List of Publications – Mihyun Kang

Highlights

- S. Diskin, J. Erde, M. Kang, and M. Krivelevich, **Isoperimetric inequalities and supercritical percolation on high-dimensional product graphs**, *Combinatorica* 44 (2024), 741-784.

  We derived isoperimetric inequalities for regular high-dimensional product graphs, generalising the well-known Harper's isoperimetric inequality for the hypercube. In addition, we investigated typical structure of the giant component in a supercritical random subgraph of a regular high-dimensional product graph, such as likely diameter and circumference of the giant component.

- J. Erde, M. Kang, and M. Krivelevich, **Expansion in supercritical random subgraphs of the hypercube and its consequences**, *Ann. Probab.* 51 (2023), 127-156.

  We solved an open problem posed in 1994 by Bollobás, Kohayakawa, and Łuczak, determining the diameter of the giant component of the percolated hypercube in the supercritical regime. We also gave a partial answer to a question raised in 2008 by Pete, obtaining a polynomial mixing time of a lazy simple random walk on the giant component.

- O. Cooley, N. Del Giudice, M. Kang, and P. Sprüssel, **Vanishing of cohomology groups of random simplicial complexes**, *Random Structures Algorithms* 56 (2020), 461-500.

  We determined the sharp threshold for the vanishing of cohomology groups of random simplicial complexes which are generated by random hypergraphs by taking the downward-closure. We also proved a hitting time result, relating the vanishing of the cohomology groups to the disappearance of the last minimal obstruction. In addition we determined the asymptotic distribution of the dimension of the cohomology group inside the critical window.

- A. Coja-Oghlan, O. Cooley, M. Kang, and K. Skubch, **Core forging and local limit theorems for the k-core of random graphs**, *J. Combin. Theory Ser. B* 137 (2019), 178-231.

  We established local limit theorems of the k-core of the Erdős–Rényi random graph. The emergence of the k-core in a random graph is related to the 'freezing phenomenon' in random boolean constraint satisfaction problems. An important ingredient to our proof is the analysis of the Warning Propagation message passing algorithm, a ubiquitous combinatorial message passing algorithm of pivotal importance to the physics view on random combinatorial structures.

- M. Kang and T. Łuczak, **The two critical phase of a random planar graph**, *Trans. Amer. Math. Soc.* 364 (2012), 4239-4265.

  We discovered that phase transitions in random planar graphs differ significantly from the classical Erdős–Rényi random graphs. The giant component emerges when the average degree is one, but its order is about half the order of the giant component in the Erdős–Rényi random graph. In addition, the giant component covers almost all vertices, yet the 2-core is still sublinear, when the average degree is close to two but smaller than two. This result was extended to random graphs on surfaces in a follow up paper [Kang, Moßhammer, and Sprüssel, **Phase transitions in graphs on orientable surfaces**, *Random Structures Algorithms* 56 (2020), 1117-1170.].

- M. Bodirsky, É. Fusy, M. Kang, and S. Vigerske, **Boltzmann samplers, Pólya theory and cycle pointing**. *SIAM J. Comput.* 40 (2011), 721-769.

  We introduced Pólya-Boltzmann samplers as a general scheme for uniform sampling of unlabelled planar graphs, planar-like graphs, and planar maps. We also introduced the cycle-pointing technique which take symmetries of graphs into consideration.

- M. Kang and M. Loebl, **The enumeration of planar graphs via Wick's theorem**, *Adv. Math.* 221 (2009), 1703-1724.

  We showed that the enumeration of graphs that are embeddable on a 2-dimensional surface can be formulated as the Gaussian matrix integral of an ice-type partition function. Some of the most puzzling conjectures of discrete mathematics are related to the notion of the cycle double cover. We expressed the number of graphs with a fixed directed cycle double cover as the Gaussian matrix integral of an Ihara-Selberg-type function.

List of Publications – Mihyun Kang

Publications in peer-reviewed journals

1. S. Diskin, J. Erde, M. Kang, and M. Krivelevich, Percolation on high-dimensional product graphs, *Random Structures Algorithms* (2025), 66: e21268. doi:10.1002/rsa.21268.

2. M. Kang and M. Missethan, Local limit of sparse random planar graphs, *SIAM J. Discrete Math.* (2025), to appear. arXiv:2101.11910.

3. M. Anastos, O. Cooley, M. Kang, and M. Kwan, Partitioning problems via random processes, *J. London Math. Soc.* (2024), 110: e70010. doi:10.1112/jlms.70010.

4. A. Coja-Oghlan, M. Kang, L. Krieg, and M. Rolvien, The k-XORSAT threshold revisited, *Electron. J. Combin.* 31-2 (2024), #P2.16. doi:10.37236/11815.

5. S. Diskin, J. Erde, M. Kang, and M. Krivelevich, Isoperimetric inequalities and supercritical percolation on high-dimensional product graphs, *Combinatorica* 44 (2024), 741-784. doi:10.1007/s00493-024-00089-0.

6. S. Diskin, J. Erde, M. Kang, and M. Krivelevich, Percolation through Isoperimetry, *Ann. Inst. Henri Poincaré Probab. Stat.* (2024), to appear arXiv:2308.10267.

7. S. Diskin, J. Erde, M. Kang, and M. Krivelevich, Percolation on irregular high-dimensional product graphs, *Combin. Probab. Comput.* 33 (2024), 377-403. doi:10.1017/S0963548323000469.

8. T. A. Do, J. Erde, and M. Kang, A note on the width of sparse random graphs, *Journal of Graph Theory* 106 (2024), 273-295. doi:10.1002/jgt.23081.

9. J. Erde, M. Kang, F. Lehner, B. Mohar, and D. Schmid, Catching a robber on a random k-uniform hypergraph, *Canadian Journal of Mathematics*. Published online 2024:1-28. doi:10.4153/S0008414X24000270.

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15. M. Kang and M. Missethan, The early evolution of the random graph process in planar graphs and related classes, *SIAM J. Discrete Math.* 37-1 (2023), 146-162. doi:10.1137/21M1450616.

16. O. Cooley, M. Kang, and O. Pikhurko, On a question of Vera T. Sós about size forcing of graphons, *Acta Math. Hungar.* 168 (2022), 1-26. doi:10.1007/s10474-022-01265-8.

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Extended abstracts in conference proceedings

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