

Ji Oon Lee

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Current Position

- Professor, Department of Mathematical Sciences, KAIST, Republic of Korea
Sep. 2020 -
- Director, Stochastic Analysis and Application Research Center, KAIST, Republic of Korea
Jun. 2019 -

Professional Experience

- Affiliate Professor, School of Mathematics, KIAS, Republic of Korea
Sep. 2019 - Aug. 2021
- Visiting Scholar, Department of Mathematics, University of Michigan, Ann Arbor, USA
Sep. 2014 - Jul. 2015
- Visiting Scholar, Department of Mathematics, Harvard University, USA
Jan. 2012 - Jun. 2012
- Associate Professor, Department of Mathematical Sciences, KAIST, Republic of Korea
Sep. 2014 - Aug. 2020
- Assistant Professor, Department of Mathematical Sciences, KAIST, Republic of Korea
Jul. 2010 - Aug. 2014

Education

Harvard University, USA, Sep. 2005 - May. 2010

- Ph.D. in Mathematics

Seoul National University, Republic of Korea, Mar. 1998 - Feb. 2002

- B.S. in Physics and Mathematics, summa cum laude

Awards and Honors

- KAIST Endowed Chair Professor, 2020 - 2022
- Member of Young Korean Academy of Science and Technology, 2019 -
- Young Scientist Award, Korean Academy of Science and Technology, 2018
- Excellent Research Paper Award, The Korean Mathematical Society, 2017
- 30 Young Scientists of Korea Award in Mathematics, 2016
- Research Grant from Samsung Science and Technology Foundation, 2014 - 2019
- Sangsan Prize for Young Mathematicians, The Korean Mathematical Society, 2014
- TJ Park Science Fellowship for Young Assistant Professors, 2014 - 2015
- Teaching Award, College of Natural Science, KAIST, 2012, 2015, 2018
- Basic Science Research Grant from the National Research Foundation of Korea, 2011 - 2014
- Samsung Scholarship for Abroad Doctoral Research, 2005 - 2009
- KFAS Undergraduate Student Scholarship, 2000 - 2002
- Silver Medal, International Mathematical Olympiad, 1997

Research Interests

- Probability Theory:
Random Matrix Theory, Spin Glass
- Mathematical Physics:
Quantum Dynamics, Bose–Einstein Condensation
- Machine Learning, Information Theory, Statistics Theory

Publications

- *Spectral Properties and Weak Detection in Stochastic Block Models* (with Y. Han and W. Yang)
Preprint - arXiv:2309.08183 (2023)
- *Fluctuations of the free energy of the spherical Sherrington-Kirkpatrick model with sparse interaction* (with H. Kim)
Preprint - arXiv:2305.11384 (2023)
- *Central limit theorem for eigenvalue statistics of sample covariance matrix with random population* (with Y. Li)
Preprint - arXiv:2211.05546 (2022)
- *Phase transition in the generalized stochastic block model* (with S. M. Lee)
To appear in Journal of Applied Probability, Preprint - arXiv:2206.09566 (2022)
- *Asymptotic normality of log likelihood ratio and fundamental limit of the weak detection for spiked Wigner matrices* (with H. W. Chung and J. Lee)
Preprint - arXiv:2203.00821 (2022)
- *Weak detection in the spiked Wigner model with general rank* (with J. H. Jung and H. W. Chung)
Preprint - arXiv:2001.05676 (2020)
- *Real eigenvalues of elliptic random matrices* (with S.-S. Byun, N.-G. Kang, and J. Lee)
International Mathematics Research Notices, **2023(3)**, 2243-2280 (2023)
- *Spherical Sherrington-Kirkpatrick model for deformed Wigner matrix with fast decaying edges* (with Y. Li)
Journal of Statistical Physics, **190**, 35 (2023)
- *Weak detection in the spiked Wigner model* (with H. W. Chung)
IEEE Transactions on Information Theory, **68**, 7427-7453 (2022)
- *Extremal eigenvalues of sample covariance matrices with general population* (with J. Kwak and J. Park)
Bernoulli, **27**, 2740-2765 (2021)
- *Detection of signal in the spiked rectangular models* (with J. H. Jung and H. W. Chung)
Proceedings of Machine Learning Research, **139: ICML**, 5158-5167 (2021)
- *Free energy of bipartite spherical Sherrington-Kirkpatrick model* (with J. Baik)
Annales de l'Institut Henri Poincaré - Probabilités et Statistiques, **56**, 2897-2934 (2020)
- *Central limit theorem for linear spectral statistics of deformed Wigner matrices* (with H. C. Ji)
Random Matrices: Theory and Applications, **9**, 2050011 (2020)
- *Local law and Tracy-Widom limit for sparse stochastic block models* (with J. Y. Hwang and W. Yang)
Bernoulli, **26**, 2400-2435 (2020)
- *Local law and Tracy-Widom limit for sparse sample covariance matrices* (with J. Y. Hwang and K. Schnelli)
Annals of Applied Probability, **29**, 3006-3036 (2019)
- *Weak detection of signal in the spiked Wigner model* (with H. W. Chung)
Proceedings of Machine Learning Research, **97: ICML**, 1233-1241 (2019)
- *Ferromagnetic to paramagnetic transition in spherical spin glass* (with J. Baik and H. Wu)
Journal of Statistical Physics, **173**, 1484-1522 (2018)
- *Trade-offs between query difficulty and sample complexity in crowdsourced data acquisition* (with H. W. Chung, D. Kim, and A. O. Hero)
Annual Allerton Conference on Communication, Control, and Computing, 639-646 (2018)
- *Fundamental limits on data acquisition: Trade-offs between sample complexity and query difficulty* (with H. W. Chung and A. O. Hero)

