

SangEun Han

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Education

KAIST (Korea Advanced Institute of Science and Technology)

DOCTOR OF PHILOSOPHY IN PHYSICS, AUGUST 2020

Adviosr: 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, FEBURARY, 2013

Double major in Physics and Mathematical Sciences

Daejeon, S.Korea

Feburary 2010 - Feburary 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

Feburary 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]

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

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

Pohang, S. Korea

Oct. 1-5, 2018

- Outstanding Poster Award

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
- PH503 Graduate Quantum Mechanics 1 at KAIST
- PH496 Colloquium & PH990 Seminar at KAIST
- PH503 Graduate Quantum Mechanics 1 at KAIST
- PH302 Undergraduate Quantum Mechanics 2 at KAIST
- PH301 Undergraduate Quantum Mechanics 1 at KAIST
- PH654 Quantum Field Theory 2 at KAIST
- PH142 General Physics 2 at KAIST
- PH141 General Physics 1 at KAIST

March 2013 - December 2017

September 2017 - December 2017

March 2017 - June 2017

September 2016 - December 2016

March 2016 - June 2016

September 2015 - December 2015

March 2015 - June 2015

March 2014 - June 2014

September 2013 - December 2013

March 2013 - June 2013

References

Prof. Eun-Gook Moon

DEPARTMENT OF PHYSICS, KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY (KAIST)

291 Daehak-ro, Yuseong-gu, Daejeon 34141, Republic of Korea

Email: egmoon@kaist.ac.kr

Prof. Yong Baek Kim

DEPARTMENT OF PHYSICS, UNIVERSITY OF TORONTO (U OF T)

60 St. George Street, University of Toronto, Toronto, Ontario M5S 1A7, Canada

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, POHANG UNIVERSITY OF SCIENCE AND TECHNOLOGY (POSTECH)

77 Cheongam-ro, Nam-gu, Pohang 37673, Republic of Korea

Email: gilyoungcho@postech.ac.kr