Kenny Lau

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POSITIONS HELD

California Institute of Technology, 2023–present
- Postdoctoral Scholar in Physics

EDUCATION

University of Minnesota, Ph.D., Physics, 2023
- Advisor: Prof. Clement Pryke
- Thesis: Constraining Inflation Models with the BICEP/Keck B-mode Experiment

Chinese University of Hong Kong, MPhil, Physics, 2013
- Advisors: Prof. Ming Chung Chu and Dr. Lap Ming Lin
- Thesis: Constraints on Tensor-to-scalar Ratio from Planck Measurement

Chinese University of Hong Kong, BSc, Physics, 2011
- First Class Honours. Minor: Mathematics

AWARDS

Antarctica Service Medal, 2021
Physics Prize, CUHK, 2011
Deans List, Faculty of Science, CUHK, 2009

RESEARCH INTERESTS

Experimental Cosmology, Early Universe Physics, Cosmic Microwave Background, Millimeter-wave Line Intensity Mapping

RESEARCH

Probing Inflation from Measurements of B-mode Polarization in Cosmic Microwave Background (CMB)
- BICEP/Keck Collaboration (2015–present). Building small aperture telescopes to measure degree-scale B-modes at the Amundsen-Scott South Pole Station.
- *Analysis*: data reduction lead (2019–2022); rewrote the pipeline for BICEP Array; led the "BK18" analysis (science results with new data from 2016–2018) — the strongest constraint to date on the tensor-to-scalar ratio r.
- *Instrument*: BICEP Array telescope mount and cryostat development team.
- *Deployment*: deployed Keck Array 270 GHz receiver in 2017/18; deployed BICEP Array mount and 30/40 GHz receiver (first light) in 2019/20.

Refining Galactic Foreground Models for Precision CMB Cosmology
- Pan-Experiment Galactic Science Group (2022–present) and CMB-S4 Collaboration (2021–present). Conducting foreground studies for large-scale B-mode observation strategy.

Constraining the Epoch of Reionization via [CII] Line Intensity Mapping

- TIME Collaboration (2023–present). Performing cryogenic and detector tests and developing an analysis pipeline for TIME observation at ARO-12m telescope.

TEACHING

Student Mentoring

- Suvinay Goyal (UIUC undergraduate), TIME & BICEP instrument, SURF 2025
- Saina Nikmehr (Caltech undergraduate), BICEP analysis, Research course & SURF 2025
- Nilo Rivera (Caltech undergraduate), BICEP analysis, Research course 2024

University of Minnesota

- Introductory Physics for Science and Engineering I/II, Teaching Assistant, Spring 2016, Fall 2016, Spring 2017
- Introductory Physics I, Teaching Assistant, Fall 2015

Chinese University of Hong Kong

- Quantum Physics II, Teaching Assistant, Spring 2012, Spring 2013
- Mechanics, Teaching Assistant, Fall 2012
- Physics Laboratory I, Teaching Assistant, Fall 2011

SERVICE

Caltech Observational Cosmology Seminar, Organizer, 2024–present

TALKS

Invited Presentations

- "Probing Inflation Physics at South Pole", Caltech Postdocs Launch Seminar, Pasadena, CA, Aug 8 2025
- "Constraining Inflation Models with BICEP/Keck B-mode Experiment", SLAC CMB group, Virtual, Feb 10 2023

Contributed Talks

- "Advancing Galactic Foreground Modeling for CMB Studies", mm Universe 2025, Chicago, IL, Jun 24 2025
- "Full-sky Galactic Microwave Emission and Polarization Models", Caltech ObsCos Seminar, Pasadena, CA, Jun 12 2025
- "Probing the Epoch of Reionization with TIME: an Overview and Update", Line Intensity Mapping 2024 Meeting, Urbana, IL, Jun 13 2024
- "BICEP/Keck Constraints on Primordial Gravitational Waves", CMB-S4 Summer Collaboration Meeting, Chicago, IL, Aug 17 2022
- "Searching for Inflation Signals with the BICEP/Keck Telescopes", 240^{th} AAS Meeting, Pasadena, CA, Jun 16 2022
- "The Latest Constraints on Inflationary B-modes by the BICEP/Keck Telescopes", 56^{th} Rencontres de Moriond on Cosmology, La Thuile, Italy, Jan 25 2022