- IEEE International Symposium on Information Theory (ISIT), 681-685 (2018)
- *Local law and Tracy–Widom limit for sparse random matrices* (with K. Schnelli)
Probability Theory and Related Fields, **171**, 543-616 (2018)
- *Rate of convergence towards Hartree dynamics with singular interaction potential* (with L. Chen and J. Lee)
Journal of Mathematical Physics, **59**, 031902 (2018)
- *Fluctuations of the free energy of the spherical Sherrington–Kirkpatrick model with ferromagnetic interaction* (with J. Baik)
Annales Henri Poincaré, **18**, 1867-1917 (2017)
- *Tracy–Widom distribution for the largest eigenvalue of real sample covariance matrices with general population* (with K. Schnelli)
Annals of Applied Probability, **26**, 3786-3839 (2016)
- *Fluctuations of the free energy of the spherical Sherrington–Kirkpatrick model* (with J. Baik)
Journal of Statistical Physics, **165**, 185-224 (2016)
- *Bulk universality for deformed Wigner matrices* (with K. Schnelli, B. Stetler, and H.-T. Yau)
Annals of Probability, **44**, 2349-2425 (2016)
- *Extremal eigenvalues and eigenvectors of deformed Wigner matrices* (with K. Schnelli)
Probability Theory and Related Fields, **164**, 165-241 (2016)
- *Edge universality for deformed Wigner matrices* (with K. Schnelli)
Reviews in Mathematical Physics, **27**, 1550018 (2015)
- *A necessary and sufficient condition for edge universality of Wigner matrices* (with J. Yin)
Duke Mathematical Journal, **163**, 117-173 (2014)
- *Measuring Large Optical Transmission Matrices of Disordered Media* (with H. Yu, T. R. Hillman, W. Choi, M. S. Feld, R. R. Dasari, Y. Park)
Physical Review Letters, **111**, 153902 (2013)
- *Local deformed semicircle law and complete delocalization for Wigner matrices with random potential* (with K. Schnelli)
Journal of Mathematical Physics, **54**, 103504 (2013)
- *Rate of convergence towards semi-relativistic Hartree dynamics*
Annales Henri Poincaré, **14**, 313-346 (2013)
- *Rate of convergence towards Hartree dynamics* (with L. Chen and B. Schlein)
Journal of Statistical Physics, **144**, 872-903 (2011)
- *Rate of convergence in nonlinear Hartree dynamics with factorized initial data* (with L. Chen)
Journal of Mathematical Physics, **52**, 052108 (2011)
- *A lower bound on the ground state energy of dilute Bose gas* (with J. Yin)
Journal of Mathematical Physics, **51**, 053302 (2010)
- *Ground state energy of dilute Bose gas in small negative potential case*
Journal of Statistical Physics, **134**, 1-18 (2009)

Conferences/Workshops Organized

- Symposium on interacting stochastic systems - Conference in Honor of S. R. S. Varadhan's 80th Birthday, Jeju, Jun. 2022
- Workshop on stochastic analysis and PDE, Virtual, Nov. 2021
- Random matrices and related topics, Seoul, May. 2019
- KAIST summer school in probability, Daejeon, Jul. 2018

