

SangEun Han

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Education

KAIST (Korea Advanced Institute of Science and Technology)

DOCTOR OF PHILOSOPHY IN PHYSICS, AUGUST 2020

Advisor: Prof. Eun-Gook Moon

Thesis: *Renormalization group study on Strongly correlated system*

Daejeon, S.Korea

March 2013 - August 2020

KAIST (Korea Advanced Institute of Science and Technology)

BACHELOR OF SCIENCE, MAGNA CUM LAUDE, FEBRUARY, 2013

Double major in Physics and Mathematical Sciences

Daejeon, S.Korea

February 2010 - February 2013

Hankuk University of Foreign Studies

IN DEPARTMENT OF PHYSICS

Seoul, S.Korea

March 2006 - January 2008

Academic Affiliation

Department of Physics, Simon Fraser University

Postdoctoral Fellow

September 2023 - Present

Department of Physics, University of Toronto

Postdoctoral Fellow

November 2020 - August 2023

School of Computational Sciences, KIAS (Korea Institute for Advanced Study)

Visiting Scholar

August 2020 - October 2020

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

Candidate of Integrated Master's and Ph.D Program

March 2013 - August 2020

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

of Nature Communications

August 2022 - Present

Referee

of Physics Review Research

January 2020 - Present

Referee

of Physics Review Letters

April 2019 - Present

Referee

of Physics Review B

September 2018 - Present

Publication list

“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**, 155155 (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 from an Unified Framework”

SANJOY BISWAS, DEBTOSH CHOWDHURY, SangEun Han, AND SEUNG J. LEE

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

MANUSCRIPTS UNDER REVIEW

“Gross-Neveu-Yukawa theory of $SO(2N) \rightarrow SO(N) \times SO(N)$ spontaneous symmetry breaking”

SangEun Han AND IGOR F. HERBUT

arXiv:2406.01681 [cond-mat.str-el] [hep-th] [cond-mat.stat-mech]

“Bosonization of Non-Fermi Liquids”

SangEun Han, FÉLIX DESROCHERS, AND YONG BAEK KIM

arXiv:2306.14955 [cond-mat.str-el] [hep-th]

