PAUL M. CHICHURA
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EDUCATION:

2025 (expected) **The University of Chicago (UChicago)**: Ph.D. (Physics, Advisor: Thomas Crawford)
2022 **UChicago**: M.S. (Physics)
2018 **University of Pennsylvania (Penn)**: M.S. (Physics and Astronomy)
2018 **Penn**: B.A. (Physics w/ honors, Math minor, *Summa Cum Laude*, Advisor: James Aguirre)
2014–2015 **The Pennsylvania State University (PSU)**: Schreyer Honors College

RESEARCH EXPERIENCE:

2020–current **South Pole Telescope (SPT) and Event Horizon Telescope (EHT)**
UChicago, Physics – Ph.D. Thesis, supervisor: Thomas Crawford
- Created and deployed XGBoost machine learning models for the SPT control system in order to **improve real-time accuracy pointing** at science targets during EHT observations. Reduced the average pointing error by 33% for sources within the training regime during the 2024 EHT campaign, a huge improvement for a decades-old problem.
- Designed and coordinated 2 month-long surveys of the galactic center with the SPT. Led analysis of **polarized variability of Sgr A***, the black hole at the center of our galaxy.
- Developed tools to create difference images of SPT data. Led the first targeted analysis of detections of **asteroids** in data from cosmic microwave background survey experiments.

2017–2019 **Hydrogen Epoch of Reionization Array (HERA)**
Penn, Physics and Astronomy – Senior Honors Thesis, supervisor: James Aguirre
- Wrote code to calculate power spectra for data from the HERA commissioning array.
- Analyzed the quality and effect of various calibration techniques.

2016 **Dark Energy Survey (DES)**
Penn, Physics and Astronomy – Summer Research Experience, supervisor: Masao Sako
- Developed code to systematically save thumbnails of point sources in FITS files.

HONORS AND AWARDS:

2024 **Nathan Sugarman Award for Excellence in Graduate Student Research**, UChicago
Awarded yearly by the Enrico Fermi Institute to graduating physics students. $2,000 prize, 2 graduate student recipients, ~40 candidates. Awarded "for creative and innovative research that has expanded the scope of science carried out with the 10-meter South Pole Telescope."

2021 **Chambliss Astronomy Achievement Student Award Honorable Mention**
Awarded by the American Astronomical Society (AAS) through a competition presenting a research poster at a AAS conference. 14 entrants: 2 recipients, 5 honorable mentions.

2018 **Phi Beta Kappa Honor Society**, Penn
The USA's oldest and most prestigious honor society, recognizing academic excellence. Inductees are within the top 10% of students at participating universities.

SELECTED PUBLICATIONS:

[2] **P. Chichura** *et al.*, "Pointing Accuracy Improvements for the South Pole Telescope with Machine Learning." *Journal of Astronomical Instrumentation*, vol. 14, no. 01n02, Jun. 2025, doi: 10.1142/s2251171725500011.
- Led analysis, development, and deployment of models; a substantial part of Ph.D. thesis

[17] **P. Chichura** *et al.*, "Asteroid Measurements at Millimeter Wavelengths with the South Pole Telescope," *The Astrophysical Journal*, vol. 936, no. 2, p. 173, Sep. 2022, doi: 10.3847/1538-4357/ac89ec.
- Led analysis and development of novel techniques; a substantial part of Ph.D. thesis

[20] S. Kohn *et al.*, "The HERA-19 Commissioning Array: Direction-dependent effects," *The Astrophysical Journal*, vol. 882, no. 1, p. 58, Sep. 2019, doi: 10.3847/1538-4357/ab2f72.
- Results from undergraduate honors thesis research

CONFERENCE PRESENTATIONS:

Speaker, National Radio Science Meeting, "Pointing the South Pole Telescope with Machine Learning, University of Colorado, 7-10 Jan. 2025.

Poster, AI+Science, "Pointing Model Predictions with Machine Learning for the South Pole Telescope," University of Chicago, 15-19 Jul. 2024.

Poster, AI+Science, "Pointing Model Predictions for the South Pole Telescope," UChicago, 17-21 Jul. 2023.

Speaker, The Transient and Variable Universe 2023, "Asteroid Measurements at Millimeter Wavelengths with the South Pole Telescope," University of Illinois Urbana-Champaign, 20-22 Jun. 2023.