Selected Talks

- “Universality and non-universality in random matrix models” in KMS Fall Meeting, Seoul, Oct. 2023 (Plenary)
- “Weak detection in spiked Wigner models” in Workshop on Random Structures and Related Topics, Hanoi/Virtual, Jul. 2022

- “Random matrix, spin glass, and signal detection” in KMS Fall Meeting, Virtual, Oct. 2023 (Special)
- “Detection of signal in the spiked rectangular models” in International Conference on Machine Learning, Virtual, Jul. 2021 (Spotlight)
- “Local law and Tracy–Widom limit for sparse stochastic block models” in Bernoulli-IMS 10th World Congress in Probability and Statistics, Virtual, Jul. 2021
- “Weak detection of signal in the spiked Wigner model” in International Conference on Machine Learning, Long Beach, Jun. 2019 (Oral)
- “Weak detection of signal in the spiked Wigner model” in KAIST-HKUST-NUS Joint Workshop in Mathematics, Daejeon, Oct. 2018
- “Free energy of spherical Sherrington–Kirkpatrick model” in International Congress on Mathematical Physics, Montréal, Jul. 2018 (Contributed)
- “Free energy of spherical spin glass model” in Toyko-Seoul Conference in Mathematics, University of Tokyo, Tokyo, Dec. 2017
- “Spherical spin glass with ferromagnetic interaction” in Probability and Statistics Session, 2017 KMS Fall Meeting, Cheonan, Oct. 2017
- “Random matrix theory” in CMC Foundations for Mathematical Challenges, Korea Institute for Advanced Study, Seoul, Aug. 2017
- “Universality in random matrix theory” in 3rd Korean-American Kavli Frontiers of Science Symposium, US National Academy of Sciences, Irvine, Jun. 2017
- “Fluctuation of the free energy of the spherical spin glass model” in International Conference on Statistical Physics, Lyon, Jul. 2016 (Contributed)
- “Fluctuation of the free energy in spherical spin glass” in 4th Bielefeld-SNU Joint Workshop, Bielefeld, Feb. 2016
- “Phase transition in spherical spin glass model” in Master Lectures on the Current Topics in Mathematical Physics and Probability, Tsinghua Sanya International Mathematical Forum, Sanya, Dec. 2015
- “Tracy–Widom distribution for sample covariance matrices” in Probability and Statistics Session, 2015 KMS Spring Meeting, Busan, Apr. 2015
- “Fluctuations of the free energy of spherical spin glass” in Analysis/Probability Seminar, University of Michigan, Ann Arbor, Apr. 2015
- “Tracy–Widom distribution for sample covariance matrices with general population” in Probability Seminar, University of Wisconsin, Madison, Mar. 2015
- “Extremal eigenvalues of deformed Wigner matrices” in Seminar Talks, IST Austria, Klosterneuburg, Feb. 2015
- “Tracy–Widom distribution for real sample covariance matrices with general population” in Center of Mathematical Sciences and Applications Random Matrix & Probability Theory Seminar, Harvard University, Cambridge, Oct. 2014
- “Largest eigenvalues of deformed Wigner matrices” in Analysis/Probability Seminar, University of Michigan, Ann Arbor, Sep. 2014
- “Extremal eigenvalues and eigenvectors of deformed Wigner matrices” in International Congress of Mathematicians, Seoul, Aug. 2014 (Contributed)
- “Random matrix theory - (1) Universality in random matrix / (2) Wigner matrices with random potential” in RIMS Workshop - Applications of Renormalization Group Methods in Mathematical Sciences, Kyoto, Sep. 2013
- “Local deformed semicircle law for Wigner matrices with random potential” in International Conference on Statistical Physics, Seoul, Jul. 2013 (Contributed)
- “Edge universality for Wigner matrices” in Mathematics Colloquium, University of Illinois, Urbana-Champaign, Jan. 2013
- “Edge universality of heavy-tailed Wigner matrices” in Mathematics Colloquium, University of California, Davis, Jan. 2013

