

# Kenny King Lau

School of Physics and Astronomy,  
Physics and Nanotechnology Building,  
115 Union St SE,  
Minneapolis, MN 55455

Email: [kennylau@umn.edu](mailto:kennylau@umn.edu)  
Office: (612) 625 1802  
[kennykinglau.github.io](https://kennykinglau.github.io)

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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

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). Using small aperture telescopes to measure degree-scale B-modes at Amundsen-Scott South Pole Station.
- *Analysis works*: data reduction lead (2019-2022); completed the “BK18” analysis (science results from 2016-18 observing seasons) - the strongest constraint of the tensor-to-scalar ratio  $r$  to date.
- *Instrument works*: developed BICEP Array mount and cryostat.
- *Deployment works*: deployed Keck Array 270 GHz receiver in 2018; deployed BICEP Array mount and 30/40 GHz receiver (first light) in 2020.
- *Ongoing researches*: rewriting the pipeline for BICEP Array; developing a pipeline for BK+SPT delensing analysis.

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

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

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

- Investigated 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 XV: The BICEP3 Cosmic Microwave Background Polarimeter and the First Three-year Data Set”, [Astrophys. J. \*\*927\*\*, 77](#) (2022)
2. 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)
3. 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)
4. S. Yeung, **K. Lau** and M.-C. Chu, “Relic Neutrino Degeneracies and Their Impact On Cosmological Parameters”, [JCAP \*\*04\*\*, 024](#) (2021)
5. 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)
6. 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)
7. 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)
8. 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”, [arXiv:2208.02755](#) (2022)
2. A. Soliman *et al.*, “2022 Upgrade and Improved Low Frequency Camera Sensitivity for CMB Observation at the South Pole”, [arXiv:2208.01080](#) (2022)
3. J. Cornelison *et al.*, “Improved Polarization Calibration of the BICEP3 CMB Polarimeter at the South Pole”, [arXiv:2207.14796](#) (2022)
4. K. Abazajian *et al.*, “Snowmass 2021 CMB-S4 White Paper”, [arXiv:2203.08024](#) (2022)
5. C. Chang *et al.*, “Snowmass 2021 Cosmic Frontier: Cosmic Microwave Background Measurements White Paper”, [arXiv: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](#) (2021)
8. M. Dierickx *et al.*, “Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array”, [arXiv: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.](#) (2020)
14. C. Zhang *et al.*, “Characterizing the Sensitivity of 40 GHz TES Bolometers for BICEP Array”, [J. Low Temp. Phys.](#) (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.](#) (2020)
16. A. Soliman *et al.*, “Optical Design and Characterization of 40 GHz Detector and Module for the BICEP Array”, [J. Low Temp. Phys.](#) (2020)
17. A. Cukierman *et al.*, “Microwave multiplexing on the Keck Array”, [J. Low Temp. Phys.](#) (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