

# Kenny Lau

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## EDUCATION

University of Minnesota, 2015-Present

- Ph.D candidate, Physics
- Advisor: Prof. Clem Pryke

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-present), 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

Teaching Assistant, School of Physics and Astronomy, University of Minnesota

- Intro. Physics for Science and Engineering I/II (Spring 2017, Fall 2016, Spring 2016), Intro. Physics I (Fall 2015)

Teaching Assistant, Physics Department, The Chinese University of Hong Kong

- Quantum Physics II (Spring 2013, Spring 2012), Mechanics (Fall 2012), Physics Laboratory I (Fall 2011)

#### OUTREACH

BICEP Array Telescope Open House, Martin. A. Pomerantz Observatory, Feb 2 2020

- Exhibited the fully functional BICEP Array telescope to support personnel of the Amundsen-Scott South Pole station.

BICEP Array Mount Open House, University of Minnesota, May 5 2019

- Demonstrated the scanning of the BICEP Array receivers on its mount to people of the School of Physics and Astronomy.

#### LANGUAGES

- Native proficiency in Cantonese
- Native proficiency in written Chinese
- Full professional proficiency in English

#### COMPUTER LANGUAGES

Python, MATLAB, HTML, JavaScript, FORTRAN,  $\text{\LaTeX}$

#### PUBLICATIONS **Peer-reviewed Papers:**

1. 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)
2. 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)
3. 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)
4. 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)
5. 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)
6. S. Yeung, **K. Lau** and M.-C. Chu, “Relic Neutrino Degeneracies and Their Impact On Cosmological Parameters”, [JCAP \*\*04\*\*, 024](#) (2021)
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. 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)
2. 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)
3. 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)
4. K. Abazajian *et al.*, “Snowmass 2021 CMB-S4 White Paper”, [arXiv:2203.08024](https://arxiv.org/abs/2203.08024) (2022)
5. C. Chang *et al.*, “Snowmass 2021 Cosmic Frontier: Cosmic Microwave Background Measurements White Paper”, [arXiv:2203.07638](https://arxiv.org/abs/2203.07638) (2022)
6. 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)
7. A. Schillaci *et al.*, “BICEP Array: 150 GHz detector module development”, [arXiv:2111.14785](https://arxiv.org/abs/2111.14785) (2021)
8. M. Dierickx *et al.*, “Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array”, [arXiv:2111.14751](https://arxiv.org/abs/2111.14751) (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