

# Daksh Bhatt

University of Massachusetts, Amherst

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## EDUCATION

**Expected Graduation:** *Dec 2025*

**University of Massachusetts, Amherst**

B.S. Astronomy & Physics

College of Natural Sciences & Commonwealth Honors College

**Relevant Coursework:**

Galaxies & Cosmology, Stellar Astrophysics, Observational Astronomy, Thermodynamics, Thermodynamics Lab, Quantum Mechanics, Classical Mechanics, Electricity & Magnetism, Statistical Mechanics, Computational Physics, Techniques of Theoretical Physics, Modern Physics, Ordinary Differential Equations, Multivariable Calculus, Linear Algebra, Writing About Astronomy, Astronomy in a Global Context.

## RESEARCH EXPERIENCE

*Feb 2025 – Present*

**Research Assistant, Calzetti Group, UMass Amherst**

*Independant Study*

*PI: Dr. Daniela Calzetti*

Investigating how dust attenuation systematically biases stellar age estimates in the M33 galaxy by calibrating multi-band photometry and comparing observations to theoretical attenuation models.

- Designed and wrote all custom Python pipelines for cross-instrument photometric calibration, including zero-point derivation and refinement to resolve calibration offsets between mosaic tiles and full drizzled frames.
- Performed multi-band photometry in Python using self-written routines; integrated attenuation models into color-color diagnostics to quantify dust-driven shifts in inferred stellar ages.
- Preliminary results show age overestimation consistent with attenuation geometry effects; manuscript in preparation (target submission: Spring 2026).

*Jul 2025 – Nov 2025*

**Research Assistant, Great Basin Observatory (GBO)**

*Remote Research*

*PI: Mr. Jerry Hilburn*

Conducted remote observational and computational research on candidate binary stars using GBO telescope data, the Washington Double Star Catalog, and Gaia DR3 to identify physically bound stellar systems.

- Reduced and analyzed telescope images in AstroImageJ, measuring separation and position angle for binary candidate WDS 20528+6307; compared results to 13 historical measurements to assess long-term orbital stability.
- Developed a Python pipeline using Gaia DR3 data to assess gravitational binding of star pairs, incorporating first-order energy tests, Monte Carlo propagation, and stellar parameter calibration for probabilistic classification.
- Authored a research paper on WDS 20528+6307 (under review at Journal of Double Star Observations) and preparing a second manuscript on the gravitational binding methodology (submission planned December 2025).

*May 2024 – Dec 2024*

**Research Assistant, nEXO, PocarGroup, UMass Amherst**

*Full Time/Independant Study*

*PI: Dr. Andrea Pocar*

Quantified optical systematics in large-scale simulation pipelines for the nEXO neutrinoless double beta decay experiment to improve reliability of photon transport modeling in liquid xenon (LXe) detectors.

- Modeled photon transport efficiency in LXe geometries using GPU-accelerated Chroma simulations, focusing on how surface representation impacts Silicon Photomultiplier light collection.
- Identified and quantified tessellation-driven artifacts from Computer-Aided Design (CAD) export settings; compared curved vs. flat reflector geometries and established reproducible simulation guidelines to reduce cross-institutional variance.
- Authored internal technical documentation adopted by the collaboration and presented results at the 2024 APS-DNP Conference.

Feb 2023 – May 2023

Research Assistant, LUX-ZEPLIN, HertelGroup, UMass Amherst

Independent Study

PI: Dr. Scott Hertel

Contributed to early-stage cryogenic hardware development for dark matter detection in support of the LUX-ZEPLIN (LZ) experiment, with a focus on low-heat, non-conductive actuation mechanisms.

- Designed and built a cryogenic mechanical switch to control detector hardware without adding thermal load or introducing conductive components into the low-temperature environment.
- Engineered a novel actuation system using repurposed ABS-based LEGO components for robust, non-conductive motion transfer suitable for cryogenic operation.
- Supported broader experimental development efforts within the LZ program, contributing to low-background instrumentation used in WIMP detection.

## PUBLICATIONS

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Nov 2025

**Astrometric Observations of WDS 20528+6307 Using the Great Basin Observatory**

*Under peer review in the Journal of Double Star Observations.*

This study presents new astrometric measurements of WDS 20528+6307 from Great Basin Observatory data compared with 40 years of archival records, finding minimal separation change ( $<1.1''$ ) but strong Gaia DR3 parallax and proper motion agreement, consistent with a common moving group or weakly bound binary.

