**Michael Crumrine**
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# 1 EDUCATION

**Ph.D. Physics: Experimental Cosmology** - In Progress
*University of Minnesota*, Minneapolis, MN

- Thesis adviser: Dr. Clem Pryke

**B.Sc Physics and Mathematics** - May 2013
*Beloit College*, Beloit, WI

- Degree awarded Magna Cum Laude
- Departmental Honors in Physics
- Chapin presidential scholarship
- James R. Ferwerda endowed science scholarship
- Thompson Observatory prize in astronomy and astrophysics

# 2 RESEARCH EXPERIENCE

**Graduate Student at University of Minnesota** with the Bicep/Keck program measuring the polarization of the cosmic microwave background in search of evidence for cosmic Inflation.

- Designed and oversaw fabriaction of cryostats for Bicep Array experiment
- Deployed and commissioned the new Bicep Array experiment at the geographic South Pole
- Deployed to South Pole Nov. 2016 - Jan. 2017, Nov. 2019 - Feb. 2020

**SULI Intern at Lawrence Berkeley National Lab** developing a new CBED / STEM hybrid imaging mode for the TEAM I transmission electron microscope. (2013)

**Instrument Construction and Alteration** with Dr. Patrick Polley. Constructing and implementing portable power supplies for Hall probe magnetometers and altering the instruments for increased sensitivity. (2012)

**REU at University of South Florida** studying exchange bias in magnetic trilayers and the role of the antiferromagnet bulk structure (2012)

- Research presented at the Midstates Undergraduate Research Symposium and at the 2013 March meeting of the American Physical Society in Baltimore as one of the undergraduate presentations

**Accelerator Repair** with Dr. Paul Stanley, working on repairing and reconstructing the dehumidification and refrigeration system (2010)

# 3 TEACHING EXPERIENCE

**Graduate Teaching Assistant:**

- PHYS 1301: Introductory Physics for Science and Engineering
  - Aug. 2014 - Dec. 2014
  - Aug. 2015 - May 2016
- PHYS 1201: Introductory Physics for Biology and Pre-Medicine
  - Jan. 2015 - May 2015
  - May 2016 - Aug. 2016

**Freelance Tutor**

- Differential Equations - University of California, Berkeley: Sept. 2013 - Nov. 2013
- First Semester Physics - University of California, Berkeley: Feb. 2014 - May 2014
- First Semester Physics - University of Minnesota, Twin Cities: May 2014 - Aug. 2014

# 4 OTHER EMPLOYMENT

**Fermilab Seasonal Employee** assisting in the decommissioning of the Collider Detector at Fermilab (CDF)

**Scenic Shop Supervisor** in a wood shop for the Beloit College theatre department (2010 - spring 2013)

**Scenic Shop Employee** in a wood shop for the Beloit College theatre department (2009-2010)

# 5 PROGRAMMING EXPERIENCE

Matlab, Octave, Java, IDL, Mathematica, C++, Origin, LaTeX, Python, Solidworks, COMSOL

# 6 PROFESSIONAL AFFILIATIONS

Phi Kappa Psi Fraternity
Mortar Board Senior Honor Society
Society of Physics Students
American Physical Society
Mathematical Association of America

# 7 Publications

- P. A. R. Ade, Z. Ahmed, R. W. Aikin, D. Barkats, S. J. Benton, C. A. Bischoff, J. J. Bock, R. Bowens-Rubin, J. A. Brevik, I. Buder, and et al. BICEP2/Keck Array XI: Beam characterization and temperature-to-polarization leakage in the BK15 data set. *The Astrophysical Journal*, 884(2):114, Oct 2019

- P.A.R. Ade, Z. Ahmed, R.W. Aikin, K.D. Alexander, D. Barkats, S.J. Benton, C.A. Bischoff, J.J. Bock, R. Bowens-Rubin, J.A. Brevik, and et al. Constraints on primordial gravitational waves using Planck, WMAP, and new BICEP2/Keck observations through the 2015 season. *Physical Review Letters*, 121(22), Nov 2018

- M. Crumrine, P. A. R. Ade, Z. Ahmed, R. W. Aikin, K. D. Alexander, D. Barkats, S. J. Benton, C. A. Bischof, J. J. Bock, and R. Bowens-Rubin et al. BICEP Array cryostat and mount design. *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX*, Jul 2018

- Denis Barkats, Marion I. Dierickx, John M. Kovac, Chris Pentacoff, P. A. R. Ade, Z. Ahmed, R. W. Aikin, K. D. Alexander, S. J. Benton, and C. A. Bischof et al. Ultra-thin large-aperture vacuum windows for millimeter wavelengths receivers. *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX*, Jul 2018

- Jae Hwan Kang, Peter A. Ade, Zeeshan Ahmed, Randol Aikin, Kate D. Alexander, Denis Barkats, Steve J. Benton, Colin A. Bischoff, James J. Bock, Hans Boenish, Rachel Bowens-Rubin, and 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*, Jul 2018

- Howard Hui, P. A. R. Ade, Zeeshan Ahmed, Randol Aikin, Kate D. Alexander, Denis Barkats, Steve J. Benton, Colin A. Bischoff, James J. Bock, Rachel Bowens-Rubin, and et al. BICEP Array: a multi-frequency degree-scale CMB polarimeter. *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy IX*, Jul 2018

- Ahmed Soliman, Steve J. Benton, Colin A. Bischoff, James J. Bock, Eric Bullock, Cora Dvorkin, Jeff P. Filippini, Stefan Fliescher, James A. Grayson, Mark Halpern, and 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*, Jul 2018