

# Donggyu Kim (김동규)

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## Current Positions

03/2025– Visiting Assistant Professor (08/2025–) and Postdoctoral Fellow (03/2025–07/2025)  
School of Mathematics, **Georgia Institute of Technology**, Atlanta, GA, USA.  
Postdoc mentor: Prof. **Matthew Baker**.

## Research Areas

Algebraic Combinatorics and Matroid Theory.  
In particular, algebraic properties of graphs; matroids with coefficients; Coxeter matroids.

## Education

03/2019–02/2025 **KAIST**, Daejeon, Korea.  
Ph.D. in Mathematical Sciences, February 2025.  
Thesis title: *Delta-matroids with coefficients and linear spaces equipped with a bilinear form*.  
Thesis advisor: Prof. **Sang-il Oum**.

03/2015–02/2019 **KAIST**, Daejeon, Korea.  
B.S. in Mathematical Sciences with *Cum Laude*.

03/2012–02/2015 Korea Science Academy of KAIST (한국과학영재학교), Busan, Korea.

## Awards

Nov. 26, 2025 **the 15th S-OIL Excellent Dissertation Award** (제15회 에스-오일 우수학위 논문상), S-OIL 과학문화재단.

July 2025–June 2027 AMS-Simons Travel Grant, American Mathematical Society (funded by the Simons Foundation).

May 28, 2022 Excellent Poster Award, 2022 KSIAM Spring Conference.

## Journal Papers

1. Matthew Baker, Changxin Ding, and **Donggyu Kim**. “The Jacobian of a regular orthogonal matroid and torsor structures on spanning quasi-trees of ribbon graphs”. **Adv. Math.**, September 2026. DOI: [10.1016/j.aim.2026.111099](https://doi.org/10.1016/j.aim.2026.111099), arXiv: [2501.08796](https://arxiv.org/abs/2501.08796).
2. Tong Jin and **Donggyu Kim**. “Orthogonal matroids over tracts”. **Forum Math. Sigma**, August 2025. DOI: [10.1017/fms.2025.10085](https://doi.org/10.1017/fms.2025.10085), arXiv: [2303.05353](https://arxiv.org/abs/2303.05353).
3. **Donggyu Kim**. “Baker–Bowler theory for Lagrangian Grassmannians”. **Int. Math. Res. Not. IMRN**, April 2025. DOI: [10.1093/imrn/rnaf094](https://doi.org/10.1093/imrn/rnaf094), arXiv: [2403.02356](https://arxiv.org/abs/2403.02356).

4. **Donggyu Kim** and Sang-il Oum. “Note on Hamiltonicity of basis graphs of even delta-matroids”. *J. Graph Theory*, March 2025. DOI: [10.1002/jgt.23237](https://doi.org/10.1002/jgt.23237), arXiv: [2308.05772](https://arxiv.org/abs/2308.05772).
5. Jungho Ahn, Debsoumya Chakraborti, Kevin Hendrey, **Donggyu Kim**, and Sang-il Oum. “Twin-width of random graphs”. *Random Structures Algorithms*, June 2024. DOI: [10.1002/rsa.21247](https://doi.org/10.1002/rsa.21247), arXiv: [2212.07880](https://arxiv.org/abs/2212.07880).
6. **Donggyu Kim** and Sang-il Oum. “Vertex-minors of graphs: A survey”. *Discrete Appl. Math.*, July 2024. DOI: [10.1016/j.dam.2024.03.011](https://doi.org/10.1016/j.dam.2024.03.011).
7. **Donggyu Kim** and Sang-il Oum. “Prime vertex-minors of a prime graph”. *European J. Combin.*, **118**:103871, May 2024. DOI: [10.1016/j.ejc.2023.103871](https://doi.org/10.1016/j.ejc.2023.103871), arXiv: [2202.07877](https://arxiv.org/abs/2202.07877).
8. **Donggyu Kim**, Duksang Lee, and Sang-il Oum. “T-graphic delta-matroids and their applications”. *Combinatorica*, **43**(5):963-983, October 2023. DOI: [10.1007/s00493-023-00043-6](https://doi.org/10.1007/s00493-023-00043-6), arXiv: [2104.11383](https://arxiv.org/abs/2104.11383).
9. **Donggyu Kim** and Suil O. “Eigenvalues and parity factors in graphs with given minimum degree”. *Discrete Math.*, **346**(4):113290, April 2023. DOI: [10.1016/j.disc.2022.113290](https://doi.org/10.1016/j.disc.2022.113290), arXiv: [2111.12966](https://arxiv.org/abs/2111.12966).
10. Jungho Ahn, Kevin Hendrey, **Donggyu Kim** and Sang-il Oum. “Bounds for the twin-width of graphs”. *SIAM J. Discrete Math.*, **36**(3):2352-2366, 2022. DOI: [10.1137/21M1452834](https://doi.org/10.1137/21M1452834), arXiv: <https://arxiv.org/abs/2110.03957>

