

## Kuan-Wen Lai

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## Empolymnt & positions

National Center for Theoretical Science, Taiwan

Member affiliated with the Mathematics Division, 2025.03–present

Tunghai University, Taiwan

Assistant Professor, 2024.08.01–present

Academia Sinica, Taiwan

Postdoctoral Researcher, 2023.09.01–2024.07.31

Mentor: Yuan-Pin Lee

Universität Bonn, Deutschland

Postdoctoral Researcher, 1 September 2021–31 August 2023

Mentor: Daniel Huybrechts / Part of the ERC Synergy Grant [HyperK \(10.3030/854361\)](#).

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, 2011.08.08–2012.07.09

## 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, 2012.08–2013.07

Menter: Chin-Lung Wang

National Taiwan University, Taiwan

M.S. Mathematics, 2011.06.04

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

Advisor: Hui-Wen Lin

B.S. Physics, with minor in Mathematics, 2009.06.07

## Grants

- NSTC Research Project ([113-2115-M-029-003-MY3](#)), 2024.10.01–2027.07.31

## Research interests

My research area is Algebraic Geometry, with a focus on birational transformations, Fourier–Mukai transforms, and algebraic varieties over finite fields. Recently, I have been investigating problems related to the arithmetic and topology of Shimura varieties arising from K3 categories.

## Publications

### *Preprints*

- Nielsen realization problem for derived automorphisms of generic K3 surfaces (with Yu-Wei Fan), <https://arxiv.org/abs/2302.12663>.

### *Published / accepted*

1. On the irrationality of moduli spaces of projective hyperkähler manifolds (with Daniele Agostini and Ignacio Barros), *Épjournal de Géométrie Algébrique*, accepted.
2. Fourier–Mukai numbers of K3 categories of very general special cubic fourfolds (with Yu-Wei Fan), *Israel Journal of Mathematics*, accepted.
3. Frobenius nonclassical hypersurfaces (with Shamil Asgarli and Lian Duan), *Mathematische Zeitschrift* 309, 18 (2025).
4. Transverse linear subspaces to hypersurfaces over finite fields (with Shamil Asgarli and Lian Duan), *Finite Fields and Their Applications* 95 (2024), Paper No. 102396.
5. New rational cubic fourfolds arising from Cremona transformations (with Yu-Wei Fan), *Algebraic Geometry* 10 (4) (2023), 432–460.
6. 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.
7. 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.
8. Decompositions of Lagrangian classes on K3 surfaces (with Yu-Shen Lin and Luca Schaffler), *Mathematical Research Letters* 28 (2021), no. 6, 1739–1763.
9. Bijective Cremona transformations of the plane (with Shamil Asgarli, Masahiro Nakahara, and Susanna Zimmermann), *Selecta Mathematica, New Series* 28, 53 (2022).
10. Transverse lines to surfaces over finite fields (with Shamil Asgarli and Lian Duan), *manuscripta mathematica* 165, 135–157 (2021).
11. Cremona transformations and derived equivalences of K3 surfaces (with Brendan Hassett), *Compositio Mathematica* 154 (2018), Issue 7, 1508–1533.
12. New cubic fourfolds with odd degree unirational parametrizations, *Algebra & Number Theory* 11 (2017), No. 7, 1597–1626.

## Invited talks

2024 Algebraic Geometry in Taipei, National Taiwan University, December 2–6

- 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

## **Teaching & related activities**

### **Tunghai University**

2025 113-2 Calculus A (II) (Two sections)

- 113-2 Capstone Research Project
  - An undergraduate independent study course conducted as a weekly seminar. This semester, we are exploring the mathematics behind combinatorial games.
- 113-2 Mission Mars (I)
  - A course in collaboration with a science fair, as part of the "Mission Mars" event at the National Museum of Natural Science in November.
- UTAR  $\times$  Tunghai International-National Mathematics Competition
  - A math competition in July 2025 co-organized by my department and the UTAR Mathematics Society of Universiti Tunku Abdul Rahman (UTAR).

2024 113-1 Calculus A (I) (Two sections)

- 113-1 Mission Mars (II)

### **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

- Advisee: Andrew Tawfeek (Amherst College)
- Fall, Fundamental Concepts of Mathematics (Two sections)
- Spring, Independent Study on Algebraic Geometry
  - Advisee: Andrew Tawfeek (Amherst College)
- 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