

CURRICULUM VITAE

KYUNGYONG LEE

Work address : Department of Mathematics, University of Alabama
345 Gordon Palmer Hall, AL 35487-0350
Email address : kyungyong.lee@ua.edu
Citizenship : South Korea (U.S. permanent resident)

Education

- 2003-2008 University of Michigan
Ph.D. in Mathematics
Thesis advisor : Robert Lazarsfeld
- 2000-2002 Military service
- 1996-2000 Seoul National University, Korea
B.S. in Mathematics.

Employment

- Tenured Associate Professor, University of Alabama, 2019–present.
- Tenure-track Assistant Professor, University of Nebraska–Lincoln, 2016 – 2019.
- KIAS Scholar, Korea Institute for Advanced Study, 2015 – present.
- Tenure-track Assistant Professor, Wayne State University, 2011 – 2015.
- Postdoctoral Fellow, University of Connecticut, 2010 – 2011.
- Research Assistant Professor, Purdue University, 2008 – 2010.
- Graduate Student Instructor, University of Michigan, 2003 – 2008.

Visiting Position

- CMC Visiting Professor, KIAS, Seoul, South Korea, 2014 – 2015.

Research Interests

- Algebraic geometry / Commutative algebra / Non-commutative algebras
- Cluster algebras / Representation theory

- Knot Theory / Topology / Mathematical physics
- Algebraic combinatorics

Grants, Honors and Awards

- NSF research grant DMS 1800207, \$150,000, 2018–2021.
- University of Nebraska Collaboration Planning Grant “Finding order in chaos: a systematic approach to turbulence control” (one of five PI/co-PIs), 2018–2019.
- NSA research grant H98230-14-1-0323, \$40,000, 2014–2017.
- AMS Centennial Fellowship, \$95,700, 2015–2016.
- University Research Grant from Wayne State University, \$10,000, 2013–2014.
- NSF research grant DMS 0901367, \$91,157, 2009 – 2013.
- First prize, Korea National Mathematics Exam for College Students, 1997 (one of two winners).
- Silver medal at International Mathematical Olympiad, Canada 1995.
- Bronze medal at International Mathematical Olympiad, Hong Kong 1994.

Publications

- (1) (with Robert Lazarsfeld) Local syzygies of multiplier ideals, *Invent. Math.* **167** (2007), no. 2, 409–418.
- (2) A short note on containment of cores, *Comm. Algebra.* **36** (2008), no. 10, 3890–3892.
- (3) On the realization of line arrangements as multiplier ideals, Thesis (Ph.D.)—University of Michigan. 2008. 84 pp. ISBN: 978-0549-81780-2.
- (4) Characteristic 2 approach to bivariate interpolation problems, *Ricerche di Matematica.* **57** (2008), no. 1, 81–93.
- (5) (with Robert Lazarsfeld and Karen E. Smith) Syzygies of multiplier ideals on singular varieties, *Mich. Math. J.* **57** (2008), 511–522.
- (6) The degrees of plane curves with prescribed log canonical threshold, *J. Algebra.* **322** (2009), 4205–4218.
- (7) The singularities of the principal component of the Hilbert scheme of points, *J. Algebra.* **324** (2010), no. 6, 1347–1363.
- (8) (with Li Li) On the diagonal ideal of $(\mathbb{C}^2)^n$ and q, t -Catalan numbers, DMTCS Proceedings, 22nd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2010), 881–888.
- (9) (with Li Li) q, t -Catalan numbers and generators for the radical ideal defining the diagonal locus of $(\mathbb{C}^2)^n$, *Electron. J. Combin.* **18** (2011), no. 1, Paper 158, 34 pp.
- (10) On cluster variables of rank two acyclic cluster algebras, *Ann. Comb.* **16** (2012), no. 2, 305–317.
- (11) (with Ralf Schiffler) A combinatorial formula for rank 2 cluster variables, *J. Alg. Com.* **37** (2013), no. 1, 67–85.

