Minsung Kim

CONTACT INFORMATION

Department of Mathematics,
Kungliga Tekniska Högskolan KTH
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RESEARCH INTERESTS

Parabolic dynamics and its connections with geometry and representation theory:
- Deviation of ergodic integrals, cohomological equations, and cocycle rigidity.

Dynamics on nilmanifolds and their probabilistic applications:
- Random walks and limit theorems on nilmanifolds.

Interactions with hyperbolic dynamics:
- Ruelle resonances and applications of transfer operator methods on anisotropic spaces.

ACADEMIC APPOINTMENT

KTH Royal Institute of Technology, Stockholm, Sweden. Oct. 2024 - present

- Post-doc research associate. (Mentor: Professor. Danijela Damjanović, Liviana Palmisano, and co-advised by Marco Martens.)

Scuola Normale Superiore, Pisa, Italy. Oct. 2022 - Oct. 2024.

- Junior visitor in Centro Ennio De Giorgi. (Mentor: Professor. Stefano Marmi.)

Nicolaus Copernicus University, Toruń, Poland. Jan. 2021 - Sep. 2022.

- Research associate. (Mentor: Professor. Krzysztof Frączek.)

EDUCATION

Ph.D. Mathematics, University of Maryland - College Park. Dec. 2020.

- Advisor: Professor. Giovanni Forni.
- Visiting doctorant, Institut de Mathematiques de Jussieu - Paris Rive Gauche.
  Oct 2017 - Aug 2018, Jan 2019 - June 2019.

M.S. Mathematics, North Carolina State University. May 2013
(Advisor: Professor. Robert H. Martin, Jr.)

B.S. Mathematics education, Pusan National University. Aug 2011
(Advisor: Professor. Jae Keol Park.)

Exchange student, University of Hawaii at Hilo, Mathematics. Fall 2009 - Spring 2010

PUBLICATIONS AND PREPRINTS

8. On invariant distributions of C^4 circle diffeomorphisms.
(with Marco Martens and Liviana Palmisano) preprint available

7. On rapid mixing for random walks on nilmanifolds.
(with Dmitry Dolgopyat and Spencer Durham) arXiv:2510.00398

6. Anisotropic spaces and nil-automorphisms (with Oliver Butterley)
Revision requested from *Nonlinearity* arXiv:2308.06630

5. Solving the cohomological equation for locally Hamiltonian flows, part II - global obstructions. (with Krzysztof Frączek)
Proceedings of the London Mathematical Society. DOI: 10.1112/plms.70094

4. Solving the cohomological equation for locally Hamiltonian flows, part I - local obstructions. (with Krzysztof Frączek)
Advances in Mathematics 446 (2024), 109668.

3. New phenomena for deviation of Birkhoff integrals for locally Hamiltonian flows. (with Krzysztof Frączek)
Journal für die reine und angewandte Mathematik (Crelle's Journal), vol. 2024, no. 807, 2024, pp. 81-149

2. Effective equidistribution for generalized higher step nilflows.
Ergodic Theory and Dynamical Systems, 42(12), 3656-3715, December 2022

1. Limit theorem for higher rank action on Heisenberg manifolds.
Discrete and Continuous Dynamical Systems - A, Vol. 42, No. 9, September 2022

Scholarship, Grant

Stiftelsen Magnusons fund (50K SEK), The Royal Swedish Academy of Sciences 2024
Hierta Retzius Foundation fund (30K SEK), Royal Swedish Academy of Sciences 2024
Scholarship from Carl Trygger's Foundation for Scientific Research 2024-26
Grant for experienced researchers from abroad, Nicolaus Copernicus University. 2021
Excellence Center 'Dynamics, Analysis and Artificial Intelligence'.
Dean's Fellowship, University of Maryland. 2013-14

Seminar and Conference talks

Special talk, Problems in parabolic dynamics, POSTECH, Pohang, Korea Nov 2025
Ergodic theory seminar, Nicolaus Copernicus University, Toruń, Poland Sep 2025
HCMC topology seminar, KIAS, Seoul, Korea Aug 2025
Job talk, Problems in parabolic dynamics, Yonsei University, Korea July 2025
Ergodic theory and Dynamical systems, POSTECH, Pohang, Korea May 2025
Workshop on Dynamics and Related Topics, NUS, Singapore Mar 2025
Winter Annual Conference on Dynamical Systems 2024, Fukuoka, Japan Jan 2025

