Kuan-Wen Lai

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Empolyment

Academia Sinica, Taiwan

Postdoc, September 1, 2023–present

Mentor: Yuan-Pin Lee

Universität Bonn, Deutschland

Postdoc, September 1, 2021–August 31, 2023

Mentor: Daniel Huybrechts / Part of the ERC Synergy Grant HyperK (ID: 854361).

University of Massachusetts Amherst, USA

Visiting Assistant Professor, September 1, 2018–August 31, 2021

Mentor: Eyal Markman

R.O.C. (Taiwan) Army, Taiwan

Obligatory military service, August 8, 2011–July 9, 2012

Education

Brown University, USA

Ph.D. Mathematics, May 27, 2018

Thesis: *Cremona transformations and rational parametrizations inspired by Hodge theory*.

Advisor: Brendan Hassett

Rice University, USA

Graduate student, August 2013–July 2015

Transferred to Brown University with thesis advisor Brendan Hassett.

Taida Institute for Mathematical Sciences, Taiwan

Research Trainee, August 2012–July 2013

Menter: Chin-Lung Wang

National Taiwan University, Taiwan

M.S. Mathematics, June 4, 2011

Thesis: *The Gromov-Witten Theory of* $\mathbb{P}^1$.

Advisor: Hui-Wen Lin

B.S. Physics, with minor in Mathematics, June 7, 2009

Research Interests

Algebraic geometry; currently working on problems related to twisted K3 surfaces, the K3 categories of cubic fourfolds, and Gushel–Mukai fourfolds.

Publications

Preprints

- On the irrationality of moduli spaces of projective hyperkähler manifolds (with Daniele Agostini and Ignacio Barros), https://arxiv.org/abs/2307.07391.
- Nielsen realization problem for derived automorphisms of generic K3 surfaces (with Yu-Wei Fan), https://arxiv.org/abs/2302.12663.
- Frobenius nonclassical hypersurfaces (with Shamil Asgarli and Lian Duan), https://arxiv.org/abs/2207.11981.

Publications / Accepted

1. Fourier–Mukai numbers of K3 categories of very general special cubic fourfolds (with Yu-Wei Fan), Israel Journal of Mathematics, accepted.
2. Transverse linear subspaces to hypersurfaces over finite fields (with Shamil Asgarli and Lian Duan), Finite Fields and Their Applications 95 (2024), Paper No. 102396.
3. New rational cubic fourfolds arising from Cremona transformations (with Yu-Wei Fan), Algebraic Geometry 10 (4) (2023), 432–460.
4. On the irrationality of moduli spaces of K3 surfaces (with Daniele Agostini and Ignacio Barros), Transactions of the American Mathematical Society 376 (2023), No. 2, 1407–1426.
5. Uniform potential density for rational points on algebraic groups and elliptic K3 surfaces (with Masahiro Nakahara), International Mathematics Research Notices 2022, no. 23, 18541–18588.
6. Bijective Cremona transformations of the plane (with Shamil Asgarli, Masahiro Nakahara, and Susanna Zimmermann), Selecta Mathematica, New Series 28, 53 (2022).
7. Decompositions of Lagrangian classes on K3 surfaces (with Yu-Shen Lin and Luca Schaffler), Mathematical Research Letters 28 (2021), no. 6, 1739–1763.
8. Transverse lines to surfaces over finite fields (with Shamil Asgarli and Lian Duan), manuscripta mathematica 165, 135–157 (2021).
9. Cremona transformations and derived equivalences of K3 surfaces (with Brendan Hassett), Compositio Mathematica 154 (2018), Issue 7, 1508–1533.
10. New cubic fourfolds with odd degree unirational parametrizations, Algebra & Number Theory 11 (2017), No. 7, 1597–1626.

Other Writings

- A tour of the rationality problem of cubic fourfolds — An expository article written for a series of lectures given at Academia Sinica during July 28–August 3, 2021.

