Yota Maeda

Alexander von Humboldt Foundation Postdoctoral Fellow
Technische Universität Darmstadt

Education

Apr 2019- Mar 2023: Ph.D. course in Mathematics, Kyoto University in Japan (Early graduation)
Advisor: Tetsushi Ito.
Thesis: Birational geometry and compactifications of modular varieties and arithmetic of modular forms
Apr 2015- Mar 2019: Undergraduate course in Science, Kyoto University in Japan.

Employment

Apr 2025 - current: Tohoku University, Japan, visiting researcher
Mar 2025 - current: Technische Universität Darmstadt, Germany, Alexander von Humboldt Foundation Postdoctoral Fellow
Sep 2022 - Feb 2025: Quantum Computing Center, Keio University, Japan, researcher.
Apr 2021 - Feb 2025: Advanced Research Laboratory, Research Platform, Sony Group Corporation, Japan, researcher.

Others

Reviewer of zbMATH

Research Interests

His research interests widely lie in mathematical science. It ranges from arithmetic geometry (Shimura varieties, Kodaira dimensions and modular forms) to their application to quantum computing and machine learning.

Grants

Mar 2025 - current: Alexander von Humboldt Foundation Postdoctoral Fellowship
Nov 2020 - Mar 2023: Japan Science and Technology Agency, ACT-X: JPMJAX200P (A solution to Kudla's modularity conjecture, a study of Shimura varieties and their applications to the post-quantum cryptography).
Apr 2021: Japan Society for the Promotion of Science, Research Fellowship for Young Scientist DC1 (declined).

Personal

Japanese: first language
English: fluent
Birthdate: March 11, 1997

E-mail address y.maeda.math@gmail.com

Skills

- Programming (C++, Python)
- Research experience on machine learning, cryptography and quantum computing

Academic Stay in Foreign Countries

- November, 2019 (3 weeks): University of Toronto, Canada
- May and September, 2022 (3 weeks & 2 weeks): Leibniz University Hannover, Germany
- September, 2022 (2 weeks): University of Bath, the UK
- January, 2023 (1 week): National University of Taiwan, Taiwan
- October, 2023 (2 weeks): Mathematisches Forschungsinstitut Oberwolfach, Germany
- January, 2024 (1 week): Taiwan
- February, 2024 (2 weeks): Vancouver
- September, 2024 (1 week): Montreal

Teaching Experience
2019-2021: Teaching Assistant at Kyoto University
Outreach activities
JST CREST: Mathematics caravan, expanding Mathematics in Kyoto (2024)

Work

0 Thesis

[0.1] Yota Maeda, "*Birational geometry and compactifications of modular varieties and arithmetic of modular forms*", Ph.D. thesis, Kyoto University (2023).

1 Papers

[1.1] Yota Maeda, Hideaki Kawaguchi, Hiroyuki Tezuka, "*Estimation of mutual information via quantum kernel method*", Quantum Mach. Intell. 7, 29 (2025).

[1.2] Klaus Hulek, Yota Maeda, "*Revisiting the moduli space of 8 points on* $\mathbb{P}^1$", Advances in Mathematics 463 (2025): 110126.

[1.3] Yota Maeda, "*Reflective obstructions of unitary modular varieties*", J. Algebra, Volume 647 (2024), Pages 341-399.

[1.4] Yota Maeda, "*Uniruledness of some low-dimensional ball quotients*", Geometriae Dedicata volume 218, Article number: 3 (2024).

[1.5] Yota Maeda, "*Irregular cusps of ball quotients*", Math. Nachr. 2023, 1–29.

[1.6] Yota Maeda, Yuji Odaka, "*Fano Shimura varieties with mostly branched cusps*", Springer Proceedings in Mathematics & Statistics (PROMS, volume 409), 2023, 633-664.

[1.7] Yota Maeda, "*Modularity of special cycles on unitary Shimura varieties over CM-fields*", Acta Arith. 204 (2022), no. 1, 1–18.

[1.8] Yota Maeda, "*The modularity of special cycles on orthogonal Shimura varieties over totally real fields under the Beilinson-Bloch conjecture*", Canad. Math. Bull. 64 (2021), no. 1, 39–53.