Dynamics seminar, Seoul National University, Seoul, Korea Dec 2024
Mathematics RIT seminar series, Great Bay University, Dongguan, China Dec 2024
Geometry and Topology seminar, National University of Singapore (NUS) Aug 2024
New Frontiers in Parabolic Dynamics and Renormalization, Bologna, Italy June 2024
Dynamics and Number Theory seminar, Uppsala University, Sweden Mar 2024
Dynamics seminar, KTH Royal Institute of Technology, Stockholm, Sweden Feb 2024
Mini-workshop, Chern Institute of Mathematics, Tianjin, China Jan 2024

Dynamics (Dagger) seminar, University of Warwick, Warwick, U.K. Dec 2023
Probability/Dynamics seminar, Leiden University, Leiden, Netherlands Nov 2023
Mini-workshop, *Group actions and rigidity theory*, Nankai University Oct 2023
Regular and Stochastic Behaviour in Dynamical Systems, CRM, Italy June 2023
Short talk in conference, *Anosov Dynamics*, CIRM, Luminy, France Apr 2023
Geometry seminar, IBS-Center for Geometry and Physics, Pohang, Korea Jan 2023

Ergodic theory seminar, Nicolaus Copernicus University, Toruń, Poland Dec 2022
Special seminar for new junior visitors, Scuola Normale Superiore, Pisa Nov 2022
Zoominar in Dynamical Systems at Porto, Portugal June 2022
Ergodic theory and Dynamical systems, POSTECH, Pohang, Korea May 2022
Dynamics seminar, Centro De Giorgi(Sculola Normale Superiore), Pisa Apr 2022
Dynamics seminar, IMPAN(Polish Academy of Sciences), Warsaw, Poland Mar 2022

Probability seminar, IMPAN(Polish Academy of Sciences), Sopot, Poland Nov 2021
Analysis seminar, Saitama University, Saitama, Japan Oct 2021
Ergodic theory and Dynamical systems, POSTECH, Pohang, Korea Sep 2021
Seminar in Ergodic theory and Dynamical systems, KIAS, Seoul, Korea Aug 2021
Ergodic theory and Dynamical systems, Nicolaus Copernicus University Mar 2021

(2 talks) Toruń, Poland Feb 2021

Contriuted talk, Workshop in Dynamical Systems and Related Topics, PSU Sep 2019

Supervision

Stage de recherche (Master's research internship at KTH)

- Clara Spector (M1, École Polytechnique, France) Mar - Aug, 2025
  - Fast mixing systems and Central Limit Theorem via transfer operator methods.

Teaching Experience

Special topics course in dynamical systems. KTH.

- Cohomology in Dynamics, FSF3675 (instructor: Danijela Damjanović) 5 weeks
  Lectured on topics in cohomological equations, higher rank actions, and time-change flows. Spring 2025

Teaching Assistant. UMCP.

- Sole Contact Instructor - *Introduction to Probability (MATH 111)* Spring 2014
- Discussion Leader
  - *Calculus II (MATH 141)* Fall 2014, Spring 2015
  - *Differential Equations for Scientists and Engineers (MATH 246)* Sp 2016,20
  - *Calculus for Life Sciences II (MATH 131)* Spring 2017
  - *Calculus III (MATH 241)* Fall 2018, 2019, 2020
- Grader

  Advanced Calculus 1,2 (MATH 410, 411), Introduction to Dynamics and Chaos (MATH 452), Introduction to Topology (MATH 432), Differential Forms and Their Applications (MATH 437), Real Analysis I (MATH 630), Dynamical systems I* (MATH 642), Differential Geometry* (MATH 740)* * for grad course.
- Directed Reading Program Mentor

  Rebecca Hsu, Riemann mapping theorem. Summer 2014

Lecture Assistant. NCSU.

- Instructor - *Contemporary Mathematics (MA 103)* Summer II 2012
- Grader
  - *Introduction to Finite Mathematics with Applications (MA 114)* Spring 2013
  - *Calculus for Life and Management Sciences (MA 231)* Fall 2012

Service

Refereed journals: Communications in Mathematical Physics.

Experience

Organizer, Dynamical system seminar, KTH Royal Institute of Technology 2024-25
Organizer, seminari di Sistemi Dinamici, Scuola Normale Superiore - Uni.Pisa 2023
Student Dynamics Seminar Organizer, University of Maryland Fall 2015 - Fall 2016
Math tutor, University of Hawaii at Hilo Fall 2009 - Spring 2010
Republic of Korea Army, completion of military service July 2006 - July 2008

Language

Korean (native), English (fluent), French, Italian (elementary), Polish (beginner)