Selected Talks

2024 Colloquium, National Sun Yat-Sen University, March 8

- Colloquium, National Kaohsiung Normal University, March 7
- Taiwanese Mathematical Society (TMS) Annual Meeting, National Chengchi University, January 22–23

- Taipei Postdoc Seminar, Academia Sinica & National Center for Theoretical Sciences (NCTS), January 3

2023 Student Geometry Seminar, National Tsing Hua University, November 16

- Algebraic Geometry in East Asia, Korea Institute for Advanced Study (KIAS), November 6–10

- NCTS Seminar in Algebraic Geometry, National Center for Theoretical Sciences (NCTS), September 22

- Algebra, geometry and number theory seminar, Universiteit Leiden, April 26

- Higher Dimensional Algebraic Geometry Workshop, National Center for Theoretical Sciences (NCTS), March 20–24

- Colloquium, National Central University, March 16

- Colloquium, National Cheng Kung University, March 9

2022 Birational Complexity of Algebraic Varieties, Simons Center for Geometry and Physics (SCGP), December 12–16

- Géométrie Algébrique et Géométrie Complexe, Centre International de Rencontres Mathématiques (CIRM), November 28–December 2

- Algebraic and Arithmetic Geometry Seminar, Universität Bielefeld, June 1

- Colloquium, National Tsing Hua University, March 21 (Online)

2021 Arithmétique et géométrie algébrique, Université de Strasbourg, December 9

- A tour of the rationality problem of cubic fourfolds, Academia Sinica, Taipei, Lecture series during July 28–August 3

- Seminar of Algebraic Geometry in East Asia, April 16 (Online)

2020 International Congress of Chinese Mathematicians (ICCM) at the University of Science and Technology of China, December 27–29 (Online)

- Mathematical Physics Seminar, Center of Mathematical Sciences and Applications (CMSA), April 20 (Online)

- Geometry, Physics, and Representation Theory Seminar, Northeastern University, January 23

- Colloquium, National Central University, Taiwan, January 9

2019 Front Range Algebraic Geometry and Number Theory (FRAGMENT) seminar, Colorado State University, December 12

- Algebra and Number Theory Seminar, Dartmouth College, September 17

- A Summer Day on Algebraic Geometry, Center for Advanced Study in Theoretical Sciences (CASTS), July 1

- NT & AG Seminar, Boston College, February 7

- Workshop on Moduli Spaces and Related Problems, Shanghai Center for Mathematical Sciences (SCMS), September 17–21

- Valley Geometry Seminar, UMass Amherst, March 2

2017 Mini-talk at Georgia Algebraic Geometry Symposium (GAGS), University of Georgia, March 3–5

- Yale Algebraic and Tropical Geometry, Yale University, February 16
- Princeton Algebraic Geometry Seminar, Princeton University, February 14
- Algebra and Algebraic Geometry Seminars, Brown University, February 10

2016 Algebra and Algebraic Geometry Seminars, Brown University, October 14

2013 Algebraic Geometry and Number Theory Seminar, Rice University, December 3

Other Activities

I have invited and hosted speakers for the following seminars:

- Seminar Algebraic Geometry, University of Bonn, Winter 2021–Summer 2023
- Valley Geometry Seminar, UMass Amherst, Fall 2018–Spring 2021

I have also helped organize the conference:

- Algebraic Geometry Northeastern Series, UMass Amherst, March 22–24, 2019

I have been invited to review papers or give quick opinions for Canadian Mathematical Bulletin, Crelle's Journal, European Journal of Mathematics, Geometry & Topology, Journal of Differential Geometry, Mathematische Zeitschrift, Selecta Mathematica, and some proceedings.

Teaching Experience

Universität Bonn

2022 Summer Semester, Birational Geometry of Algebraic Varieties

UMass Amherst

2021 Spring, Fundamental Concepts of Mathematics (Two sections)

2020 Fall, Independent Study on Algebraic Geometry, Andrew Tawfeek
- Fall, Fundamental Concepts of Mathematics (Two sections)
- Spring, Independent Study on Algebraic Geometry, Andrew Tawfeek
- Spring, Fundamental Concepts of Mathematics
- Spring, Multivariate Calculus

2019 Fall, Multivariate Calculus (Two sections)
- Spring, Calculus II (Two sections)

2018 Fall, Calculus I (Two sections)

Brown University

2017 Fall, Intermediate Calculus

2015 Fall, Introductory Calculus I

Rice University

2015 Summer, Single Variable Calculus II