Poster, 238th Meeting of the American Astronomical Society, "Measuring the Millimeter-Wavelength Flux of Asteroids with the South Pole Telescope," remote, 7-9 Jun 2021.

Poster, 231st Meeting of the American Astronomical Society, "Polarized Power Spectra from HERA-19 Commissioning Data: Effect of Calibration Techniques," Washington, DC, 8-9 Jan. 2018.

TEACHING EXPERIENCE:

2025 (expected) **College Teaching Certificate**, UChicago
Certificate awarded by the Chicago Center for Teaching and Learning upon completion of a range of professional development activities including a pedagogical class in course design, observation and feedback, and reflection on teaching and inclusive pedagogy.

2023–current **Research Advising**, UChicago and University of Illinois Urbana-Champaign (UIUC)
Remotely advised a graduate student at UIUC on a research project continuing my work with asteroids in SPT data; met weekly and helped prepare conference presentations.

2024 **Guest Lecturer**, UChicago
Designed and taught 3 lectures for undergraduate course *ASTR 12620: The Big Bang.*

2021–2023 **Research Experience for Undergraduates (REU) Advisor**, UChicago
Directly supervised 3 REU students, 1 per summer, including career and research mentoring with weekly meetings.

2019–2020 **Teaching Assistant**, UChicago
Designed and taught discussion sections, ran lab sessions, graded assignments and exams, and held office hours for undergraduate courses *PHSC 116: Physics for Future Presidents*, *PHSC 117: Physics for Future presidents*, *PHYS 123: General Physics III.*

2018–2019 **Teaching Assistant**, Penn
Led active-learning class activities and held office hours for undergraduate courses *PHYS 101: General Physics: Mechanics*, *PHYS 102: General Physics Electricity and Magnetism.*

OUTREACH ACTIVITIES AND DEI EFFORTS:

2020–current **First Discoveries Lead and Volunteer**, UChicago
- An initiative by the SPT Collaboration to improve early-childhood science education and teacher self-efficacy, especially within marginalized communities.
- Program leader, 2022-current: organized and led weekly volunteer meetings, communicated with school administration and teachers, published select lesson plans.[1]

[1] https://pole.uchicago.edu/public/First%20Discoveries.html

- Program volunteer, 2020-current: designed and taught lessons at John Fiske Elementary School, main contact for four classes as large as 16 students.
- Expansion: co-designed, co-led professional development training for 15 teachers, 2023.

2022 **South Side Science Festival Volunteer**, UChicago
- A community event bringing together UChicago scientists so that local families can meet scientists and engage in experiments at demonstration tables.
- Created and ran a demonstration table for SPT Collaboration. ~100 family interactions

2021–2023 **DEI Discussion Organizer**, UChicago
- Organized and led weekly discussions on DEI efforts during Chicago-SPT group meetings, including: updating ongoing efforts, identifying areas of improvement, discussing readings.
- Initiated, conducted 3 climate surveys of the Chicago-SPT group. Led discussions on responses, resulting in demonstrable changes to group culture and structure.

ALL SCIENTIFIC PUBLICATIONS:

[1] Camphuis, E., et al. "SPT-3G D1: CMB Temperature and Polarization Power Spectra and Cosmology from 2019 and 2020 Observations of the SPT-3G Main Field." *arXiv*, Jun. 2025, arXiv: 2506.20707.

[2] *** P. Chichura** *et al.*, "Pointing Accuracy Improvements for the South Pole Telescope with Machine Learning." *Journal of Astronomical Instrumentation*, vol. 14, no. 01n02, Jun. 2025, doi: 10.1142/s2251171725500011.

[3] M. Archipley, *et al.* "Millimeter-Wave Observations of Euclid Deep Field South Using the South Pole Telescope: A Data Release of Temperature Maps and Catalogs." *arXiv*, May 2025, arXiv: 2506.00298.

[4] A. Foster, *et al.* "Detection of Thermal Emission at Millimeter Wavelengths from Low-Earth Orbit Satellites." *The Open Journal of Astrophysics*, vol. 8, May 2025, doi: 10.33232/001c.137526.

[5] F. Ge *et al.*, "Cosmology from CMB Lensing and Delensed EE Power Spectra Using 2019–2020 SPT-3G Polarization Data." *Physical Review. D. (2016)*, vol. 111, no. 8, Apr. 2025, doi: 10.1103/physrevd.111.083534.

