

Brian Koopman

CONTACT INFORMATION Cornell University Physics Department (607) 255-0833
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EDUCATION **Cornell University - Ithaca, NY**
Ph.D., Physics (Advisor: Prof. Michael Niemack) **In Progress**
M.S., Physics **June 2015**

Clark University - Worcester, MA
B.A., *summa cum laude*, with highest honors in Physics and Math **May 2012**
GPA: 3.96 on a 4.00 scale

RESEARCH INTERESTS Study of the of cosmic microwave background (CMB) and the instrumentation associated with such study. Recent work includes hardware development for upgrades to the Atacama Cosmology Telescope Polarimeter, ACTPol, a CMB telescope located in the Atacama Desert in Chile. This work includes optical modeling, detector assembly and characterization, software development and data analysis.

HONORS AND AWARDS **NASA Space Technology Research Fellow**, NASA **2013 – 2017**
Dean's List - First Academic Honors, Clark University **2008 – 2012**
Roy S. Andersen '43 Award, Clark University **2009**
Albert C. Erickson '30 Summer Research Award, Clark University **2009 – 2010**
Erickson Award for the Academic Year, Clark University **2010 – 2011**

RESEARCH EXPERIENCE **Graduate Researcher**, Cornell University, Ithaca, NY 14850 **December 2012 – Present**
Research related to optics and detector developments for ACTPol, Advanced ACTPol, and CCATp. Work includes modeling polarization systematics using Code V, studying optical design tolerances, producing the ACT detector polarization calibrations, assembling and characterizing prototype Advanced ACTPol detectors, developing remote observation tools, and analyzing observation data.

Student Researcher, Clark University, Worcester, MA 01601 **Sept. 2011 – May 2012**
Conducted research in experimental condensed matter, specifically Scanning Tunneling Microscopy (STM), under the guidance of Prof. Michael Boyer. Aided in construction of the new STM laboratory. Performed analysis of Fe doped $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+x}$ (Bi-2212) using custom software written for IDL.

Caltech REU Student, LIGO Livingston, Livingston, LA 70754 **Summer 2011**
Researched piezoelectric actuators for use in the Output Mode Cleaner (OMC) of the Laser Interferometer Gravitational Wave Observatory (LIGO) under the guidance of Dr. Valera Frolov. Participated in optical path construction and alignment of experimental OMC with non-linear planar ring oscillator (NPRO), Nd:YAG, laser. Collection of data with LIGO data acquisition system and processing with MATLAB.

Student Researcher, Clark University, Worcester, MA 01601 **Summer 2009, 2010**
 Researched 1D antiferromagnetic chains $\text{Cu}_{(1-x)}\text{Zn}_{(x)}(3,5\text{-diClpy})_2\text{Cl}_2$ and $\text{Cu}(\text{Py})_2\text{Cl}_{2(1-x)}\text{Br}_{2(x)}$ under the guidance of Prof. Christopher Landee. Performed synthesis, simulation with the Algorithms and Libraries for Physics Simulations (ALPS), collected data using a SQUID Magnetometer and analyzed data using Origin 7.0.

TEACHING
EXPERIENCE

Teaching Assistant, Cornell University, Ithaca, NY 14850
 PHYS2214 - Physics III: Oscillations, Waves, and Quantum Physics **Fall 2012**
 PHYS2213 - Physics II: Electromagnetism **Spring 2013**

Teaching Assistant, Clark University, Worcester, MA 01601
 PHYS127 - Computer Simulations **Spring 2011**
 MATH217 - Probability and Statistics **Fall 2010, 2011**
 CS120 - Introduction to Computing **Fall 2009, 2010**

