Curriculum Vitae

James Ross Cheshire IV

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Education

2017– Doctor of Philosophy (Ph.D.), Astrophysics, University of Minnesota Twin Cities (in-progress, 2024 expected)

2013–2017 Bachelor of Science (B.S.), Physics and Astronomy, Concentration in Computational Physics, University of Illinois at Urbana-Champaign

Research Experience

2017– ***Graduate Research Assistant*, Pryke Laboratory, University of Minnesota. Supervisor: Prof. Clement Pryke.**

- Involved heavily with assembly, integration, and testing of the BICEP Array (BA) mount, cryostats, and full instrument at the University of Minnesota and commissioning on-site at the geographic South Pole
- Conducted on-site BICEP Array receiver upgrades and calibration measurements in seasons following initial deployment
- Led *Keck Array* 2019 and BICEP3 2019-2020 full-season B-mode analyses
- Characterization of initial BA instrument performance and data quality
- Supervisory duties for BA telescope operations, including coordination with winter-over engineers
- Supervisory duties overseeing BICEP3 and BICEP Array weekly data quality-monitoring
- Rewrote/redesigned BK initial data reduction and data quality monitoring tools
- Conducted investigations into a variety of sources of systematic error, particularly the contributions from unresolved polarized radio sources and instrumental readout crosstalk

- Heavily involved with from-scratch reanalysis of all historical BICEP/*Keck* data, with a particular eye to improved internal consistency testing

2015–2017 ***Undergraduate Research Assistant,* Observational Cosmology Laboratory, University of Illinois at Urbana-Champaign. Supervisor: Prof. Joaquin Vieira.**

- Assisted with fabrication, integration, and testing of detectors, readout electronics, and cryogenics for the South Pole Telescope's SPT-3G instrument at Illinois and at Argonne and Fermilab national laboratories
- Assisted with development, fabrication, and testing of sub-millimeter multi-chroic anti-reflection coatings for SPT-3G optics
- Designed, built, programmed, and analyzed the data from a small-scale, educational 1420 MHz radio telescope which successfully observed Doppler shifts and line broadening of neutral hydrogen clouds in the Milky Way using cheap, off-the-shelf components

Teaching Experience

2018–2019 ***Head Teaching Assistant,* Minnesota Institute for Astrophysics, University of Minnesota, Minneapolis, MN**
– Astronomy 1001: Exploring the Universe (Fall 2018, Spring 2019)

- Coordinated other teaching assistants
- Scheduled labs and made lab section teaching assignments
- Configured and maintained laboratory equipment setups and environment
- Organized weekly public talks and observing nights
- Led weekly meetings
- Performed standard TA duties (teaching, proctoring, etc.)

2017–2018 ***Teaching Assistant,* Minnesota Institute for Astrophysics, University of Minnesota, Minneapolis, MN**
– Astronomy 1001: Exploring the Universe (Fall 2017, Spring 2018)

- Taught three laboratory sections of 24 students each, both semesters
- Graded lab assignments
- Held review sessions and weekly office hours
- Proctored exams

Technical Skills and Tools

- Programming Languages: MATLAB (advanced); Python, bash (intermediate); C++, Java, JavaScript (basic)
- Document typesetting with LaTeX
- Basic familiarity with HTML/JS for web development
- Linux networking and system administration (comfortable, but not an expert)
- SOLIDWORKS computer-aided design (intermediate)
- Experience with cryostats and cryogenic systems
- Experience with telescope control systems

Outreach

- Universe in the Park – gave public lectures and led telescope observing sessions at parks near the Twin Cities area.
- Minnesota Institute for Astrophysics Public Night – organized and presented public lectures and held telescope observing sessions at the University of Minnesota.
- Helped organize "Universe at Home" program aiming to maintain an outreach presence during the COVID-19 pandemic
- Helped organize and host inaugural Twin Cities "Astronomy on Tap" program at local bars
- Minnesota Institute for Astrophysics "Best Outreach" award for Spring 2019

Refereed Journal Publications

- A. Nadolski *et al.* Broadband, Millimeter-Wave Antireflection Coatings for Large-Format, Cryogenic Aluminum Oxide Optics. *Applied Optics* **59**, 3285–3295 (2020).
- BICEP/*Keck* Collaboration *et al.* BICEP/*Keck* XII: Constraints on axion-like polarization oscillations in the cosmic microwave background. *Physical Review D* **103**, 042002 (2021).
- BICEP/*Keck* and SPTpol Collaborations *et al.* A Demonstration of Improved Constraints on Primordial Gravitational Waves with Delensing. *Physical Review D* **103**, 022004 (2021).
- BICEP/*Keck* Collaboration *et al.* BICEP/*Keck* XIII: Improved Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/*Keck* Observations through the 2018 Observing Season. *Physical Review Letters* **127**, 151301 (2021).
- BICEP/*Keck* Collaboration *et al.* BICEP/*Keck* XV: The BICEP3 Polarimeter and the First Three Year Data Set. *The Astrophysical Journal* **927**, 77 (2022).