### Submitted Papers / Preprints

11. Changxin Ding and **Donggyu Kim**. “Pseudo-orientable ribbon graphs: Matrix-Quasi-tree Theorem and log-concavity”. arXiv: [2603.05702](https://arxiv.org/abs/2603.05702), 2026.
12. **Donggyu Kim**, Rose McCarty, and Caleb McFarland. “Graphs whose Eulerian trails have unique labels”. arXiv: [2603.02501](https://arxiv.org/abs/2603.02501), 2026.
13. Changxin Ding and **Donggyu Kim**. “Grassmann-Plücker functions for orthogonal matroids”. arXiv: [2601.19830](https://arxiv.org/abs/2601.19830), 2026.
14. Matthew Baker, June Huh, **Donggyu Kim**, Mario Kummer, Oliver Lorscheid. “Representation theory for polymatroids”. arXiv: [2507.14718](https://arxiv.org/abs/2507.14718), 2025.
15. Rutger Campbell, **Donggyu Kim**, and Jorn van der Pol. “Turán’s theorem for Dowling geometries”. arXiv: [2508.20843](https://arxiv.org/abs/2508.20843), 2025.
16. **Donggyu Kim** and Hyunwoo Lee. “Reconstructing hypergraph matching polynomials”. arXiv: [2501.19081](https://arxiv.org/abs/2501.19081), 2025.

### Refereed Conference Papers

17. **Donggyu Kim**, Duksang Lee, and Sang-il Oum. “T-graphic delta-matroids and their applications”. In: *Proceedings of the 32nd International Symposium on Algorithms and Computation (ISAAC2021, December 6-8, 2021, Fukuoka, Japan)*. Ed. by Hee-Kap Ahn and Kunihiko Sadakane. Vol. 212. Accepted. Dagstuhl, Germany: Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021, 70:1-70:13. DOI: [10.4230/LIPIcs.ISAAC.2021.70](https://doi.org/10.4230/LIPIcs.ISAAC.2021.70).

## Previous Positions

07/2019–02/2025 Student researcher (학생 연구원), Discrete Mathematics Group, **IBS** (Institute for Basic Science), Daejeon, Korea.

## Research Talks

June 30, 2026 Unimodular representations of ribbon graphs, *SiMEGG: Structure in Matroids, Embedded Graphs and Graphs*, ICMS, Bayes Centre, Edinburgh, UK.

June 18, 2026 Theory of matroids with coefficients and its generalizations, *Special Seminar*, Sungkyunkwan University, Suwon, South Korea.

May 17, 2026 Grassmann–Plücker functions for orthogonal matroids, *34th Cumberland Conference*, Auburn University, Auburn, AL, U.S.

Mar. 29, 2026 Pseudo-orientable ribbon graphs: Matrix–Quasi-tree Theorem and log-concavity, *Special session on Algebraic Combinatorics at the AMS Sectional Meeting*, Georgia Southern University in Savannah, GA, U.S.