- (12) (with Ralf Schiffler) Proof of a positivity conjecture of M. Kontsevich on noncommutative cluster variables, *Compos. Math.* **148** (2012), 1821–1832.
- (13) (with Li Li and Nicholas A. Loehr) Limits of Modified Higher q, t -Catalan Numbers, *Electron. J. Combin.* **20** (2013), no. 3, Paper 4, 23 pp.
- (14) (with Li Li) On natural maps from strata of quiver Grassmannians to ordinary Grassmannians, *Noncommutative birational geometry, representations and combinatorics*, 199–214, *Contemp. Math.*, 592, Amer. Math. Soc., Providence, RI, 2013.
- (15) (with Li Li and Andrei Zelevinsky) Greedy elements in rank 2 cluster algebras, *Selecta Math.* (N.S.) **20** (2014), no. 1, 57–82.
- (16) (with Li Li and Nicholas A. Loehr) Combinatorics of certain higher q, t -Catalan polynomials: chains, joint symmetry, and the Garsia-Haiman formula, *J. Alg. Comb.* **39** (2014), 749–781.
- (17) (with Ralf Schiffler) Positivity for cluster algebras of rank 3, *Publ. Res. Inst. Math. Sci.* **49** (2013), 601–649.
- (18) (with Li Li and Andrei Zelevinsky) Positivity and tameness in rank 2 cluster algebras, *J. Alg. Comb.* **40** (2014), 823–840.
- (19) (with Li Li, Dylan Rupel and Andrei Zelevinsky) Greedy bases in rank 2 quantum cluster algebras, *PNAS* **111** (2014) 9712–9716.
- (20) (with Ralf Schiffler) Positivity for cluster algebras, *Annals of Math.* **182** (1), (2015) 73–125.
- (21) (with Ilke Canakci and Ralf Schiffler) On cluster algebras from unpunctured surfaces with one marked point, *Proc. Amer. Math. Soc. Ser. B* **2** (2015) 35–49.
- (22) (with Li Li and Matthew R. Mills) A Combinatorial Formula for Certain Elements of Upper Cluster Algebras, *SIGMA* **11** (2015), 049, 24 pages.
- (23) (with Li Li, Dylan Rupel and Andrei Zelevinsky) The existence of quantum greedy bases in rank 2 cluster algebras, *Adv. Math.* **300** (2016), 360–389.
- (24) (with Seok-Jin Kang and Kyu-Hwan Lee) A combinatorial approach to root multiplicities of rank 2 hyperbolic Kac-Moody algebras, *Comm. Algebra.* **45** (2017) 4785–4800.
- (25) (with Li Li and Ba Nguyen) New Combinatorial Formulas for Cluster Monomials of Type A Quivers, *Electron. J. of Combin.* **24**(2) (2017), #P2.42.
- (26) (with Li Li and Nicholas A. Loehr) A Combinatorial Approach to the Symmetry of q, t -Catalan Numbers, *SIAM J. Discrete Math.* **32**(1) (2018) 191–232.
- (27) (with Kyu-Hwan Lee) A correspondence between rigid modules over path algebras and simple curves on Riemann surfaces, *Experimental Math.*, 10.1080/10586458.2018.1538910.
- (28) (with Kyu-Hwan Lee) Rigid reflections and Kac-Moody algebras, *Sci. China Math.* **62** (2019), 1317–1330.
- (29) (with Ralf Schiffler) Cluster algebras and Jones polynomials, *Selecta Math.* **25** (2019) Article number: 58.
- (30) (with Li Li, Matthew Mills, Ralf Schiffler, and Alexandra Seceleanu) Frieze varieties : A characterization of the finite-tame-wild trichotomy for acyclic quivers, *Advances in Math.*, accepted.
- (31) (with Sergey Fomin and Kiyoshi Igusa) Universal quivers, submitted.
- (32) (with Seongjune Han, Li Li and Nicholas A. Loehr) Chain Decompositions of q, t -Catalan Numbers via Local Chains, submitted.
- (33) (with Li Li and Ralf Schiffler) Newton polytopes of rank 3 cluster variables, submitted.

- (34) (with George D. Nasr and Jamie Radcliffe) A Combinatorial Formula for Kazhdan-Lusztig Polynomials of ρ -Removed Uniform Matroids, submitted.

