

SANAH A. BHIMANI

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Postdoctoral Research Associate ◊ University of Chicago ◊ Chicago, IL 60622

PROFILE

I'm an experimental astrophysicist driven by curiosity about the subtle signals hidden in our Universe. I build precision instruments that decode whispers from the Cosmic Microwave Background, and I am excited to venture into mm-wave line intensity mapping, an emerging technique poised to explore vast, uncharted cosmic territories to further define cosmic evolution. Passionate about interdisciplinary collaboration, outreach, and mentorship, I love empowering others to approach science with clarity and confidence. At heart, I believe exploring the nature of the Universe also reveals equal insight into the nature within our human selves.

EMPLOYMENT

University of Chicago, Chicago, IL Postdoctoral Research Associate	Sept 2024 - Present
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EDUCATION

Yale University, New Haven, CT Ph.D. in Physics	Jul 2019 - Aug 2024
University of California - Berkeley, Berkeley, CA B.A. in Astrophysics & Physics	Aug 2013 - Dec 2017

HONORS & AWARDS

PEO State Scholar Awarded CT state recognition by the Philanthropic Educational Organization for ability to make significant contributions in chosen field of study as a woman in a doctoral program	2022
Yale Physics Graduate Diversity Fellowship Awarded for implementing the framework for a long-term climate survey and database analyzed by social scientists to promote tangible efforts in diversity and belonging in the Physics Department	2021 - 2022
Warren A. and Hibernia S. Tyrrell Fellowship Awarded to an outstanding student pursuing a Ph.D. in Physics	2020 - 2021
Chapin-Herron Scholarship Merit-based scholarship awarded to UC-Berkeley undergraduate	2014
Estha M. Rodkey Scholarship Merit- & need-based scholarship awarded to UC-Berkeley undergraduate	2014
Jean C. Witter Jr. Liberty Scholarship Merit-based scholarship awarded to UC-Berkeley undergraduate	2014
Jesse Koshland Scholarship Merit-based scholarship awarded to UC-Berkeley undergraduate	2013
Phoebe A. Hearst Scholarship Merit- & need-based awarded to UC-Berkeley undergraduate	2013

RESEARCH COLLABORATIONS

University of Chicago—The Simons Observatory

2024 - Present

Advisor: Jeff McMahon

- Lead the design, prototyping, and characterization of advanced silicon lens metamaterial structures optimized for higher-frequency applications with the CCAT-prime telescope
- Lead a comprehensive overhaul of legacy fabrication and metrology software (**SawPy**) for mm-wave metamaterial lenses and filters, transforming it into a scalable, automated, and modular software stack (**MetaLens**). **MetaLens** is being developed to also integrate advanced machine-learning capabilities, enabling automated quality checks, real-time hardware monitoring, and improved process control for lens manufacturing pipelines used in Simons Observatory, ASO, and next-generation mm-wave LIM experiments.

Yale University—The Simons Observatory

2018 - 2024

Advisor: Laura Newburgh

- Developed a PCA-based clustering algorithm using initial commissioning data from the first-deployed Simons Observatory telescope (SAT-MF1) to isolate atmospheric modes in detector timestreams, accurately identifying detectors optically coupled to the sky and flagging non-ideal detectors. Integrated this tool into the Simons Observatory's automated preprocessing pipeline, standardizing data-quality selection across all telescope arrays.
- Developed, deployed, and commissioned critical data acquisition and instrument control software within the Simons Observatory's novel software framework, **OCS**, enabling robust, real-time operations and monitoring for all four telescopes at the Chilean observation site.
- Led the development of **G3tHK**, a full-stack software package enabling efficient/rapid extraction, transformation, and analysis of detector and house-keeping calibration data, utilizing SQL databases and ETL pipelines for streamlined Simons Observatory data operations.
- Led the construction, calibration, and error analysis of SO's cryogenic thermometry readout systems, specializing in the construction and integration of cryogenic sensors with warm electronics and precision instrumentation for accurate low-temperature measurements.