OUTREACH

Hong Kong Astro Teacher Programme (Caltech Session), Invited Lecturer, Jul 2025
Caltech Stargazing Lecture, Q&A Panelist, Spring 2025
Solar Eclipse Viewing Event at Caltech Campus, Outreach Assistant, Apr 2024
Adopt-a-Physicist Program (3-week online forum for high school students), Teacher, Fall 2023, 2024
BICEP Array Telescope Open House at Martin A. Pomerantz Observatory, Co-organizer, Feb 2020
BICEP Array Mount Open House at University of Minnesota, Co-organizer, May 2019

PUBLICATIONS

Peer-reviewed Papers:

1. J. Borrill *et al.* (The Pan-Experiment Galactic Science Group), "Full-sky Models of Galactic Microwave Emission and Polarization at Subarcminute Scales for the Python Sky Model", Astrophys. J. **991**, 23 (2025)
2. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XVIII: Measurement of BICEP3 polarization angles and consequences for constraining cosmic birefringence and inflation", Phys. Rev. D **111**, 063505 (2025)
3. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XVII: Line of Sight Distortion Analysis: Estimates of Gravitational Lensing, Anisotropic Cosmic Birefringence, Patchy Reionization, and Systematic Errors", Astrophys. J. **949**, 43 (2023)
4. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XVI: Characterizing Dust Polarization Through Correlations with Neutral Hydrogen", Astrophys. J. **945**, 72 (2023)
5. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XV: The BICEP3 Cosmic Microwave Background Polarimeter and the First Three-year Data Set", Astrophys. J. **927**, 77 (2022)
6. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XIV: Improved constraints on axionlike polarization oscillations in the cosmic microwave background", Phys. Rev. D **105**, 022006 (2022)
7. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XIII: Improved Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/Keck Observations through the 2018 Observing Season", Phys. Rev. Lett. **127**, 151301 (2021)
8. S. Yeung, K. Lau and M.-C. Chu, "Relic Neutrino Degeneracies and Their Impact On Cosmological Parameters", JCAP **04**, 024 (2021)
9. P.A.R. Ade *et al.* (BICEP/Keck Collaboration), "BICEP/Keck XII: Constraints on Axion-like Polarization Oscillations in the Cosmic Microwave Background", Phys. Rev. D **103**, 042002 (2021)
10. P.A.R. Ade *et al.* (BICEP/Keck and SPTpol Collaborations), "A Demonstration of Improved Constraints on Primordial Gravitational Waves with Delensing", Phys. Rev. D **103**, 022004 (2021)
11. P.A.R. Ade *et al.* (Keck Array and BICEP2 Collaborations), "BICEP2/Keck Array XI: Beam Characterization and Temperature-to-Polarization Leakage in the BK15 Data Set", Astrophys. J. **884**, 114 (2019)

12. P.A.R. Ade *et al.* (Keck Array and BICEP2 Collaborations), "Constraints on Primordial Gravitational Waves Using Planck, WMAP, and New BICEP2/Keck Observations through the 2015 Season", Phys. Rev. Lett. **121**, 221301 (2018)

Other Selected Publications (Conference Proceedings and arXiv Papers):