- “Rate of convergence in Hartree dynamics” in Mathematical Physics Seminar, University of Texas, Austin, Jan. 2013
- “Edge universality for heavy-tailed random matrices” in International Congress on Mathematical Physics, Aalborg, Aug. 2012 (Contributed)
- “Rate of convergence in semi-relativistic Hartree dynamics” in Fudan-KAIST Workshop on Applied Mathematics, Fudan University, Shanghai, Jul. 2012
- “Ground state energy of Bose gas” in Mathematics Seminar, Tsinghua University, Beijing, Dec. 2010
- “Many-body effects of the Bose gas” in Mathematics Seminar, Korea Institute for Advanced Study, Seoul, Aug. 2007

Sessions Organized/Chaired

- “Random matrices and related fields” in Bernoulli-IMS 10th World Congress in Probability and Statistics, Virtual, Jul. 2021 (Chair)
- “Theoretical analysis of random walks, random graphs and clustering” in Bernoulli-IMS 10th World Congress in Probability and Statistics, Virtual, Jul. 2021 (Organizer/Chair)

Professional Service

- Referee/Reviewer:
 Annales de l’Institut Henri Poincaré - Probabilités et Statistiques,
 Annals of Applied Probability, Annals of Statistics, Bernoulli,
 Communications in Mathematical Physics,
 Communications in Statistics - Theory and Methods,
 Conference on Neural Information Processing Systems (NeurIPS),
 Electronic Journal of Probability,
 IEEE Journal of Selected Topics in Signal Processing,
 International Conference on Machine Learning (ICML),
 International Symposium on Information Theory (ISIT),
 Journal of the American Statistical Association, Journal of Applied Probability,
 Journal of the Korean Mathematical Society, Journal of the Korean Statistical Society,
 Journal of Mathematical Physics, Journal of Statistical Physics,
 Latin American Journal of Probability and Mathematical Statistics,
 Lithuanian Mathematical Journal, Mathematical Reviews (AMS), Patterns,
 Probability Theory and Related Fields
- Mathematical Olympiad Teaching:
 Winter School - 2011, 2014, 2018
 Summer School - 2011, 2012, 2013, 2016, 2017, 2018
 Weekend Lecture - 2011, 2013, 2016, 2017

Teaching Experience

Assistant Professor / Associate Professor, KAIST

- MAS101, Calculus I, Spring 2013, Spring 2019
- MAS109, Introduction to Linear Algebra, Spring 2011 (as a coordinator)
- MAS241, Analysis I, Spring 2018, Spring 2019
- MAS242, Analysis II, Fall 2018, Fall 2019
- MAS442, Fourier Analysis and Applications, Fall 2013, Fall 2016
- MAS464, Mathematical Mechanics, Fall 2012, Fall 2015, Fall 2017, Fall 2021
- MAS540, Real Analysis, Spring 2011, Spring 2014, Spring 2016, Spring 2017, Spring 2021, Spring 2022, Spring 2023
- MAS550, Probability Theory, Fall 2017
- MAS583C, Topics in Mathematics - Random Matrix Theory, Fall 2013, Spring 2020

- MAS641, Functional Analysis, Fall 2010, Fall 2011, Fall 2012, Fall 2015, Fall 2016, Fall 2020, Fall 2022, Fall 2023
- MAS651, Theory of Stochastic Processes, Spring 2018

Teaching Fellow, Harvard University

- Math 1A, Introduction to Calculus, Fall 2007, Fall 2008, Fall 2009

Selected Conference Participation

- Allerton Conference on Communication, Control, and Computing, Monticello, 2018
- International Conference on Acoustics, Speech and Signal Processing (ICASSP), Calgary, 2018
- International Symposium on Information Theory (ISIT), Barcelona, 2016, Vail, 2018
- Quantum Information Processing, Barcelona, 2014
- Mathematical Statistical Physics, Kyoto, 2013
- 4th MSJ-SI Nonlinear Dynamics in Partial Differential Equations, Fukuoka, 2011
- Seminal Interactions between Mathematics and Physics, Rome, 2010
- Clay Mathematics Institute Summer School: Evolution Equations, Zürich, 2008
- Oberwolfach Seminar: Feynman Diagrams in Quantum Dynamics, Oberwolfach, 2008

Personal Information

- Date of Birth: Jan. 8, 1980. (Seoul, Republic of Korea)
- Citizenship: Republic of Korea
- Languages: English (fluent), Korean (native), Japanese (moderate)

Business Experience

- Software Director, Korea Trade Network, Seoul, Republic of Korea, May. 2003 - Jul. 2004
- Software Developer, LG CNS, Seoul, Republic of Korea, Jan. 2002 - May. 2003