukawa theory of SO(2N)→SO(N)×SO(N) spontaneous symmetry breaking — *Mar. 18, 2025*

Informal Theory Seminar at Institute for Solid State Physics (Invited) — *Kashiwa, Japan*

Quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *Feb. 5, 2025*

Condensed Matter Physics Seminar at Korea Institute for Advanced Study (Invited) — *Seoul, S. Korea*

Quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *Jan. 20, 2025*

CTP Seminar at Seoul National University (Invited) — *Seoul, S. Korea*

Quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *Jan. 17, 2025*

Condensed Matter Group Seminar at Hanyang University (Invited) — *Seoul, S. Korea*

Quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *Jan. 9, 2025*

Physics Seminar at KAIST (Invited) — *Daejeon, S. Korea*

Quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *Jan. 8, 2025*

APS March Meeting 2024 — *Minneapolis, USA*

Bosonization of Non-Fermi Liquids — *Mar. 4, 2024*

ASG Mini-workshop — *Daejeon, S. Korea*

Theory of a quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *June 21, 2023*

Condensed Matter Seminar at Simon Fraser University (Invited) — *Burnaby, Canada*

Theory of a quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *May 25, 2023*

Condensed Matter Seminar at University of Cincinnati (Invited, Zoom) — *Cincinnati, USA*

Microscopic theory of multi-stage Fermi surface reconstruction in higher-rank moment quantum materials — *May 10, 2023*

APS March Meeting 2023 — *Las Vegas, USA*

Microscopic theory of multi-stage Fermi surface reconstruction in heavy fermion systems with quartet multipolar local moments — *Mar. 8, 2023*

2022 CAP Congress — *Hamilton, Canada*

Realization of fractonic quantum phases in the breathing pyrochlore lattice — *Jun. 8, 2022*

APS March Meeting 2022 — *Chicago, USA*

Realization of fractonic quantum phases in the breathing pyrochlore lattice — *Mar. 17, 2022*

APS March Meeting 2020 (Virtual APS March Meeting) — *Denver, USA*

Quantum criticalities with lattice vibrations — *Mar. 3, 2020*

12th BK21+ Young Physicists Workshop — *Daejeon, S. Korea*

Emergence of Supersymmetry from spin-lattice coupling — *Feb. 4, 2020*

KAIST-Weizmann Workshop on Quantum Condensed Matter Physics (Invited) — *Rehovot, Israel*

Emergence of Supersymmetry from spin-lattice coupling — *Dec. 5, 2019*

2019 KPS Fall Meeting — *Gwangju, S. Korea*

Quantum criticalities with lattice vibrations — *Oct. 25, 2019*

APS March Meeting 2019 — *Boston, USA*
Emergent Anisotropic Non-Fermi Liquid — *Mar. 4, 2019*

11th BK21+ Young Physicists Workshop — *Pohang, S. Korea*
Emergent Anisotropic Non-Fermi Liquid — *Feb. 15, 2019*

2018 KPS Spring Meeting — *Daejeon, S. Korea*
Emergent Anisotropic Non-Fermi Liquid — *Apr. 26, 2018*

APS March Meeting 2018 — *Los Angeles, USA*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators — *Mar. 7, 2018*

2017 KPS Spring Meeting — *Daejeon, S. Korea*
Topological Phase Transitions in Dirac semi-metals of distorted spinels — *Apr. 21, 2017*

APS March Meeting 2017 — *New Orleans, USA*
Topological Phase Transitions in Dirac semi-metals of distorted spinels — *Mar. 14, 2017*

Poster presentation

International Conference on Strongly Correlated Electron Systems 2023 (SCES 2023) — *Songdo, S. Korea*
Theory of a quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction — *Jul. 3-7, 2023*

Quantum Matter Workshop — *Waterloo, Canada*
Microscopic theory of multi-stage Fermi surface reconstruction in heavy fermion systems with quartet multipolar local moments — *Nov. 14-16, 2022*

2020 Theory Winter School — *Tallahassee, USA*
Emergence of supersymmetry from spin-lattice coupling — *Jan. 6-10, 2020*

IBSPCS-KIAS International Workshop Frustrated Magnetism — *Daejeon, S. Korea*
Stability of Quantum Criticalities — *Oct. 14-18, 2019*

The 2nd Workshop on Spin-orbit Coupled Topological States — *Pohang, S. Korea*
Stability of Quantum Criticalities — *Sep. 19-21, 2019*

KIAS workshop on Topology and Correlation in quantum materials — *Busan, S. Korea*
Emergent Anisotropic Non-Fermi Liquid at a Topological Phase Transition in Three Dimensions — *May 29-31, 2019*

The 19th JAPAN-KOREA-TAIWAN SYMPOSIUM ON STRONGLY CORRELATED ELECTRON SYSTEMS — *Tokyo, Japan*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid — *Jan. 11-13, 2019*

The 1st Workshop on Spin-Orbit Coupled Topological States — *Pohang, S. Korea*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid — *Oct. 1-5, 2018*
- *Outstanding Poster Award*

Advanced School and Workshop on Correlations in Electron Systems – from Quantum Criticality to Topology — *Trieste, Italy*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid — *Aug. 6-17, 2018*

International Workshop on "New Paradigms in Quantum Matter 2018" — *Beijing, China*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid — *Jun. 24-Jul. 7, 2018*

KIAS workshop on Topology and Correlation — *Seoul, S. Korea*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators — *Jun. 7-8, 2018*

10th BK21+ Young Physicists Workshop — *Seoul, S. Korea*
Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators — *Feb. 8-9, 2018*

The 19th International Conference on Recent Progress in Many-Body Theories *Pohang, S. Korea*

Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators *Jun. 25-30, 2017*

2016 Quantum Materials Symposium *Incheon, S. Korea*

Topological Phase Transitions in Line-nodal Superconductors *Feb. 22-26, 2016*

Teaching experiences

Teaching Assistants in *March 2013 - December 2017*

- PH504 Graduate Quantum Mechanics 2 at KAIST — September 2017 - December 2017
- PH503 Graduate Quantum Mechanics 1 at KAIST — March 2017 - June 2017
- PH496 Colloquium & PH990 Seminar at KAIST — September 2016 - December 2016
- PH503 Graduate Quantum Mechanics 1 at KAIST — March 2016 - June 2016
- PH302 Undergraduate Quantum Mechanics 2 at KAIST — September 2015 - December 2015
- PH301 Undergraduate Quantum Mechanics 1 at KAIST — March 2015 - June 2015
- PH654 Quantum Field Theory 2 at KAIST — March 2014 - June 2014
- PH142 General Physics 2 at KAIST — September 2013 - December 2013
- PH141 General Physics 1 at KAIST — March 2013 - June 2013

References

Prof. Eun-Gook Moon

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Email: egmoon@kaist.ac.kr

Prof. Yong Baek Kim

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Email: ybkim@physics.utoronto.ca

Prof. Igor F. Herbut

Department of Physics, Simon Fraser University (SFU)

Department of Physics, Simon Fraser University, 8888 University Drive, Burnaby, British Columbia V5A 1S6, Canada
Email: iherbut@sfu.ca

Prof. Hongki Min

Department of Physics and Astronomy, Seoul National University

1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea
Email: hmin@snu.ac.kr

Prof. Gil Young Cho

Department of Physics, Korea Advanced Institute of Science and Technology (KAIST)

291 Daehak-ro, Yuseong-gu, Daejeon 34141, Republic of Korea
Email: gilyoungcho@kaist.ac.kr

Prof. Qiang Li

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