Invited talks

- (1) Workshop on integral closure, core and multiplier ideals, American Institute of Mathematics, December 2006
- (2) Joint Algebraic Geometry / Commutative Algebra seminar, Purdue University, September 2007
- (3) Algebraic Geometry seminar, University of Illinois, Urbana-Champaign, October 2007
- (4) Mathematics Department Colloquium, University of Michigan-Flint, January 2008
- (5) Special Session on Algebraic Geometry of Matrices and Determinants, Southeastern AMS Meeting, Baton Rouge, LA, March 2008
- (6) Mathematics Department Colloquium, University of South Florida, September 2008
- (7) Algebraic Geometry / Commutative Algebra seminar, University of Notre Dame, October 2008
- (8) Algebra and Geometry Seminar, University of Kentucky, December 2008
- (9) Algebra, Geometry and Combinatorics Seminar, University of Illinois, Urbana-Champaign, April 2009
- (10) Algebra Seminar, University of Kansas, September 2009
- (11) Combinatorics Seminar, University of Kansas, September 2009
- (12) Algebraic Geometry Seminar, University of Illinois, Chicago, October 2009
- (13) Algebra Combinatorics and Geometry Seminar, University of Pittsburgh, October 2009
- (14) Combinatorics/Partitions Seminar, Penn State University, October 2009
- (15) Philadelphia Combinatorics and Algebraic Geometry (CAGE) seminar, University of Pennsylvania, October 2009
- (16) Route 81 Conference on Algebraic Geometry and Commutative Algebra, Syracuse University, October 2009
- (17) Special Session on Algebraic Geometry, Joint Meeting of the AMS and Korean Mathematical Society, Seoul, South Korea, Dec 2009
- (18) Session on Algebraic Combinatorics, CMS Summer Meeting, June 2010
- (19) Algebra Seminar, University of Connecticut, Sep 2010
- (20) Mathematics Department Colloquium, Central Michigan University, January 2011
- (21) Mathematics Department Colloquium, Wayne State University, February 2011
- (22) Algebraic Geometry Seminar, Princeton University, March 2011
- (23) Algebraic Geometry Seminar, Ohio State University, May 2011
- (24) Mathematics Department Colloquium, Wayne State University, September 2011
- (25) Special Session on Commuting matrices and Hilbert schemes, AMS Spring Meeting, Boston College, 2013.
- (26) Cluster algebra seminar at the University of Connecticut in 2013.
- (27) Colloquium at Oakland University, 2013.
- (28) Algebra seminar at the University of Connecticut in March 2014.
- (29) Conference at CRM, Montreal in May 2014.
- (30) Invited lecture series in algebra seminar at KIAS in July 2014.

- (31) Colloquium at Sogang University, Korea in September 2014.
- (32) Colloquium at Sungkyunkwan University, Korea in October 2014.
- (33) Colloquium at the University at Buffalo in November 2014.
- (34) Invited lecture in an advanced winter school at KIAS in December 2014.
- (35) Colloquium talk at the University at Toronto in January 2015.
- (36) Combinatorics seminar at MIT, January 2015.
- (37) Colloquium talk at Michigan State University in January 2015.
- (38) Colloquium talk at the University at Virginia in January 2015.
- (39) Colloquium talk at the University at Nebraska-Lincoln in January 2015.
- (40) Colloquium talk at the Texas A&M University in February 2015.
- (41) Colloquium talk at the University of Connecticut in February 2015.
- (42) 4-hour lecture series in an advanced winter school at KIAS in February 2015.
- (43) Colloquium talk at KAIST, Korea in March 2015.
- (44) 2 seminar talks and a colloquium talk at NIMS, Korea in March 2015.
- (45) Sino-Korea International Conference on Number Theory and Algebraic Geometry, Academy of Mathematics and System Science, Beijing, China, May 2015.
- (46) Commutative Algebra Seminar at the University at Nebraska-Lincoln in November 2015.
- (47) Combinatorics Seminar, Kansas State University, April 2016.
- (48) Smith Colloquium, University of Kansas, April 2016.
- (49) Special Session on Combinatorial Ideals and Applications, AMS Spring Central Sectional Meeting at North Dakota State University, April 2016.
- (50) Lecture series, Zhejiang University, China, May 2016.
- (51) 2016 Combinatorics Workshop, KAIST, Korea, July 2016.
- (52) Plenary speaker, The 17th International Conference on Representations of Algebras, Syracuse, August 2016.
- (53) Commutative Algebra Seminar, University of Nebraska-Lincoln, September 2016.
- (54) Commutative Algebra Seminar, University of Nebraska-Lincoln, March 2017.
- (55) Landscape Seminar, University of Nebraska-Lincoln, March 2017.
- (56) Special Session on Cluster Algebras in Representation Theory and Combinatorics, AMS Sectional Meeting at Hunter College in New York, May 2017.
- (57) 5-hour short course, Cluster Algebra Spring School, University of Connecticut, May 2017.
- (58) The 2017 Midwest Combinatorics Conference, Minnesota, May 2017.
- (59) US-Mexico Conference on Representation theory, Categorification, and Noncommutative Algebra, Centro de Investigacion en Matematicas (CIMAT) in Guanajuato, Mexico, June 2017.
- (60) Topology seminar, Seoul National University, June 2017.
- (61) The international workshop on cluster algebras and related topics, Chern Institute of Mathematics at Nankai University, Tianjin, China, July 2017.
- (62) Public Lecture, Korean Mathematical Olympiad, KAIST, Korea, August 2017.
- (63) Special Session on Non-commutative birational geometry, Cluster algebras, and Canonical bases, AMS Sectional Meeting at University of California, Riverside, November 2017.