PUBLICATIONS

11. Miyatake, H., Battaglia, N., Hilton, M., et al. *Weak-Lensing Mass Calibration of ACTPol Sunyaev-Zel'dovich Clusters with the Hyper Suprime-Cam Survey*, arXiv preprint (April 16, 2018), submitted to ApJ; arXiv:1804.05873.
10. Hilton, M., Hasselfield, M., Sifón, C., et al. *The Atacama Cosmology Telescope: The Two-Season ACTPol Sunyaev-Zel'dovich Effect Selected Cluster Catalog*, arXiv preprint (September 17, 2017), submitted to ApJS; arXiv:1709.05600.
9. Sherwin, B. D., van Engelen, A., Sehgal, N., et al. *The Atacama Cosmology Telescope: Two-Season ACTPol Lensing Power Spectrum*, Phys. Rev. D 95, 123529 (June 21, 2017); doi:10.1103/PhysRevD.95.123529, arXiv:1611.09753.
8. Louis, T., Grace, E., Hasselfield, M., et al. *The Atacama Cosmology Telescope: Two-Season ACTPol Spectra and Parameters*, Journal of Cosmology and Astroparticle Physics, 6, 31 (June 15, 2017); doi:10.1088/1475-7516/2017/06/031, arXiv:1610.02360.
7. Gallardo, P. A., **Koopman, B.**, Cothard, N., et al. *Deep Reactive Ion Etched Anti-Reflection Coatings for Sub-millimeter Silicon Optics*, Applied Optics, 56, 2796-2803 (April 1, 2017); doi:10.1364/AO.56.002796, arXiv:1610.07655.
6. De Bernardis, F., Aiola, S., Vavagiakis, E. M., et al. *Detection of the pairwise kinematic Sunyaev-Zel'dovich effect with BOSS DR11 and the Atacama Cosmology Telescope*, Journal of Cosmology and Astroparticle Physics, 3, 8 (March 7, 2017); doi:10.1088/1475-7516/2017/03/008, arXiv:1607.02139.
5. Thornton, R. J., Ade, P. A. R., Aiola, S., et al. *The Atacama Cosmology Telescope: The polarization-sensitive ACTPol instrument*, ApJ, 227, 21, (December 9, 2016); doi:10.3847/1538-4365/227/2/21, arXiv:1605.06569.
4. Erdenemunkh, U., **Koopman, B.**, Fu, L., et al. *Suppression of Superfluid Density and the Pseudogap State in the Cuprates by Impurities*, Physical Review Letters 117, (2016); doi:10.1103/PhysRevLett.117.257003, arXiv:1607.05238.
3. Schaan, E., Ferraro, S., Vargas-Magaña, M., et al. *Evidence for the kinematic Sunyaev-Zel'dovich effect with ACTPol and velocity reconstruction from BOSS*, Phys. Rev. D 93, 082002 (April 11, 2016); doi:10.1103/PhysRevD.93.082002, arXiv:1510.06442.
2. van Engelen, A., Sherwin, B. D., Sehgal, N., et al. *The Atacama Cosmology Telescope: Lensing of CMB Temperature and Polarization Derived from Cosmic Infrared Background Cross-Correlation*, ApJ, 808, 7 (July 20, 2015); doi:10.1088/0004-637X/808/1/7, arXiv:1412.0626.
1. Naess, S., Hasselfield, M., McMahon, J., et al. *The Atacama Cosmology Telescope: CMB Polarization at $200 < \ell < 9000$* , Journal of Cosmology and Astroparticle Physics, 10, 7 (October 3, 2014); doi:10.1088/1475-7516/2014/10/007, arXiv:1405.5524.

