

Seonghyuk Im(임성혁)

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Current Position

- **KAIST** Daejeon, South Korea
Integrated master's/doctoral program, Department of Mathematical Sciences 2021.03-Current
– Advised by Jaehoon Kim and Hong Liu.
- **IBS ECOPRO** Daejeon, South Korea
Student Researcher 2022.04-Current

Education

- **KAIST** Daejeon, South Korea
B.S., Department of Mathematical Sciences 2016.03-2020.08
- **Hansung Science High School(한성과학고등학교)** Seoul, South Korea
High school education 2014.03-2016.02

Research Interests

- Extremal graph theory, especially
 - Dirac-type problems
 - Spanning structures in random and randomly perturbed graphs
 - Homomorphism counting
- Computational complexity of graph problems

Preprints submitted

- An efficient algorithm for \mathcal{F} -SUBGRAPH-FREE EDGE DELETION on graphs having a product structure (with Shinwoo An, Seokbeom Kim, and Myounghwan Lee), arXiv:2510.14674
- Perturbation of dense graphs (with Jie Han, Bin Wang, and Junxue Zhang), arXiv:2508.18042
- Unbounded degree spanning hypertrees in Dirac hypergraphs (with Yaobin Chen and Junchi Zhang), arXiv:2508.06843
- On high discrepancy 1-factorizations of complete graphs (with Jiangdong Ai, Fankang He, Hyunwoo Lee), arXiv:2503.17176

- Ramsey–Dirac theory for bounded degree hypertrees (with Jie Han, Jaehoon Kim, and Donglei Yang), arXiv:2411.17996
- Graph with any rational density and no rich subsets of linear size (with Suyun Jiang, Hong Liu, and Tuan Tran), arXiv:2402.13825
- A bandwidth theorem for graph transversals (with Debsoumya Chakraborti, Jaehoon Kim, and Hong Liu), arXiv:2302.09637

Published

To appear

- Sidorenko’s conjecture for subdivisions and theta substitutions (with Ruonan Li and Hong Liu), arXiv:2408.03491
To appear in *Combinatorics, Probability, and Computing*
- The proper conflict-free k -coloring problem and the odd k -coloring problem are NP-complete on bipartite graphs (with Jungho Ahn and Sang-il Oum), arXiv:2208.08330
To appear in *Discrete Applied Mathematics*

2025

- On rainbow Turán Densities of Trees (with Jaehoon Kim, Hyunwoo Lee, and Haesong Seo), *Random Structures & Algorithms*, 66(3), e70005.
arXiv:2312.15956 doi.org/10.1002/rsa.70005
- Dirac’s theorem for linear hypergraphs (with Hyunwoo Lee), *SIAM Journal on Discrete Mathematics*, 39(2), 834-847.
arXiv:2403.14269, doi.org/10.1137/24M1659467
- Crux, space constraints and subdivisions (with Jaehoon Kim, Younjin Kim, and Hong Liu) *Journal of Combinatorial Theory, Series B* 170 (2025): 82-127.
arXiv:2207.06653, doi.org/10.1016/j.jctb.2024.08.005. An extended abstract appears in EUROCOMB’23

2024

- A proof of the Elliott–Rödl conjecture on hypertrees in Steiner triple systems (with Jaehoon Kim, Joonkyong Lee, and Abhishek Methuku) *Forum of Mathematics, Sigma* 2024;12:e75
arXiv:2208.10370, doi.org/10.1017/fms.2024.34
- On the spectral radius of graphs with given maximum degree and girth (with Jiangdong Ai, Jaehoon Kim, Hyunwoo Lee, Suil O, and Liwen Zhang) *Linear Algebra and its Applications* vol 691, 182-195
doi.org/10.1016/j.laa.2024.03.026

2016

- On the mean square displacement of a random walk on a graph (with Hwidong Kim, Jiho Maeng, Jihwan Yu, Yongwook Cha, and Seong-Hun Paeng) *European Journal of Combinatorics* 51 (2016): 227-235
doi.org/10.1016/j.ejc.2015.05.009

Talks

- 2025 Combinatorics Workshop
Aug 18, 2025 at Daejeon, South Korea
Random perturbation of dense graphs (site)
- (invited) Discrete Analysis at Yonsei
June 19, 2025 at Yonsei University (Seoul, South Korea)
Ramsey–Dirac theory for bounded degree hypertrees (site)
- 2025 KMS Spring Meeting
April 25, 2025 at KAIST (Daejeon, South Korea)
Spanning hypertrees in dense pseudorandom hypergraphs (site)
- (invited) 4th East Asia Workshop on Extremal and Structural Graph Theory
March 29, 2025 at Sun-Yet Sen University (Guangzhou, China)
Ramsey–Dirac theory for bounded degree hypertrees (site)
- (invited) BUPT(Beijing University for Posts and Telecommunications) workshop
December 15, 2024 at Hainan, China
Ramsey–Dirac theory for bounded degree hypertrees
- (invited) Beijing Institute of Technology(BIT) seminar
December 10, 2024 at Beijing Institute of Technology (Beijing, China)
Almost spanning hypertrees in a Steiner triple system
- (invited) 2024 KMS Annual Meeting - Special Section: Recent developments in combinatorics
October 25, 2024 at Sungkyunkwan University (Suwon, South Korea)
Sidorenko’s conjecture for theta substitutions (site)
- (invited) Discrete Analysis Seminar
October 15, 2024 at Yonsei University (Seoul, South Korea)
Rainbow Turán Densities of Trees via Graph Limits (site)
- (invited) Shandong University Seminar
August 5, 2024, Zoom
Rainbow Turán Densities of Trees via Graph Limits
- 9th European Congress of Mathematics(ECM) - CS-15: 04. Combinatorics and Discrete Mathematics (II)
July 16, 2024 at Sevilla, Spain
Graph with any rational density and no rich subsets of linear size (site)
- Summit280
July 11, 2024 at Budapest, Hungary
Dirac’s theorem for linear hypergraphs (site)
- 30th British Combinatorial Conference(BCC)
July 3, 2024 at London, UK
Dirac’s theorem for linear hypergraphs (site)

