

Chia-Kai Kuo

Postdoctoral Researcher, Max Planck Institute for Physics, Munich

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PROFILE

I am a theoretical physicist working on scattering amplitudes, correlation functions, positive geometry, and modern on-shell methods in quantum field theory. My Ph.D. research focused on ABJM theory, especially the formulation of scattering amplitudes as differential forms associated with novel positive geometries.

ACADEMIC POSITION

Postdoctoral Researcher, Max Planck Institute for Physics, Munich, Germany 01/06/2024 – Present

EDUCATION

Ph.D. in Theoretical Physics, National Taiwan University, Taipei, Taiwan 01/02/2021 – 30/05/2024

Supervisor: Song He and Yu-Tin Huang

Thesis: *Loop Amplitudes of ABJM and Its Positive Geometry*

M.Sc. in Physics, National Taiwan University, Taipei, Taiwan 01/09/2018 – 31/08/2020

B.Sc. in Physics, National Taiwan University, Taipei, Taiwan 01/09/2014 – 31/08/2018

PUBLICATIONS

I have authored 10 original research articles in peer-reviewed journals and 1 preprint. For up-to-date citation data, see my [INSPIRE-HEP profile](#).

Refereed Publications

1. C.-K. Kuo and Q. Yang, “Notes on off-shell conformal integrals and correlation functions at five points”, *Phys. Rev. D* 113 (2026) 5. [arXiv:2512.21947](#).
Description: We construct pure two-loop five-point off-shell conformal integral bases and use them to compute five-point half-BPS correlators at symbol level, including both maximal and non-maximal sectors.
2. Y.-T. Huang, C.-K. Kuo and C. Zhang, “BDS ansatz in ABJM via scaffolding triangulations”, *JHEP* 02 (2026) 022. [arXiv:2510.20663](#).
Description: We formulate the ABJM two-loop BDS ansatz using scaffolding triangulations, proving elliptic-cut cancellation and triangulation independence at arbitrary multiplicity.
3. S. He, Y.-T. Huang and C.-K. Kuo, “Leading singularities and chambers of Correlahedron”, *JHEP* 03 (2026) 071. [arXiv:2505.09808](#).
Description: We analyse leading singularities and chamber structures of the Correlahedron, showing that four-point correlator integrands admit a chamber-based geometric organisation beyond three loops.
4. S. He, Y.-T. Huang and C.-K. Kuo, “All-loop geometry for four-point correlation functions”, *Phys. Rev. D* 110 (2024) 8, L081701. [arXiv:2405.20292](#).
Description: We propose an all-loop positive geometry for four-point correlators in planar $\mathcal{N} = 4$ SYM and verify that its canonical forms reproduce known correlator integrands up to three loops.
5. S. He, Y.-T. Huang and C.-K. Kuo, “The ABJM Amplituhedron”, *JHEP* 09 (2023) 165. [arXiv:2306.00951](#).
Description: We construct the ABJM amplituhedron as an all-loop, all-multiplicity positive geometry and obtain explicit one-loop and two-loop integrands from its canonical forms.
6. S. He, C.-K. Kuo, Z. Li and Y.-Q. Zhang, “Emergent unitarity, all-loop cuts and integrations from the ABJM amplituhedron”, *JHEP* 07 (2023) 212. [arXiv:2303.03035](#).
Description: We prove all-loop unitarity properties of the four-point ABJM amplituhedron and integrate its negative geometries up to two loops to extract infrared-finite data.
7. S. He, C.-K. Kuo and Z. Li, “The two-loop eight-point amplitude in ABJM theory”, *JHEP* 02 (2023) 065. [arXiv:2211.01792](#).
Description: We compute the two-loop eight-point ABJM amplitude, fixing the integrand from dual conformal symmetry, maximal cuts and soft-collinear constraints, and analyse its integrated finite part.

8. S. He, C.-K. Kuo, Z. Li and Y.-Q. Zhang, “All-Loop Four-Point Aharony-Bergman-Jafferis-Maldacena Amplitudes from Dimensional Reduction of the Amplituhedron”, Phys. Rev. Lett. 129 (2022) 221604. [arXiv:2204.08297](#).
Description: We define a reduced amplituhedron for four-point ABJM amplitudes by dimensional reduction of the $\mathcal{N} = 4$ SYM amplituhedron and obtain explicit integrands up to five loops.
9. S. He, C.-K. Kuo and Y.-Q. Zhang, “The momentum amplituhedron of SYM and ABJM from twistor-string maps”, JHEP 02 (2022) 148. [arXiv:2111.02576](#).
Description: We relate twistor-string maps to momentum amplituhedra in $\mathcal{N} = 4$ SYM and ABJM, showing how tree amplitudes arise as canonical forms of positive geometries.
10. Y.-T. Huang, C.-K. Kuo and C. Wen, “Dualities for Ising networks”, Phys. Rev. Lett. 121 (2018) 251604. [arXiv:1809.01231](#).
Description: We establish a correspondence between planar Ising networks and cells of the positive orthogonal Grassmannian, leading to recursive methods for computing network correlators.

Preprint

1. Y.-T. Huang, C.-K. Kuo, Y. Liu and J. Mei, “Beyond Discontinuities: Cosmological WFCs from the Supersymmetric Orthogonal Grassmannian”, Preprint. [arXiv:2604.08512](#).
Description: We extend the orthogonal-Grassmannian construction from discontinuities to full supersymmetric cosmological wavefunction coefficients, using $\mathcal{N} = 2$ supersymmetry to solve the inhomogeneous Ward identities.

AWARDS AND HONORS

- **NTU-CTP Best Student Paper Award** 2023
Awarded by the Center for Theoretical Physics at National Taiwan University for an outstanding student research paper in theoretical physics.
- **NCTS Student Outstanding Paper Award** 2023
Awarded by the National Center for Theoretical Sciences for the quality and originality of student-led research in theoretical physics.

INVITED TALKS

- **Chamber Dissection of the Correlahedron in Four-Point Correlators**, New Ways to Higher Points, Humboldt University of Berlin, Germany 01/10/2025
- **BDS Local Integrand in ABJM Theory**, 42nd International Conference on High Energy Physics, IUPAP C11 and Czech academic institutions, Czech Republic 19/07/2024
- **Geometry of the Four-Point Correlators**, Kick-off Workshop on Positive Geometry in Particle Physics and Cosmology, Max Planck Institute for Mathematics, Germany 16/02/2024
- **The ABJM Amplituhedron**, Amplitudes 2023 Conference, CERN, Switzerland 07/08/2023
- **All-Loop Four-Point ABJM Amplitudes from Dimensional Reduction of the Amplituhedron**, 2022 NTU-Kyoto High Energy Physics Workshop / Kawai Fest, National Taiwan University, Taiwan 18/12/2022
- **On-shell method on ABJM two-loop amplitudes**, NTU-NCTS String Seminar, National Taiwan University, Taiwan 25/11/2022

TEACHING AND SUPERVISION EXPERIENCE

Teaching Assistant for “Electricity and Magnetism”, “Quantum Mechanics”, and “Applied Mathematics I” at the Department of Physics, National Taiwan University.

COMPUTER SKILLS

Languages LaTeX
Software Mathematica, Maple