CONFERENCE
PROCEEDINGS

28. Crowley, K. T., Austermann, J. E., Choi, S. K., et al. *Advanced ACTPol TES Device Parameters and Noise Performance in Fielded Arrays*, Journal of Low Temperature Physics (July 19, 2018); arXiv:1807.07496.
27. Cothard, N. F., Abe, M., Nikola, T., et al. *Optimizing the efficiency of Fabry-Perot interferometers with silicon-substrate mirrors*, Proc. SPIE 10706, Advances in Optical and Mechanical Technologies for Telescopes and Instrumentation III, 107065B (10 July 2018); doi:10.1117/12.2313483, arXiv:1807.06019.
26. Bryan, S. A., Simon, S. M., Gerbino, M., et al. *Development of calibration strategies for the Simons Observatory*, Proc. SPIE 10706, Advances in Optical and Mechanical Technologies for Telescopes and Instrumentation III, 107065B (9 July 2018); doi:10.1117/12.2313832.
25. Parshley, S. C., Niemack, M., Hills, R., et al. *The optical design of the six-meter CCAT-prime and Simons Observatory telescopes*, Proc. SPIE 10706, Advances in Optical and Mechanical Technologies for Telescopes and Instrumentation III, 107065B (6 July 2018); doi:10.1117/12.2314073, arXiv:1807.6679.
24. Vavagiakis, E. M., Ahmed, Z., Ali, A., et al. *Prime-Cam: A first-light instrument for the CCAT-prime telescope*, Proc. SPIE 10706, Advances in Optical and Mechanical Technologies for Telescopes and Instrumentation III, 107065B (29 June 2018); arXiv:1807.00058.
23. Simon, S. M., Beall, J. A., Cothard, N. F., et al. *The Advanced ACTPol 27/39 GHz Array*, Journal of Low Temperature Physics (May 21, 2018); doi:10.1007/s10909-018-1963-7.
22. **Koopman, B.**, Cothard, N. F., Choi, S. K., et al. *Advanced ACTPol Low Frequency Array: Readout and Characterization of Prototype 27 and 39 GHz Transition Edge Sensors*, Journal of Low Temperature Physics (May 11, 2018); doi:10.1007/s10909-018-1957-5, arXiv:1711.02594.
21. Coughlin, K. P., McMahon, J. J., Crowley, K. T., et al. *Pushing the Limits of Broadband and High Frequency Metamaterial Silicon Antireflection Coatings*, Journal of Low Temperature Physics (April 23, 2018); arXiv:1804.08368.
20. Choi, S. K., Austermann, J., Beall, J. A., et al. *Characterization of the Mid-Frequency Arrays for Advanced ACTPol*, Journal of Low Temperature Physics (November 13, 2017); arXiv:1711.04841.
19. Vavagiakis, E. M., Henderson, S. W., Zheng, K., et al. *Magnetic Sensitivity of AlMn TESes and Shielding Considerations for Next Generation CMB Surveys*, Journal of Low Temperature Physics (October 23, 2017); arXiv:1710.08456.
18. Ho, S. P., Austermann, J., Beall, J. A., et al. *Highly uniform 150 mm diameter multichroic polarimeter array deployed for CMB detection*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 991418 (July 20, 2016); doi:10.1117/12.2233113.
17. Crowley, K. T., Choi, S., Kuan, J., et al. *Characterization of AlMn TES impedance, noise, and optical efficiency in the first 150 mm multichroic array for Advanced ACTPol*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 991431 (July 20, 2016); doi:10.1117/12.2231999.
16. Li, Y., Choi, S., Ho, S. P., et al. *Assembly and integration process of the first high density detector array for Atacama Cosmology Telescope*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 991435 (July 20, 2016); doi:10.1117/12.2233470.
15. Henderson, S. W., Stevens, J. R., Amiri, M., et al. *Readout of two-kilopixel transition-edge sensor arrays for Advanced ACTPol*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 99141G (July 19, 2016); doi:10.1117/12.2233895, arXiv:1607.06064.
14. Rojas, P. A. F., Planella, R. D., Maurin, L., et al. *Far sidelobe effects from panel gaps of the Atacama Cosmology Telescope*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 99142Q (July 19, 2016); doi:10.1117/12.2231421.