Presentation

ORAL PRESENTATION

APS March Meeting 2024 Bosonization of Non-Fermi Liquids	<i>Minneapolis, USA</i> <i>Mar. 4, 2024</i>
ASG Mini-workshop Theory of a quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction	<i>Daejeon, S. Korea</i> <i>June 21, 2023</i>
Condensed Matter Seminar at Simon Fraser University (Invited) Theory of a quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction	<i>Burnaby, Canada</i> <i>May 25, 2023</i>
Condensed Matter Seminar at University of Cincinnati (Invited, Zoom) Microscopic theory of multi-stage Fermi surface reconstruction in higher-rank moment quantum materials	<i>Cincinnati, USA</i> <i>May 10, 2023</i>
APS March Meeting 2023 Microscopic theory of multi-stage Fermi surface reconstruction in heavy fermion systems with quartet multipolar local moments	<i>Las Vegas, USA</i> <i>Mar. 8, 2023</i>
2022 CAP Congress Realization of fractonic quantum phases in the breathing pyrochlore lattice	<i>Hamilton, Canada</i> <i>Jun. 8, 2022</i>
APS March Meeting 2022 Realization of fractonic quantum phases in the breathing pyrochlore lattice	<i>Chicago, USA</i> <i>Mar. 17, 2022</i>
APS March Meeting 2020 (Virtual APS March Meeting) Quantum criticalities with lattice vibrations	<i>Denver, USA</i> <i>Mar. 3, 2020</i>
12th BK21+ Young Physicists Workshop Emergence of Supersymmetry from spin-lattice coupling	<i>Daejeon, S. Korea</i> <i>Feb. 4, 2019</i>
KAIST-Weizmann Workshop on Quantum Condensed Matter Physics (Invited) Emergence of Supersymmetry from spin-lattice coupling	<i>Rehovot, Israel</i> <i>Dec. 5, 2019</i>
2019 KPS Fall Meeting Quantum criticalities with lattice vibrations	<i>Gwangju, S. Korea</i> <i>Oct. 25, 2019</i>
APS March Meeting 2019 Emergent Anisotropic Non-Fermi Liquid	<i>Boston, USA</i> <i>Mar. 4, 2019</i>
11th BK21+ Young Physicists Workshop Emergent Anisotropic Non-Fermi Liquid	<i>Pohang, S. Korea</i> <i>Feb. 15, 2019</i>
2018 KPS Spring Meeting Emergent Anisotropic Non-Fermi Liquid	<i>Daejeon, S. Korea</i> <i>Apr. 26, 2018</i>
APS March Meeting 2018 Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators	<i>Los Angeles, USA</i> <i>Mar. 7, 2018</i>
2017 KPS Spring Meeting Topological Phase Transitions in Dirac semi-metals of distorted spinels	<i>Daejeon, S. Korea</i> <i>Apr. 21, 2017</i>
APS March Meeting 2017 Topological Phase Transitions in Dirac semi-metals of distorted spinels	<i>New Orleans, USA</i> <i>Mar. 14, 2017</i>
POSTER PRESENTATION	
International Conference on Strongly Correlated Electron Systems 2023 (SCES 2023) Theory of a quantum impurity model for two-stage multipolar ordering and Fermi surface reconstruction	<i>Songdo, S. Korea</i> <i>Jul. 3-7, 2023</i>
Quantum Matter Workshop Microscopic theory of multi-stage Fermi surface reconstruction in heavy fermion systems with quartet multipolar local moments	<i>Waterloo, Canada</i> <i>Nov. 14-16, 2022</i>
2020 Theory Winter School Emergence of supersymmetry from spin-lattice coupling	<i>Tallahassee, USA</i> <i>Jan. 6-10, 2020</i>
IBSPCS-KIAS International Workshop Frustrated Magnetism Stability of Quantum Criticalities	<i>Daejeon, S. Korea</i> <i>Oct. 14-18, 2019</i>

The 2nd Workshop on Spin-orbit Coupled Topological States Stability of Quantum Criticalities	Pohang, S. Korea Sep. 19-21, 2019
KIAS workshop on Topology and Correlation in quantum materials Emergent Anisotropic Non-Fermi Liquid at a Topological Phase Transition in Three Dimensions	Busan, S. Korea May 29-31, 2019
The 19th JAPAN-KOREA-TAIWAN SYMPOSIUM ON STRONGLY CORRELATED ELECTRON SYSTEMS Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid	Tokyo, Japan Jan. 11-13, 2019
The 1st Workshop on Spin-Orbit Coupled Topological States Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid • Outstanding Poster Award	Pohang, S. Korea Oct. 1-5, 2018
Advanced School and Workshop on Correlations in Electron Systems – from Quantum Criticality to Topology - Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid	Trieste, Italy Aug. 6-17, 2018
International Workshop on “New Paradigms in Quantum Matter 2018” Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators / Emergent Anisotropic Non-Fermi Liquid	Beijing, China Jun. 24-Jul. 7, 2018
KIAS workshop on Topology and Correlation Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators	Seoul, S. Korea Jun. 7-8, 2018
10th BK21+ Young Physicists Workshop Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators	Seoul, S. Korea Feb. 8-9, 2018
The 19th International Conference on Recent Progress in Many-Body Theories Long-range Coulomb Interaction effects on Topological Phase Transitions between Semi-metals and Insulators	Pohang, S. Korea Jun. 25-30, 2017
2016 Quantum Materials Symposium Topological Phase Transitions in Line-nodal Superconductors	Incheon, S. Korea Feb. 22-26, 2016

Teaching experiences

Teaching Assistants in

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

References

Prof. Eun-Gook Moon

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291 Daehak-ro, Yuseong-gu, Daejeon 34141, Republic of Korea
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Prof. Yong Baek Kim

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60 St. George Street, University of Toronto, Toronto, Ontario M5S 1A7, Canada
Email: ybkim@physics.utoronto.ca

Prof. Igor F. Herbut

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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

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Prof. Gil Young Cho

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