Hydrogen Probe of the Epoch of Reionization (HYPERION)

2016 - 2018

Advisors: Aaron Parsons & Nipanjana Patra

Designed & constructed absorber baffles using low-frequency absorbers (Zote-foam, pyramidal foam, ferrite tiles); conducted antenna return-loss (S11) measurements (using Fourier spectrum analyzer) to determine ideal absorber in HYPERION's 30-150MHz bandwidth. From S11 measurements, applied principal component analysis of the simulated Epoch of Reionization signal to classify HYPERION instrument noise

Analyzing Stellar Magnetic Activity via *Kepler* Space Mission 2016 - 2018

Advisor: Gibor Basri

Developed robust autocorrelation method in IDL to determine accurate rotation rates of high-range stars. Built novel period-finding programming that combines autocorrelation and periodogram methods to calculate rotation periods of low-range stars

Calibrating SNO Detector Response 2015 - 2016

Advisor: Gabriel Orebi Gann

Constrained the change in angular response for the Sudbury Neutrino Observatory (SNO) using MiniSim, a Monte Carlo program in C++ to calibrate for next-generation experiment, SNO+

PUBLICATIONS

15. Polzin *et al.* Astronomy as a Field: A Guide for Aspiring Astrophysicists
14. Mangu *et al.* The Simons Observatory: Design, Integration, and Current Status of Small Aperture Telescopes
13. Galitzki *et al.* The Simons Observatory: Design, integration, and testing of the small aperture telescopes
12. **Bhimani** *et al.* The Simons Observatory: Site deployment of the Observatory Control System and data access software, SAT-MF1
11. Koopman *et al.* The Simons Observatory: Deployment of the Observatory Control System and supporting infrastructure,
10. Nguyen *et al.* The Simons Observatory: Alarms and Detector Quality Monitoring,
9. Guan *et al.* Simons Observatory: Observatory Scheduler and Automated Data Processing
8. Errard, Adler, Austermann, Azzoni, Baccigalupi, Beall, **Bhimani** *et al.* (Upcoming 2024), A Brief Overview of the Simons Observatory, *mmUniverse Proceedings*
7. Bhandarkar, **Bhimani** *et al.* (2022), The Simons Observatory: Development and Validation of the Large Aperture Telescope Receiver, *In Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI*, Proc. SPIE 12190 [arXiv 2207.14212]
6. CMB-S4 Collaboration [> 300 authors, including **Bhimani**] (2022), Snowmass 2021 CMB-S4 White Paper, *Contribution to Snowmass 2021* [arXiv:2203.08024]
5. Zhu *et al.* [> 20 authors, including **Bhimani**] (2021), The Simons Observatory Large Aperture Telescope Receiver, *The Astrophysical Journal Supplemental Series 256*, 23 [arXiv:2103.02747]
4. Koopman, Lashner, Saunders, Hasselfield, Bhandarkar, **Bhimani** *et al.*, The Simons Observatory: Overview of data acquisition, control, monitoring, and computer infrastructure, *In Software and Cyberinfrastructure for Astronomy VI*, Proc. SPIE 11452 [arXiv:2012.10345]
3. CMB-S4 Collaboration. [> 150 authors, including **Bhimani**] (2019), CMB-S4 Science Case, Reference Design, and Project Plan, *FNAL Technical Report* [arXiv:1907.04473]
2. Simons Observatory Collaboration [> 200 authors, including **Bhimani**] (2019), The Simons Observatory: Astro2020 Decadal Project Whitepaper, *NASA Technical Report* [arXiv:1907.08284]

1. CMB-S4 Collaboration [> 150 authors, including **Bhimani**] (2019), CMB-S4 Decadal Survey APC White Paper, *NASA Technical Report* [arXiv:1908.01062]

PRESENTATIONS

Simons Observatory Integration & Testing Workshop	May 2021
<i>Thermometry Calibration Analysis & Uncertainties for Assessing Detector Performance</i>	Remote
234th Meeting of the American Astronomical Society	January 2019
<i>Thermometry Integration and Calibration for the Simons Observatory</i>	Seattle Convention Center
Wright Laboratory: High Energy Physics Instrumentation	October 2018
<i>Thermometry Construction and Validation Process for the Simons Observatory</i>	Yale University
UC-Berkeley Astrophysical Symposium	August 2017
<i>Stellar Rotation Periods from the Kepler Space Mission</i>	UC-Berkeley
UC-Berkeley Astrophysical Symposium	August 2017
<i>HYPERION: Characterizing Absorbers at Low Radio Frequencies</i>	UC-Berkeley