13. Simon, S., Austermann, J., Beall, J. A., et al. *The design and characterization of wideband spline-profiled feedhorns for Advanced ACTPol*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 991416 (July 19, 2016); doi:10.1117/12.2233603.
12. Ward, J. T., Austermann, J., Beall, J. A., et al. *Mechanical designs and development of TES bolometer detector arrays for the Advanced ACTPol experiment*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 991437 (July 19, 2016); doi:10.1117/12.2233746.
11. De Bernardis, F., Stevens, J. R., Hasselfield, M., et al. *Survey strategy optimization for the Atacama Cosmology Telescope*, Proc. SPIE 9910, Observatory Operations: Strategies, Processes, and Systems VI, 991014 (July 7, 2016); doi:10.1117/12.2232824, arXiv:1607.02120.
10. **Koopman, B.**, Austermann, J., Cho, H.-M., et al. *Optical modeling and polarization calibration for CMB measurements with ACTPol and Advanced ACTPol*, Proc. SPIE 9914, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 99142T (July 6, 2016); doi:10.1117/12.2231912, arXiv:1607.01825.
9. Duff, S. M., Austermann, J., Beall, J. A. et al. *Advanced ACTPol Multichroic Polarimeter Array Fabrication Process for 150 mm Wafers*, Journal of Low Temperature Physics 184, 634 (March 22, 2016); doi:10.1007/s10909-016-1576-y.
8. Ho, S. P., Pappas, C. G., Austermann, J. et al. *The First Multichroic Polarimeter Array on the Atacama Cosmology Telescope: Characterization and Performance*, Journal of Low Temperature Physics 184, 559 (March 15, 2016); doi:10.1007/s10909-016-1573-1.
7. Pappas, C. G., Austermann, J., Beall, J. A., et al. *High-Density Superconducting Cables for Advanced ACTPol*, Journal of Low Temperature Physics, 184, 473 (January 11, 2016); doi:10.1007/s10909-015-1454-z.
6. Datta, R., Austermann, J., Beall, J. A., et al. *Design and Deployment of a Multichroic Polarimeter Array on the Atacama Cosmology Telescope*, Journal of Low Temperature Physics, 184, 568 (October 27, 2015); doi:10.1007/s10909-016-1553-5, arXiv:1510.07797.
5. Henderson, S. W., Allison, R., Austermann, J., et al. *Advanced ACTPol Cryogenic Detector Arrays and Readout*, Journal of Low Temperature Physics, 184, 772 (October 9, 2015); doi:10.1007/s10909-016-1575-z, arXiv:1510.02809v1.
4. Hubmayr, J., Austermann, J., Beall, J., et al. *Feedhorn-Coupled transition-edge superconducting bolometer arrays for cosmic microwave background Polarimetry*, 26th International Symposium on Space Terahertz Technology, ISSTT 2015. (March 2015); <https://www.nrao.edu/meetings/isstt/papers/2015/2015000030.pdf>.
3. Stacey, G.J., Parshley, S., Nikola, T., et al. *SWCam: the short wavelength camera for the CCAT Observatory*, Proc. SPIE 9153, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 915310L (August 19, 2014); doi:10.1117/12.2057101.
2. Grace, E., Beall, J., Bond, J.R., et al. *ACTPol: on-sky performance and characterization*, Proc. SPIE 9153, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 915310 (July 23, 2014); doi:10.1117/12.2057243.
1. Wheeler, J.D., **Koopman, B.**, Gallardo, P., et al. *Antireflection coatings for submillimeter silicon lenses*, Proc. SPIE 9153, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 91532Z (July 23, 2014); doi:10.1117/12.2057011.

CONTRIBUTED
TALKS

10. *Advanced ACTPol: Telescope Systems and Project Status*, SPIE Astronomical Telescopes and Instrumentation 2018, June 2018, doi:10.1117/12.2314078.
9. *Advanced ACTPol Low Frequency Array: Readout and Characterization of Prototype 27 and 39 GHz TESes*, Low Temperature Detectors 17, July 2017 (poster)
8. *The CCAT-prime Extreme Field-of-View Submillimeter Telescope on Cerro Chajnantor*, 229th American Astronomical Society Meeting, January 2017 (poster)

7. *Optical modeling and polarization calibration for CMB measurements with ACTPol and Advanced ACTPol*, University of California San Diego, September 13, 2016
6. *Optical modeling and polarization calibration for CMB measurements with ACTPol and Advanced ACTPol*, SPIE Astronomical Telescopes and Instrumentation 2016, June 2016 (poster)
5. *Atacama Cosmology Telescope: Polarization calibration analysis for CMB measurements with ACTPol and Advanced ACTPol*, APS April Meeting 2015, April 2015
4. *Deep reactive ion etching of silicon anti-reflection coatings for sub-millimeter optics*, SPIE Astronomical Telescopes and Instrumentation 2014, June 2014 (poster)
3. *ACTPol: Status and preliminary CMB polarization results from the Atacama Cosmology Telescope*, APS April Meeting 2014, April 2014
2. *Development of Optics and Detectors for Advanced CMB Polarization Measurements*, Cornell Graduate Student Seminar, November 2013
1. *Scanning Tunneling Microscopy of Fe Doped $Bi_2Sr_2CaCu_2O_{8+x}$* , APS March Meeting 2012, February 2012

OUTREACH AND
SERVICE

Cornell Physics Graduate Society (PGS) Communications Officer
 Organized PGS Outreach at Dragon Boat Festival
 Organized PGS Outreach at Ithaca Festival
 Expanding Your Horizons Conference Volunteer

2013 – 2014
Summer 2013
Summer 2013
2013