

# Kenny King 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

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

- with Honours, First Class
- Minor: Mathematics

## AWARDS

Antarctica Service Medal, 2021

## RESEARCH

### **Searching for Inflation Signals with the BICEP/Keck Telescopes**

- Installed and calibrated the Keck Array 270 GHz receiver at the Amundsen-Scott South Pole Station in Nov 2017-Jan 2018.
- Demolished the Keck Array mount, built the BICEP Array mount, installed the BICEP Array 30/40 GHz receiver and completed the first light CMB map analysis during the entire summer season campaign at the Amundsen-Scott South Pole Station in Nov 2019-Feb 2020.
- Led the BICEP/Keck weekly data reduction campaign in 2019-2022.
- Completed the analysis of CMB data from Keck Array and BICEP3 2016-2018 observing seasons for the  $r$  constraint. The result is published in the “[BK18](#)” paper.
- Conducted test runs on the BICEP Array 150 GHz detector modules and receiver as a visiting student researcher at the California Institute of Technology in Jul 2021-Sep 2021.
- Developing new subsystems, particularly the telescope mount and the cryostat, for BICEP Array.
- Rewriting the analysis pipeline for BICEP Array.
- Leading the “pipeline A” analysis of the BK18+SPT-3G delensing studies.
- Conducting foreground studies for CMB-S4.

### **Impacts of Relic Neutrino Degeneracies on Cosmic Microwave Background**

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

TEACHING	<p>Teaching Assistant, School of Physics and Astronomy, University of Minnesota</p> <ul style="list-style-type: none"> <li>• Introductory Physics for Science and Engineering II, Spring 2017</li> <li>• Introductory Physics for Science and Engineering I, Fall 2016</li> <li>• Introductory Physics for Science and Engineering II, Spring 2016</li> <li>• Introductory College 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</li> <li>• Mechanics, Fall 2012</li> <li>• Quantum Physics II, Spring 2012</li> <li>• 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	Python, MATLAB, HTML, JavaScript, FORTRAN, $\text{\LaTeX}$
PUBLICATIONS	<p>h-index: 10, &gt; 850 citations</p> <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 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>2. 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>3. 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>4. 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> <li>5. P.A.R. Ade <i>et al.</i> (BICEP/Keck Collaboration), “BICEP/Keck XII: Constraints on Axion-like Polarization Oscillations in the Cosmic Microwave Background”, <a href="#">Phys. Rev. D <b>103</b>, 042002</a> (2021)</li> </ol>

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)

**Primary Author Conference Proceedings:**

1. 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)

**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. A. Schillaci *et al.*, “BICEP Array: 150 GHz detector module development”, [arXiv:2111.14785](#) (2021)
7. M. Dierickx *et al.*, “Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array”, [arXiv:2111.14751](#) (2021)
8. 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)
9. 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)
10. 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)
11. 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)
12. A. Schillaci *et al.*, “Design and Performance of the First BICEP Array Receiver”, [J. Low Temp. Phys.](#) (2020)

13. C. Zhang *et al.*, “Characterizing the Sensitivity of 40 GHz TES Bolometers for BICEP Array”, [J. Low Temp. Phys.](#) (2020)
14. T. St. Germaine *et al.*, “Optical Characterization of the Keck Array and BICEP3 CMB Polarimeters from 2016 to 2019”, [J. Low Temp. Phys.](#) (2020)
15. A. Soliman *et al.*, “Optical Design and Characterization of 40-GHz Detector and Module for the BICEP Array”, [J. Low Temp. Phys.](#) (2020)
16. A. Cukierman *et al.*, “Microwave multiplexing on the Keck Array”, [J. Low Temp. Phys.](#) (2020)
17. 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)
18. 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)
19. 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)
20. M. Crumrine *et al.*, “BICEP Array cryostat and mount design”, [Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX; 107082D](#) (2018)
21. 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)
22. J. Kang *et al.*, “2017 upgrade and performance of BICEP3: a 95GHz 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