

# SangEun Han

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

✉ se.han@utoronto.ca | 🏠 sehan.org | 📞 SangEun Han | 📠 0000-0003-3141-1964

## 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, University of Toronto

Postdoctoral Fellow

November 2020 - Present

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

Vising 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

### Sergeant

at Military service at Army in Republic of Korea

February 2008 - January 2010

## Publication list

---

### ***“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

### ***“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

#### **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 2<sup>nd</sup> 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 1<sup>st</sup> 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
- 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. 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