2 Proceedings of peer-reviewed conferences

[2.1] Masakazu Yoshimura, Teruaki Hayashi Yota Maeda, "*MambaPEFT: Exploring Parameter-Efficient Fine-Tuning for Mamba*", International Conferences on Learning Representations (ICLR 2025).

[2.2] Hiroshi Yano, Yota Maeda, "*Generalization capacity of singular models in quantum state estimation*", Quantum Techniques in Machine Learning (QTML 2024).

[2.3] Yota Maeda, et.al., "*Quantum PC algorithm: data-efficient and nonlinear causal discovery*", IEEE International Conference on Quantum Computing and Engineering (QCE 2024).

3 Preprints

[3.1] Yota Maeda, Kazuma Ohara, "*Finiteness of free algebras of modular forms on unitary groups*", arXiv:2505.13698, 2025 (44 pages)

[3.2] Klaus Hulek, Yota Maeda, "*The Universe of Deligne-Mostow Varieties*", arXiv:2504.16235, 2025 (23 pages)

[3.3] Yuta Kambe, Yota Maeda, Tristan Vaccon, "*Geometric Generality of Transformer-Based Gröbner Basis Computation*", arXiv:2504.12465, 2025 (19 pages)

[3.4] Yota Maeda et. al., "*Quantum-enhanced causal discovery for a small number of samples*", arXiv:2501.05007,(19 pages).

[3.5] Hiroshi Yano, Yota Maeda, Naoki Yamamoto, "*Statistical inference for quantum singular models*", arXiv:2411.16396 (57 pages, equally contributed).

[3.6] Klaus Hulek, Yota Maeda, Shigeyuki Kondo, "*Compactifications of the Eisenstein ancestral Deligne-Mostow variety*", arXiv:2403.18345 (50 pages).

4 Proceedings (with no peer review)

[4.1] Yota Maeda, "*Volume formulae for algebraic groups*", Sendai modular form mini workshop at Tohoku (2025).

[4.2] Hiroshi Yano, Yota Maeda, "*Generalization capacity of singular models in quantum state estimation*" Quantum Techniques in Machine Learning (QTML2024) at Melbourne, Australia (2024).

[4.3] Yota Maeda et. al., "*Quantum PC algorithm: data-efficient and nonlinear causal discovery*" IEEE International Conference on Quantum Computing and Engineering at Montréal, Canada (2024).

[4.4] Hiroshi Yano, Yota Maeda, "*A quantum widely applicable information criterion for quantum state estimation*", Joint Symposium on Quantum Computing 2024 at National Taiwan University (2024).

[4.5] Yota Maeda, "*A solution to Kudla's modularity conjecture, a study of Shimura varieties and its application to the post-quantum cryptography*" ACT-X: Debriefing session at Tokyo (2024).

[4.6] Yota Maeda, "*The Kodaira dimension of modular varieties*", Mathsci freshman seminar (2021).

[4.7] Yota Maeda, "*On the Kodaira dimension of unitary Shimura varieties*", RIMS conference "Automorphic forms, Automorphic representations, Galois representations, and its related topics"Kokyuroku (2021).

[4.8] Yota Maeda, "*Uniruledness of some unitary Shimura varieties*", Kinosaki Algebraic Geometry Symposium, Kyoto University Research Information Repository (2020).

[4.9] Yota Maeda, "*On the modularity of special cycles on Shimura varieties*", Mathsci freshman seminar (2020).

[4.10] Yota Maeda, "*On the modularity of special cycles on orthogonal Shimura varieties*", RIMS conference "Analytic, geometric and p-adic aspects of automorphic forms and L-functions" Kokyuroku (2020).

[4.11] Yota Maeda, "*The local Langlands conjecture for GL_n*", Mathsci freshman seminar (2019).

5 Talks (conferences)

[5.1] "*Extendability of the period maps on $M_{0,n}$*, Sendai modular form mini workshop, Tohoku, 2024.

[5.2] "*Extendability of the period maps on $M_{0,n}$*, Number Theory Seminar at Kyoto University, Kyoto, 2023.

[5.3] "*Extendability of the period maps on $M_{0,n}$*, Tsuda Seisuron Workshop, Tokyo, 2023.

[5.4] "*Modular interpretation of the moduli spaces of weighted pointed stable rational curves*", Nagoya Algebraic Geometry Seminar at Nagoya University, 2023.