TEACHING EXPERIENCE

Department of Physics, Teaching Fellow, Yale University	
Being Human in STEM - Physics 107	Spring 2024
Advanced Physics Lab - Physics 382L	Spring 2023
Advanced Classical Physics - Physics 382L	Fall 2022
Advanced Physics Lab - Physics 382L	Spring 2022
Advanced Physics Lab - Physics 382L	Fall 2021
Modern Physical Measurement Lab - Physics 205L	Spring 2021
Modern Physical Measurement Lab - Physics 205L	Fall 2020
Electromagnetism - Physics 181	Spring 2020
Modern Physical Measurement Lab - Physics 205L	Fall 2019

SERVICE & LEADERSHIP

Simons Observatory EDI Lead	
Lead EDI initiatives for SO: including organizing town hall discussions, analyzing 2020 climate survey results, identifying/presenting recommendations based on climate survey, and developing more robust climate survey with social scientists for improved assessment of interpersonal and research environment	2020 - Present
GAINS Conference Panelist & Volunteer	
Led demonstrations of lab work to high school students at the Girls Advancing in STEM Conference at Yale's Wright Laboratory; spoke about day in the life of an experimental cosmologist	2022
High School Physics Tutor for Bay Area Academic Coaching Program	
Tutored remotely to high school physics students in Sacramento, CA through the Academic Coaching Program, an initiative from the Aga Khan Development Network that focuses on providing resources for Afghan refugee students in the Bay Area, CA	2020 - 2021

Panelist at Yale Peer Pathways

Spoke to high school and college students via a remote seminar about graduate school experiences, research, being a woman in STEM 2020

Panelist and Volunteer at CuWiP at Yale

Spoke as a panelist at the Conference for Undergraduate Women in Physics (CuWiP) about my PhD path, gap year experience, and graduate school apps 2020

Simons Observatory Ambassador for APS-IDEA Initiative

Served on the committee for the Simons Observatory initiative with the American Physical Society Inclusion, Diversity, and Equity Alliance. Participated in hands-on workshops with senior members of SO; developed inclusive climate surveys/programs that create an inclusive collaborative environment for all SO members 2020 - 2022

SO-NSBP Scholars Program Committee Member

Organized the mentor-mentee matching for the inaugural SO-NSBP Program, spoke at panels for PhD experience, provided resources and helped one-on-one with PhD program personal statements, and developed programming workshops for CMB analysis 2020 - 2022

Activity Leader, Volunteer, & Panelist for Yale Pathways to Science

Served as volunteer, activity leader, and science panelist for Girls' Science Investigation, an initiative at Yale that empowers girls to develop skills for pursuing STEM careers through hands-on activities in a lab environment 2019 - 2021

University of Central Asia (UCA) Astronomy Program Developer

Developed a summer programming course for students at UCA to analyze the rotation periods of exoplanets and their host stars providing them with the ability to define intrinsic characteristics about planetary systems 2019 - 2021

Yale Graduate Student Advisory Committee (GSAC) Member

Representative for 1st- and 2nd-year Yale physics graduate students for GSAC, a committee that serves as the point of communication between the head of the department and the Director of Graduate Studies at Yale's physics department 2019 - 2021

Public Talk: *Cosmology: the Evolution of the Universe*

Presented to students of the local Ismaili Muslim Connecticut community on cosmology, life as an experimental cosmologist, and being a woman in STEM 2019

Statistics Curriculum Reviewer for UCA - Khorog, Tajikistan

Re-imagined and redeveloped lectures, assignments, class activities, and projects for the UCA statistics curriculum in Khorog, Tajikistan 2017 - 2018

Bay Area Scientists in School

Be A Scientist (BAS) mentor for 7th- and 8th- grade science projects at Willard Middle School, Berkeley, CA 2017