Feb. 25, 2026 Pseudo-orientable ribbon graphs: Matrix–Quasi-tree Theorem and log-concavity, *Combinatorics Seminar*, Auburn University, Auburn, AL, U.S.

Jan. 8, 2026 Representation theory for polymatroids, *Combinatorics Seminar at HY*, Hanyang University, Seoul, Korea.

Dec. 26, 2025 Grassmann–Plücker functions for orthogonal matroids, *Discrete Math Seminar*, IBS Discrete Mathematics Group, Daejeon, South Korea.

Dec. 22, 2025 Representation theory for polymatroids, **35th KIAS Combinatorics Workshop**, Busan, South Korea.

Sep. 12, 2025 Turán’s theorem for Dowling geometries, *Combinatorics Seminar*, Georgia Tech, Atlanta, Georgia, U.S.

May 21, 2025 Group structures on spanning quasi-trees of ribbon graphs and regular orthogonal matroids, *CanaDAM 2025*, University of Ottawa, Ottawa, Canada.

Feb. 28, 2025 Torsor structures on spanning quasi-trees of ribbon graphs, *Discrete Analysis Seminar*, Yonsei University, Seoul, South Korea.

Oct. 24, 2024 Baker-Bowler theory for Lagrangian Grassmannians, **Geometry of Matroids Workshop**, IAS, Princeton, New Jersey, U.S.

Aug. 30, 2024 Two ways to generalize matroids with coefficients, *2024 Combinatorics Workshop*, Chung Buk National University, Cheongju, South Korea.

Aug. 20, 2024 Baker-Bowler theory for Lagrangian Grassmannians, *2024 Workshop on (Mostly) Matroids*, IBS, Daejeon, South Korea.

Jul. 8, 2024 Baker-Bowler theory for Lagrangian Grassmannians, *SIAM Conference on Discrete Mathematics (DM24)*, Spokane, Washington, U.S.

Apr. 19, 2024 Baker-Bowler theory for Lagrangian Grassmannians, *2024 KMS Spring Meeting*, Daejeon, South Korea.

Apr. 15, 2024 Baker-Bowler theory for Lagrangian Grassmannians, *Joint seminar Atlanta-Groningen*, Online.

- Mar 18, 2024 Twin-width of random graphs, *Combinatorics Seminar*, Yeungnam University, Gyeongsan, Gyeongbuk, South Korea.
- Mar 9, 2024 Orthogonal matroids over tracts, **30th KIAS Combinatorics Workshop**, Seoul, South Korea.
- Oct. 28, 2023 Hamiltonicity of basis graphs of even delta-matroids, *2023 KMS Annual Meeting*, Seoul, South Korea.
- Sep. 19, 2023 Orthogonal matroids over tracts, *Discrete Math Seminar*, IBS Discrete Mathematics Group, Daejeon, South Korea.
- Jun. 7, 2023 Prime vertex-minors of prime graphs, *CanADAM 2023*, Winnipeg, Canada.
- Apr. 29, 2023 Orthogonal matroids over tracts, *2023 KMS Spring Meeting*, Daejeon, South Korea.
- April, 2023 (Poster) Orthogonal Matroids over Tracts, (Internal) IBS ECOPRO and DIMAG poster day.
- Dec. 4, 2022 Matroid theory arising from projective geometry, *Workshop for Young Mathematicians in Korea 2022*, KAIST, Daejeon, South Korea.
- Jun. 1, 2022 Stronger versions of Tutte's wheel theorem for vertex-/pivot-minors, *Student Symposium in Combinatorics 2022*, Online, Australia.
- May 28, 2022 (Poster)  $\Gamma$ -graphic delta-matroids and their applications, *2022 KSIAM Spring Conference*, IBS, Daejeon, South Korea.
- Apr. 28, 2022 A stronger version of Tutte's wheel theorem for vertex-minors, *2022 KMS Spring Meeting*, Online, South Korea.
- Feb. 21, 2022 A stronger version of Tutte's wheel theorem for vertex-minors, *Discrete Math Seminar*, IBS Discrete Mathematics Group, Daejeon, South Korea.
- Nov. 25, 2021 Eigenvalues and parity factors in graphs, *KAIST Math Graduate student Seminar*, Online, KAIST, South Korea.
- Nov. 14, 2021 Eigenvalues and parity factors in graphs, *2021 China-Korea Young Scholars' Symposium on Discrete Mathematics, Statistics and Optimization*, Online, South Korea and China.
- Oct. 26, 2021  $\Gamma$ -graphic delta-matroids and their applications, *Discrete Math Seminar*, IBS Discrete Mathematics Group, Daejeon, South Korea.
- Oct. 21, 2021  $\Gamma$ -graphic delta-matroids and their applications, *2021 KMS Annual Meeting*, Online, South Korea.