[5.5] "*Modular interpretation of the moduli spaces of weighted pointed stable rational curves*", Number Theory Seminar at Waseda University, Tokyo, 2023.

[5.6] "*Revisiting the moduli space of 8 points on $\mathbb{P}^1$*", Sendai modular form mini workshop, Tohoku, 2023.

[5.7] "*Deligne-Mostow theory and beyond*", International Seminar on Automorphic Forms (Zoom meeting), 2023.

[5.8] "*Deligne-Mostow theory and beyond*", East Asia Core Doctoral Forum in Mathematics, Taiwan, 2023.

[5.9] "*Deligne-Mostow theory and beyond*", a colloquium at Tokyo University of Science, Tokyo, 2022.

[5.10] "*On the geometry of higher dimensional ball quotients*", 21-st Sendai-Hiroshima Workshop on Number Theory, Tohoku, 2022.

[5.11] "*The volumes of unitary groups and geometry of ball quotients*", Number theory & Automorphic forms Seminar, Osaka, 2022.

[5.12] "*The Hirzebruch-Mumford volume of unitary groups and its application to the geometry of ball quotients*", Research Seminar Number Theory and Arithmetic Geometry (Leibniz University Hannover), 2022.

[5.13] , "*The Hirzebruch-Mumford volume of unitary groups and its application to birational types of ball quotients*", Algebraic Geometry Seminar, Nagoya, 2022.

[5.14] "*Big line bundles on ball quotients*", Sendai modular form mini workshop, Tohoku, 2022.

[5.15] "*Irregular cusps and Kodaira dimension of unitary modular varieties*", Number theory Autumn workshop, Kanazawa, 2021.

[5.16] "*Fano Shimura varieties and special modular forms*", Algebraic Number Theory in Kyushu (Zoom meeting), 2021.

[5.17] "*Fano Shimura varieties with mostly branched cusps*", Friday Tea Time Zoom Seminar (Zoom meeting), 2021.

[5.18] "*The Kodaira dimension of modular varieties*", Mathsci freshman seminar 2021 (Zoom meeting), 2021.

[5.19] "*On the Kodaira dimension of unitary Shimura varieties*", RIMS conference "Automorphic forms, Automorphic representations, Galois representations, and its related topics" (Zoom meeting), 2021.

[5.20] "*On the Kodaira dimension of unitary Shimura varieties*", Hannover algebraic geometry seminar (Zoom meeting), 2020.

[5.21] "*Uniruledness of some unitary Shimura varieties*", Kinosaki Algebraic Geometry Symposium 2020 (Zoom meeting), 2020.

[5.22] "*On the singularities of unitary Shimura varieties and their applications to the Kodaira dimension*", 19-th Hiroshima-Sendai Workshop on Number Theory (Zoom meeting), 2020.

[5.23] "*On the modularity of special cycles on Shimura varieties*", Mathsci freshman seminar 2020, Nagoya 2020.

[5.24] "*On the modularity of special cycles on orthogonal Shimura varieties*", RIMS conference "Analytic, geometric and p-adic aspects of automorphic forms and L-functions", Kyoto, 2020.

[5.25] "*On the modularity of the generating series of special cycles on orthogonal Shimura varieties*", Number Theory Seminar, Kyoto, 2019.

[5.26] "*The local Langlands conjecture for* $\mathrm{GL_n}$", Mathsci freshman seminar 2019, Kyoto, 2019.

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6 Talks (others)

[6.1] "*Deligne-Mostow theory and beyond*", poster presentation at Session "Young Mathematicians Challenges", Tokyo, 2023.

[6.2] "*Eichler orders and the Deuring correspondence*", A number thoretic approach for Post-Quantum Cryptography related to Ramanujan graphs, Kyushu, 2021.

[6.3] "*Modular varieties and modular forms〜intersection of number theory and algebraic geometry〜*", Student Colloquium at Kyoto University (Zoom meeting), 2021.

7 Panel discussion

[7.1] "*Keio Quantum Computing Center and Expectations for Quantum Computers*", Frontiers of Quantum Computers at Keio Quantum Computing Center, 2023.

8 Patents

Four patents in cryptography and quantum computation using number theory.