[6] F. Qu, *et al.* "Unified and Consistent Structure Growth Measurements from Joint ACT, SPT and *Planck* CMB Lensing." *arXiv*, Apr. 2025, arXiv: 2504.20038.

[7] J. Zebrowski, *et al.* "Constraints on Inflationary Gravitational Waves with Two Years of SPT-3G Data." *arXiv*, Apr. 2025, arXiv: 2505.02827.

[8] A. Coerver *et al.*, "Measurement and Modeling of Polarized Atmosphere at the South Pole with SPT-3G." *The Astrophysical Journal*, vol. 982, no. 1, Mar. 2025, p. 15, doi: 10.3847/1538-4357/ada35d.

[9] K. Kornoelje, *et al.* "The SPT-Deep Cluster Catalog: Sunyaev-Zel'dovich Selected Clusters from Combined SPT-3G and SPTpol Measurements over 100 Square Degrees." *arXiv*, Mar. 2025, arXiv: 2503.17271.

[10] B. Ansarinejad *et al.*, "Mass calibration of DES Year-3 clusters via SPT-3G CMB cluster lensing," *Journal of Cosmology and Astroparticle Physics*, vol. 2024, no. 07, p. 024, Jul. 2024, doi: 10.1088/1475-7516/2024/07/024.

[11] K. Prabhu *et al.*, "Testing the ΛCDM Cosmological Model with Forthcoming Measurements of the Cosmic Microwave Background with SPT-3G," *The Astrophysical Journal*, vol. 973, no. 1, p. 4, Sep. 2024, doi: 10.3847/1538-4357/ad5ff1.

[12] S. Raghunathan *et al.*, "First Constraints on the Epoch of Reionization Using the Non-Gaussianity of the Kinematic Sunyaev-Zel'dovich Effect from the South Pole Telescope and Herschel-SPIRE Observations," *Physical Review Letters*, vol. 133, no. 12, Sep. 2024, doi: 10.1103/physrevlett.133.121004.

[13] C. Tandoi *et al.*, "Flaring Stars in a Nontargeted Millimeter-wave Survey with SPT-3G," *The Astrophysical Journal*, vol. 972, no. 1, p. 6, Aug. 2024, doi: 10.3847/1538-4357/ad58db.

[14] Z. Pan *et al.*, "Measurement of gravitational lensing of the cosmic microwave background using SPT-3G 2018 data," *Physical Review D.*, vol. 108, no. 12, Dec. 2023, doi: 10.1103/physrevd.108.122005.

[15] L. Balkenhol *et al.*, "Measurement of the CMB temperature power spectrum and constraints on cosmology from the SPT-3G 2018 TT , TE , and EE dataset," *Physical Review. D/Physical Review. D.*, vol. 108, no. 2, Jul. 2023, doi: 10.1103/physrevd.108.023510.

[16] E. Schiappucci *et al.*, "Measurement of the mean central optical depth of galaxy clusters via the pairwise kinematic Sunyaev-Zel'dovich effect with SPT-3G and DES," *Physical Review. D/Physical Review. D.*, vol. 107, no. 4, Feb. 2023, doi: 10.1103/physrevd.107.042004.

[17] *** P. Chichura** *et al.*, "Asteroid Measurements at Millimeter Wavelengths with the South Pole Telescope," *The Astrophysical Journal*, vol. 936, no. 2, p. 173, Sep. 2022, doi: 10.3847/1538-4357/ac89ec.

[18] K. Ferguson *et al.*, "Searching for axionlike time-dependent cosmic birefringence with data from SPT-3G," *Physical Review. D/Physical Review. D.*, vol. 106, no. 4, Aug. 2022, doi: 10.1103/physrevd.106.042011.
[19] A. Ghosh *et al.*, "Foreground modelling via Gaussian process regression: an application to HERA data," *Monthly Notices of the Royal Astronomical Society*, vol. 495, no. 3, pp. 2813–2826, Jan. 2020, doi: 10.1093/mnras/staa1331.
[20] ***** S. Kohn *et al.*, "The HERA-19 Commissioning Array: Direction-dependent effects," *The Astrophysical Journal*, vol. 882, no. 1, p. 58, Sep. 2019, doi: 10.3847/1538-4357/ab2f72.