- (64) Algebraic combinatorics and Mathematical physics seminar, University of Nebraska-Lincoln, November 2017.
- (65) Mathematics Colloquium, University of Florida, February 2018.
- (66) Mathematics Colloquium, George Mason University, February 2018.
- (67) CombinaTexas Conference, Texas A&M University, February 2018.
- (68) Mathclub Talk, University of Nebraska-Kearney, March 2018.
- (69) Mathematics Colloquium, Texas State University San Marcos, September 2018.
- (70) KUMUNU commutative algebra conference, University of Kansas, October 2018.
- (71) Combinatorics and beyond: the many facets of Sergey Fomin's mathematics, University of Michigan, November 2018.
- (72) Cluster Algebras 2019, RIMS, Kyoto, June 2019.
- (73) Colloquium, IBS-CGP, Pohang, South Korea, August 2019.
- (74) AMS sectional meeting, Madison, WI, September 2019.
- (75) Representation Theory Seminar, Seoul National University, South Korea, December 2019.

Teaching

- (before joining UA) Topics in algebra, Algebraic geometry, Graduate algebra, Advanced Linear algebra, Undergraduate algebra, Number theory, Discrete mathematics, Multivariable calculus, Linear algebra, Differential equations, Calculus, Pre-calculus
- (at UA) Math 301, 371, 674

Students supervised

- Masters students : Chris Creighton (2013), Daniel Puig-Pey (2014)
- PhD students :
 - Ba Nguyen (graduated in 2016, currently a postdoc at Queens University, Canada)
 - Matthew R. Mills (graduated in 2018, currently a NSF postdoc at Michigan State University)
 - Su Ji Hong (current), George Nasr (current), Tucker Ervin (current), Son Nguyen (current)

Selected Services

- co-organizer of the KIAS workshop on algebra-geometry-combinatorics, Seoul, 2019.
- co-organizer of the workshop on Invariants in Low-dimensional Topology, Seoul, 2017.
- NSA grant panel, 2015–2016.
- FPSAC Program Committee, 2014–2015.

- organizer of the workshop on Positivity in Algebraic Combinatorics, Seoul, 2016.
- organizer of the Conference on Strings, Quivers and Cluster Algebras in Mathematical Physics, Seoul, 2014.
- organizer of the Conference on Cluster Algebras in Combinatorics and Topology, Seoul, 2014.
- organizer of the Conference on Cluster Algebras and Representation Theory, Seoul, 2014.
- co-organizer of special session “Cluster algebras and related combinatorics” in the AMS Western sectional meeting, 2013
- Referee for journals including *Compositio Math*, *Adv. Math.*, *Selecta Math.*, *Algebra & Number Theory*, *IMRN*, *Journal of Geometric Analysis*, *Proc. Amer. Math. Soc.*, *Combinatorial Theory series A*, *Combinatorial Theory series B*, *J. Alg. Comb.*, *Electronic Journal of Combinatorics*, *Linear Algebra Appl.*, and *J. Approx. Theory*.
- Graduate Committee, Colloquium organizer, Algebra seminar organizer (6 times), Algebra-Geometry-Topology-Combinatorics seminar organizer (5 times), GTA supervision committee (3 times), Algebra Prelim Committee, Putnam coach (5 times)
- Referee for NSA grant proposals and an Odysseus (Flemish FWO) grant proposal
- Reviewer for MathSciNet (49 articles) and Zentralblatt MATH (20 articles)

Computer Skills

- C++, Macaulay 2, SAGE, Maple, Matlab, Singular