- BICEP/*Keck* Collaboration *et al.* BICEP/*Keck* XIV: Improved constraints on axion-like polarization oscillations in the cosmic microwave background. *Physical Review D* **105**, 022006 (2022).
- BICEP/*Keck* XVI: Characterizing Dust Polarization through Correlations with Neutral Hydrogen. *The Astrophysical Journal* **945**, 72 (2023).
- BICEP/*Keck* XVII: Line of Sight Distortion Analysis: Estimates of Gravitational Lensing, Anisotropic Cosmic Birefringence, Patchy Reionization, and Systematic Errors. *The Astrophysical Journal* **949**, 43 (2023).

Conference Proceedings

- A. Cukierman, Z. Ahmed, S. Henderson *et al.* Microwave Multiplexing on the *Keck Array*. *Journal of Low Temperature Physics* **199**, 858–866 (2020).
- T. St Germaine, P.A.R. Ade, Z. Ahmed *et al.* Optical Characterization of the Keck Array and BICEP3 CMB Polarimeters from 2016 to 2019. *Journal of Low Temperature Physics* **199**, 824–832 (2020).
- C. Zhang, P.A.R. Ade, Z. Ahmed *et al.* Characterizing the Sensitivity of 40 GHz TES Bolometers for BICEP Array. *Journal of Low Temperature Physics* **199**, 968–975 (2020).
- A. Soliman, P.A.R. Ade, Z. Ahmed *et al.* Optical Design and Characterization of 40-GHz Detector and Module for the BICEP Array. *Journal of Low Temperature Physics* **199**, 1118–1126 (2020).
- A. Schillaci, P.A.R. Ade, Z. Ahmed *et al.* Design and Performance of the First BICEP Array Receiver. *Journal of Low Temperature Physics* **199**, 976–984 (2020).
- L. Moncelsi, P.A.R. Ade, Z. Ahmed *et al.* Receiver development for BICEP Array, a next-generation CMB Polarimeter at the South Pole. *Proceedings of SPIE* **11453** (2020).
- T.S. Germaine, P.A.R. Ade, Z. Amhed, *et al.* Analysis of Temperature-to-Polarization Leakage in BICEP3 and Keck CMB Data from 2016 to 2018. *Proceedings of SPIE* **11453**, 353–361 (2020).
- J.H. Kang, P.A.R. Ade, Z. Ahmed, *et al.* Observing the low elevation sky and the CMB Cold Spot with BICEP3 at the South Pole. *Proceedings of SPIE* **11453**, 341–352 (2020).
- J. Cornelison, P.A.R. Ade, Z. Ahmed, *et al.* Polarization Calibration of the BICEP3 CMB polarimeter at the South Pole. *Proceedings of SPIE* **11453**, 302–313 (2020).
- A. Soliman, P.A.R. Ade, Z. Ahmed, *et al.*. 2022 upgrade and improved low frequency camera sensitivity for CMB observation at the South Pole. *Proceedings of SPIE* **12190**, 533–539 (2022).
- D. Goldfinger, P.A.R. Ade, Z. Ahmed, *et al.*. Thermal testing for cryogenic CMB instrument optical design. *Proceedings of SPIE* **12190**, 805–813 (2022).
- J. Cornelison, C. Verges *et al.*. Improved polarization calibration of the BICEP3 CMB polarimeter at the South Pole. *Proceedings of SPIE* **12190**, 829–848 (2022).

- M. Dierickx, P.A.R. Ade, Z. Ahmed, *et al.* Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array. *Journal of Low Temperature Physics* **211**, 366–374 (2023).
- A. Schillaci, P.A.R. Ade, Z. Ahmed, *et al.* BICEP Array: 150 GHz detector module development. Accepted by *Journal of Low Temperature Physics* (2023).

Talks & Presentations

- "Low-Cost Radio Telescope for Observations of the Galactic Plane at 21 cm", University of Illinois Undergraduate Research Symposium (2017).
- "BICEP Array Upgrades, Primordial Gravitational Wave Constraint Forecasts, and Low-Frequency Receiver Performance", APS April Meeting 2022, K15.004 (2022).
- "Constraining Primordial Gravitational Waves with the BICEP/*Keck* Series of CMB Polarization Experiments", APS April Meeting 2023, V13.00002 (2023).