

## Kuan-Wen Lai

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## Empolyment

Tunghai University, Taiwan

Assistant Professor, August 1, 2024–present

Academia Sinica, Taiwan

Postdoctoral Researcher, September 1, 2023–July 31, 2024

Mentor: Yuan-Pin Lee

Universität Bonn, Deutschland

Postdoctoral Researcher, September 1, 2021–August 31, 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, 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

My research field is Algebraic Geometry. Recently, I am focusing on problems related to the arithmetic and topology of Shimura varieties arising from K3 categories, especially their moduli spaces or stability conditions. These categories include the derived category of a K3 surface, the K3 category of a cubic fourfold, and more generally the Kuznetsov component of the derived category of a K3-type Fano fourfold.

## 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>.

### *Published / Accepted*

1. Frobenius nonclassical hypersurfaces (with Shamil Asgarli and Lian Duan), *Mathematische Zeitschrift*, accepted.
2. Fourier–Mukai numbers of K3 categories of very general special cubic fourfolds (with Yu-Wei Fan), *Israel Journal of Mathematics*, accepted.
3. Transverse linear subspaces to hypersurfaces over finite fields (with Shamil Asgarli and Lian Duan), *Finite Fields and Their Applications* 95 (2024), Paper No. 102396.
4. New rational cubic fourfolds arising from Cremona transformations (with Yu-Wei Fan), *Algebraic Geometry* 10 (4) (2023), 432–460.
5. 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.
6. 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.
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. Bijective Cremona transformations of the plane (with Shamil Asgarli, Masahiro Nakahara, and Susanna Zimmermann), *Selecta Mathematica, New Series* 28, 53 (2022).
9. Transverse lines to surfaces over finite fields (with Shamil Asgarli and Lian Duan), *manuscripta mathematica* 165, 135–157 (2021).
10. Cremona transformations and derived equivalences of K3 surfaces (with Brendan Hassett), *Compositio Mathematica* 154 (2018), Issue 7, 1508–1533.
11. New cubic fourfolds with odd degree unirational parametrizations, *Algebra & Number Theory* 11 (2017), No. 7, 1597–1626.

## Grants

- NSTC Research Project (113-2115-M-029-003-MY3), October 1, 2024–July 31, 2027

## 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 Experiences**

### **Tunghai University**

- 2024 Fall Semester, Calculus A (I) (Two sections)
- Fall Semester, Special Topic on Creative Science (I)

### **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