### Organizing Academic Events

- 2025 Fall–current Co-organizing the Algebra Seminar at Georgia Tech
- Jul. 29–Aug. 2, 2024 Co-organizing **2024 Korean Student Combinatorics Workshop**, Gongju, South Korea.

### Teaching

- 2026 Spring Applied Combinatorics (Math3012 D/E), *Georgia Tech*.  
Directed Reading Program (mentored an undergraduate student through a semester-long reading project), *Georgia Tech*.

2025 Fall	Introduction to Linear Algebra (Math1553 B/C), <i>Georgia Tech.</i>
2025 Summer	Algebra, Summer Edge Program (intensive review of undergraduate-level abstract algebra for incoming graduate students), <i>Georgia Tech.</i>
2023 Fall	TA, Introduction to Graph Theory (MAS477), <i>KAIST.</i>
2023 Summer	TA, 2023 Third International Summer School for Advanced Undergraduate Students – Topological Methods in Combinatorics, <i>KAI-X Mathematics Global Workshop</i> (July 31st – August 3rd).
2023 Spring	TA, Linear Algebra (MAS212), <i>KAIST.</i>
2022 Fall	TA, Logic and Set Theory (MAS270), <i>KAIST.</i>
2022 Spring	TA, Discrete Mathematics (MAS275), <i>KAIST.</i>
2021 Fall	TA, Probability and Statistics (CC511), <i>KAIST.</i> TA, Introduction to Linear Algebra (MAS109), <i>KAIST.</i>
2021 Spring	TA, Differential Equations and Applications (MAS201), <i>KAIST.</i> TA, Discrete Mathematics (MAS275), <i>KAIST.</i>
2020 Fall	TA, Calculus I (MAS101), <i>KAIST.</i> TA, Introduction to Graph Theory (MAS477), <i>KAIST.</i>
2020 Spring	TA, Introduction to Linear Algebra (MAS109), <i>KAIST.</i> ( <b>Excellent TA Award</b> ) TA, Discrete Mathematics (MAS275), <i>KAIST.</i>
2019 Fall	TA, Introduction to Linear Algebra (MAS109), <i>KAIST.</i> TA, Linear Algebra (MAS212), <i>KAIST.</i>
2019 Spring	TA, Calculus I (MAS101), <i>KAIST.</i>

### Review Activities

Journals	Bull. Iranian Math. Soc. European J. Combin. Algr. Combin. Theoret. Comput. Sci. Discrete Appl. Math. J. Combin. Theory Ser. B Graphs Combin. Studia Sci. Math. Hungar. Inform. and Comput.
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Conferences	2026 FPSAC (2) 2025 SODA 2024 WG 2023 WALCOM 2023 MFCS
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### Math Posts

Apr. 27, 2026	Unimodular matrix representations for pseudo-orientable ribbon graphs - <a href="#">A guest post in the Matroid Union</a>
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Mar. 16, 2026      What are the cycles of ribbon graphs? - [A guest post in the Matroid Union](#)

### Miscellaneous

Design      KAIST 45th Anniversary Emblem Contest - [Prize winner \(Jan. 6th, 2016\)](#)  
KAIST Dept. of Mathematical Sciences Logo Design Contest - [2nd award \(Nov. 29th, 2021\)](#)

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