1. C. Giannakopoulos *et al.*, "Calibration measurements of the BICEP3 and BICEP array CMB polarimeters from 2017 to 2024", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XII; 1310219 (2024)
2. Y. Nakato *et al.*, "Development of the 220/270 GHz BICEP Array CMB receiver", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XII; 1310207 (2024)
3. V. Butler *et al.*, "TIME: the Tomographic Ionized-carbon Mapping Experiment: an update on design, characterization, and data from the 2022 commissioning observations", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XII; 131022G (2024)
4. S. Fatigoni *et al.*, "Results and Limits of Time-Division Multiplexing for the BICEP Array High-Frequency Receivers", J. Low Temp. Phys. **216**, 29 (2024)
5. A. Schillaci *et al.*, "BICEP Array: 150 GHz detector module development", J. Low Temp. Phys. **213**, 317 (2023)
6. M. Dierickx *et al.*, "Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array", J. Low Temp. Phys. **211**, 366 (2023)
7. D. Goldfinger *et al.*, "Thermal Testing for Cryogenic CMB Instrument Optical Design", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI; 121901V (2022)
8. A. Soliman *et al.*, "2022 Upgrade and Improved Low Frequency Camera Sensitivity for CMB Observation at the South Pole", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI; 1219014 (2022)
9. J. Cornelison *et al.*, "Improved Polarization Calibration of the BICEP3 CMB Polarimeter at the South Pole", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI; 121901X (2022)
10. K. Abazajian *et al.*, "Snowmass 2021 CMB-S4 White Paper", arXiv:2203.08024 (2022)
11. C. Chang *et al.*, "Snowmass 2021 Cosmic Frontier: Cosmic Microwave Background Measurements White Paper", arXiv:2203.07638 (2022)
12. K. Lau *et al.*, "The Latest Constraints on Inflationary B-modes from the BICEP/Keck Telescopes", Proceedings of the 56th Rencontres de Moriond on Cosmology (2022)
13. L. Moncelsi *et al.*, "Receiver development for BICEP Array, a next-generation CMB polarimeter at the South Pole", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy X; 1145314 (2020)
14. T. St. Germaine *et al.*, "Analysis of Temperature-to-Polarization Leakage in BICEP3 and Keck CMB Data from 2016 to 2018", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy X; 114532E (2020)

15. J. Cornelison *et al.*, "Polarization calibration of the BICEP3 CMB polarimeter at the South Pole", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy X; 1145327 (2020)
16. J. Kang *et al.*, "Observing low elevation sky and the CMB Cold Spot with BICEP3 at the South Pole", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 114532D (2020)
17. A. Schillaci *et al.*, "Design and Performance of the First BICEP Array Receiver", J. Low Temp. Phys. **199**, 976 (2020)
18. C. Zhang *et al.*, "Characterizing the Sensitivity of 40 GHz TES Bolometers for BICEP Array", J. Low Temp. Phys. **199**, 968 (2020)
19. T. St. Germaine *et al.*, "Optical Characterization of the Keck Array and BICEP3 CMB Polarimeters from 2016 to 2019", J. Low Temp. Phys. **199**, 824 (2020)
20. A. Soliman *et al.*, "Optical Design and Characterization of 40 GHz Detector and Module for the BICEP Array", J. Low Temp. Phys. **199**, 1118 (2020)
21. A. Cukierman *et al.*, "Microwave multiplexing on the Keck Array", J. Low Temp. Phys. **199**, 858 (2020)
22. B. Racine *et al.*, "Measurements of Degree-Scale B-mode Polarization with the BICEP/Keck Experiments at South Pole", Proceedings of the 53rd Rencontres de Moriond on Cosmology (2018)
23. A. Soliman *et al.*, "Design and performance of wide-band corrugated walls for the BICEP Array detector modules at 30/40 GHz", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 107082G (2018)
24. D. Barkats *et al.*, "Ultra-Thin Large-Aperture Vacuum Windows for Millimeter Wavelengths Receivers", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 107082K (2018)
25. M. Crumrine *et al.*, "BICEP Array cryostat and mount design", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 107082D (2018)
26. H. Hui *et al.*, "BICEP Array: a multi-frequency degree-scale CMB polarimeter", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 1070807 (2018)
27. J. Kang *et al.*, "2017 upgrade and performance of BICEP3: a 95 GHz refracting telescope for degree-scale CMB polarization", Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 107082N (2018)

REFERENCES

Prof. James Bock, jjb@astro.caltech.edu
Prof. Abigail Crites, atc72@cornell.edu
Prof. Clement Pryke, cspryke@umn.edu