

# Kenny Lau

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**POSITIONS HELD** California Institute of Technology, 2023–

- 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

The 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

The Chinese University of Hong Kong, B.Sc., Physics, 2011

- with Honours, First Class
- Minor: Mathematics

**AWARDS** Antarctica Service Medal, 2021

**RESEARCH** **Probing Inflation from Measurements of B-mode Polarization in Cosmic Microwave Background (CMB)**

- BICEP/Keck Collaboration member (2015–), Caltech visiting student researcher (Jul 2021-Sep 2021). Using small aperture telescopes to measure degree-scale B-modes at Amundsen-Scott South Pole Station.
- *Analysis work*: data reduction lead (2019–2022); rewrote the pipeline for BICEP Array; completed the “BK18” analysis (science results with new data from 2016–2018) — the strongest constraint to date on the tensor-to-scalar ratio  $r$ .
- *Instrument work*: key member of the BICEP Array mount and cryostat development team.
- *Deployment work*: deployed Keck Array 270 GHz receiver in 2017/18; deployed BICEP Array mount and 30/40 GHz receiver (first light) in 2019/20.
- *Ongoing research*: developing a pipeline for BICEP/Keck+South Pole Telescope delensing analysis; acting as an analysis pipeline consultant.

**Searching for Primordial Gravitational Waves with CMB-S4 experiment**

- Conducting foreground studies for large-scale B-mode observation strategy.

**Investigating Impacts of Relic Neutrino Degeneracies on CMB**

- Studied the impacts of neutrino degeneracies in CMB data fitting, particularly for the constraint of Hubble parameter  $H_0$  and spectral index  $n_s$ .

TEACHING	<p>Teaching Assistant, School of Physics and Astronomy, University of Minnesota</p> <ul style="list-style-type: none"> <li>• Intro. Physics for Science and Engineering I/II (Spring 2017, Fall 2016, Spring 2016), Intro. Physics I (Fall 2015)</li> </ul> <p>Teaching Assistant, Physics Department, The Chinese University of Hong Kong</p> <ul style="list-style-type: none"> <li>• Quantum Physics II (Spring 2013, Spring 2012), Mechanics (Fall 2012), Physics Laboratory I (Fall 2011)</li> </ul>
OUTREACH	<p>BICEP Array Telescope Open House, Martin. A. Pomerantz Observatory, Feb 2 2020</p> <ul style="list-style-type: none"> <li>• Exhibited the fully functional BICEP Array telescope to support personnel of the Amundsen-Scott South Pole station.</li> </ul> <p>BICEP Array Mount Open House, University of Minnesota, May 5 2019</p> <ul style="list-style-type: none"> <li>• Demonstrated the scanning of the BICEP Array receivers on its mount to people of the School of Physics and Astronomy.</li> </ul>
LANGUAGES	<ul style="list-style-type: none"> <li>• Native proficiency in Cantonese</li> <li>• Native proficiency in written Chinese</li> <li>• Full professional proficiency in English</li> </ul>
COMPUTER LANGUAGES	<p>Python, MATLAB, HTML, JavaScript, FORTRAN, <math>\text{\LaTeX}</math></p>
PUBLICATIONS	<p><b>Peer-reviewed Papers:</b></p> <ol style="list-style-type: none"> <li>1. P.A.R. Ade <i>et al.</i> (BICEP/Keck Collaboration), “BICEP/Keck XVII: Line of Sight Distortion Analysis: Estimates of Gravitational Lensing, Anisotropic Cosmic Birefringence, Patchy Reionization, and Systematic Errors”, <a href="#">Astrophys. J. <b>949</b>, 43</a> (2023)</li> <li>2. P.A.R. Ade <i>et al.</i> (BICEP/Keck Collaboration), “BICEP/Keck XVI: Characterizing Dust Polarization Through Correlations with Neutral Hydrogen”, <a href="#">Astrophys. J. <b>945</b>, 72</a> (2023)</li> <li>3. P.A.R. Ade <i>et al.</i> (BICEP/Keck Collaboration), “BICEP/Keck XV: The BICEP3 Cosmic Microwave Background Polarimeter and the First Three-year Data Set”, <a href="#">Astrophys. J. <b>927</b>, 77</a> (2022)</li> <li>4. P.A.R. Ade <i>et al.</i> (BICEP/Keck Collaboration), “BICEP/Keck XIV: Improved constraints on axionlike polarization oscillations in the cosmic microwave background”, <a href="#">Phys. Rev. D <b>105</b>, 022006</a> (2022)</li> <li>5. P.A.R. Ade <i>et al.</i> (BICEP/Keck Collaboration), “BICEP/Keck XIII: Improved Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/Keck Observations through the 2018 Observing Season”, <a href="#">Phys. Rev. Lett. <b>127</b>, 151301</a> (2021)</li> <li>6. S. Yeung, <b>K. Lau</b> and M.-C. Chu, “Relic Neutrino Degeneracies and Their Impact On Cosmological Parameters”, <a href="#">JCAP <b>04</b>, 024</a> (2021)</li> </ol>

7. 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)
8. 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)
9. 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)
10. 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. M. Dierickx *et al.*, “Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array”, [J. Low Temp. Phys. \*\*211\*\*, 366](#) (2023)
2. 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)
3. 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)
4. 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)
5. K. Abazajian *et al.*, “Snowmass 2021 CMB-S4 White Paper”, [arXiv:2203.08024](#) (2022)
6. C. Chang *et al.*, “Snowmass 2021 Cosmic Frontier: Cosmic Microwave Background Measurements White Paper”, [arXiv:2203.07638](#) (2022)
7. **K. Lau** *et al.*, “The Latest Constraints on Inflationary B-modes from the BICEP/Keck Telescopes”, [Proceedings of the 56<sup>th</sup> Rencontres de Moriond on Cosmology](#) (2022)
8. A. Schillaci *et al.*, “BICEP Array: 150 GHz detector module development”, [arXiv:2111.14785](#) (2021)
9. 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)
10. 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)
11. 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)

12. 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)
13. A. Schillaci *et al.*, “Design and Performance of the First BICEP Array Receiver”, [J. Low Temp. Phys.](#) **199**, 976 (2020)
14. C. Zhang *et al.*, “Characterizing the Sensitivity of 40 GHz TES Bolometers for BICEP Array”, [J. Low Temp. Phys.](#) **199**, 968 (2020)
15. 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)
16. 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)
17. A. Cukierman *et al.*, “Microwave multiplexing on the Keck Array”, [J. Low Temp. Phys.](#) **199**, 858 (2020)
18. B. Racine *et al.*, “Measurements of Degree-Scale B-mode Polarization with the BICEP/Keck Experiments at South Pole”, [Proceedings of the 53<sup>rd</sup> Rencontres de Moriond on Cosmology](#) (2018)
19. 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)
20. 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)
21. M. Crumrine *et al.*, “BICEP Array cryostat and mount design”, [Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX](#); 107082D (2018)
22. 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)
23. 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)

## TALKS

1. “BICEP/Keck Constraints on Primordial Gravitational Waves”, CMB-S4 Summer Collaboration Meeting, Chicago, IL, Aug 17 2022
2. “Searching for Inflation Signals with the BICEP/Keck Telescopes”, 240<sup>th</sup> AAS Meeting, Pasadena, CA, Jun 16 2022
3. “The Latest Constraints on Inflationary B-modes by the BICEP/Keck Telescopes”, 56<sup>th</sup> Rencontres de Moriond on Cosmology, La Thuile, Italy, Jan 25 2022