- (invited) 31st KIAS combinatorics workshop
June 1, 2024 at Jeju, South Korea
Dirac's theorem for linear hypergraphs (site)
- 2024 KMS Spring Meeting
April 19, 2024 at Daejeon, South Korea
On rainbow Turán densities of trees (site)
- (invited) Yeungnam University Combinatorics Seminar
March 18, 2024 at Yeungnam University (Gyeongsan, South Korea)
Graph with any rational density and no rich subsets of linear size (site)
- 2023 European Conference on Combinatorics, Graph Theory and Applications (EUROCOMB'23)
August 31, 2023 at Prague, Czech Republic
Crux, space constraints and subdivisions (Extended abstract)
- (invited) 2023 KMS Spring Meeting - Special Section: Extremal Combinatorics: Methods and Applications
April 29, 2023 at Daejeon, South Korea
A bandwidth theorem for graph transversals (site)
- (invited) Shandong University Seminar
March 30, 2023, Zoom
A bandwidth theorem for graph transversals (Bilibili)
- (invited) IBS Discrete Math Seminar
November 29, 2022 at IBS (Daejeon, South Korea)
A proof of the Elliott-Rödl conjecture on hypertrees in Steiner triple systems (Youtube)
- KAIST Math Graduate student Seminar (KMGS)
November 3, 2022 at KAIST (Daejeon, South Korea)
Large clique subdivisions in graphs without small dense subgraphs (site)
- 2021 Combinatorics Workshop
December 21, 2021 at Yangpyeong, South Korea
Large clique subdivisions in graphs without small dense subgraphs (Youtube)
- (invited) IBS Discrete Math Seminar
November 30, 2021 at IBS (Daejeon, South Korea)
Large clique subdivisions in graphs without small dense subgraphs (Youtube)

Teaching

- Mini course: Finding Large Structures (with Hyunwoo Lee)
Nankai University
2025 Feb 18-21

TA works

2025

- (fall) CC511 Probability and Statistics at KAIST
- (spring) CS492 Algorithmic Graph Theory at KAIST

2024

- (fall) MAS 477 Introduction to graph theory at KAIST
- (spring) MAS 275 Discrete mathematics at KAIST

2023

- (fall) MAS 102 Calculus 2 and MAS 480 Topological methods in combinatorics at KAIST
- (spring) MAS 101 Calculus 1 and MAS 275 Discrete mathematics at KAIST

2022

- (fall) MAS 102 Calculus 2 and MAS 477 Introduction to Graph Theory at KAIST
- (spring) MAS 102 Calculus 2 and MAS 275 Discrete mathematics at KAIST

2021

- (fall) MAS 102 Calculus 2 and CC511 Probability and Statistics at KAIST
- (spring) MAS 101 Calculus 1 at KAIST (Won the Outstanding Teaching Assistant Award).

Organizing events

- Co-organizing Deep seminar in combinatorics, 2023-Current ([link](#))
- Co-organizing 2024 KSCW (Korean Student Combinatorics Workshop), 2024 July 29-August 2 ([link](#))
- Co-organizing IBS ECOPRO student reading group, 2022-2023 ([link](#))

Awards & Honors

Outstanding TA Award	2021
<i>Awarded by KAIST</i>	
37th Mathematical Contest for University Students - Silver Prize	2018
<i>Awarded by Korean Mathematical Society</i>	
2018 Kakao Code Festival 5th prize (30th place)	2018
<i>Awarded by Kakao Corporation</i>	
36th Mathematical Contest for University Students - Silver Prize	2017
<i>Awarded by Korean Mathematical Society</i>	

Research Visits

- Visited Nankai University, Tianjin, China
at the invitation of Prof. Jiangdong Ai (February 13-25, 2025).
- Visited Beijing University for Posts and Telecommunications Hainan Campus, Hainan, China
at the invitation of Prof. Luyining Gan (December 11-23, 2024).
- Visited Beijing Institute of Technology, Beijing, China
at the invitation of Prof. Jie Han (December 09-11, 2024).
- Visited Nankai University, Tianjin, China
at the invitation of Prof. Jiangdong Ai (February 16-25, 2024).

References

- **Prof. Jaehoon Kim**
Department of Mathematical Sciences, KAIST
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- **Prof. Hong Liu**
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Other manuscripts

- Complexity of Partitioning Hypergraphs, arXiv:1812.09206