## RESEARCH PAPERS

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Dec 2024

**Star Formation Rate in the First Billion Years: Insights from High-Redshift Galaxies**

*Unpublished*

Analyzed PRIMER survey data to investigate  $\text{SFR-M}^*$  and  $\text{sSFR-M}^*$  relations of massive galaxies ( $M^* > 10^{10} M_\odot$ ) across  $0 < z < 14$ , revealing higher star formation efficiency at  $z > 6$  and feedback-driven quenching at lower redshifts.

Aug 2024

**Exploring Chroma Simulation Discrepancies: Comparative Analysis of CAD Geometries**

*Unpublished*

Investigated how CAD surface resolution and geometry variations affect optical simulations in Chroma, a GPU-based ray-tracing framework. Results informed simulation practices within the PocarGroup and the nEXO collaboration.

## PRESENTATIONS

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Oct 2024

**American Physics Society, Division of Nuclear Physics, Fall'24 Meeting**

Presented a first-author poster on optical simulation fidelity in LXe, showing how CAD surface tessellation affects photon transport and detector modeling in nEXO. [Abstract, Poster]

## TEACHING EXPERIENCE

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Feb 2025 – May 2025

**Teaching Assistant: PHYS281 - Computational Physics, UMass Amherst**

*Supervisor: Dr. Shubha Tewari*

Supported instruction for a 25-student course in Python-based scientific computing; assisted students with debugging, data analysis, and simulations during labs and office hours, and evaluated their code-based project work.

Sept 2024 – Dec 2024

**Teaching Assistant: PHYS131 - Introduction to Mechanics, UMass Amherst**

*Supervisor: Dr. Heath Hatch*

Assisted instruction for a 75-student introductory mechanics course; guided students through problem-solving during class and office hours, graded assignments and exams, and led review sessions to reinforce conceptual understanding.

Feb 2024 – May 2024

**Teaching Assistant: ASTRON105 - Weather and Astronomy, UMass Amherst**

*Supervisor: Dr. Don Candella*

Conducted weekly office hours and graded assignments for a general education course introducing 120+ non-major students to weather phenomena through the lens of basic physics and astronomy.

Sept 2023 – May 2025

**Lab Assistant: ASTRON100 - Exploring the Universe, UMass Amherst**

*Supervisor: Dr. Stephen Schneider*

Assisted 50 first-year astronomy majors during lab sessions, helping students navigate Stellarium software and apply core astronomy concepts to night sky simulations..

OUTREACH & MENTORING EXPERIENCE

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- Sept 2025

Astronomy On Tap - Bengaluru, India

Introduced audiences to stellar nucleosynthesis and the cosmic origins of the elements, using stardust as an accessible narrative bridge between astrophysics and human connection.
- May 2025

Astronomy On Tap - Western Massachusetts, USA

Selected as the first undergraduate from UMass Astronomy to present on star-formation rates in high-redshift galaxies, comparing evolutionary signatures of young and mature galaxy populations for a public audience.
- May 2024 – Dec 2024

Peer Mentor: Astronomy, UMass Amherst

Invited by the Department of Astronomy. Paired with three first-year students to provide academic and social support, offer course and research guidance, and help them navigate the department and adjust to college life.
- Nov 2024

Astro Night, UMass Amherst

Led public observing sessions on the Leonids meteor shower using the 16-inch Cassegrain at Orchard Hill Observatory, guiding 80 visitors through night-sky objects and related astrophysical concepts.
- Nov 2023

Rocketry Demonstration for High Schoolers, Amherst

Organized and led hands-on water-rocketry demonstrations and introductory coding activities for 50 high school students, teaching propulsion physics and basic programming through interactive STEM outreach.
- Feb 2023 – Aug 2023

New Student Orientation Mentor, Rocketry Club, UMass Amherst

Nominated by club members to mentor incoming students; organized onboarding meetings and conducted bi-monthly check-ins to support integration into the team and its projects.

HONORS AND AWARDS

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- Oct 2024

APS DNP Fall’24 Meeting, Boston, USA

Awarded full travel, housing, and registration support by the American Physical Society to present research.
- Fall’24, Spring’25

Dean’s List, UMass Amherst

Awarded for obtaining a semester GPA of 3.5 or greater in semesters with higher-level courses.
- Sept 2022 – Dec 2025

Chancellor’s Award, UMass Amherst

Competitive scholarship awarded upon admission, covering approximately 30% of total tuition.

SOCIETIES & MEMBERSHIPS

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- American Physical Society (APS)

Astronomical Society of India (ASI)
- American Astronomical Society (AAS)

Indian Physics Association (IPA)
- Society of Physics Students (SPS)

nEXO collaboration

EXTRA CURRICULAR ACTIVITIES

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- May 2024 – May 2025

Left Winger, UMass SPS, Intramural Club Soccer

Played in the university’s competitive intramural league, representing the UMass Amherst Society of Physics Students in seasonal tournaments.
- May 2023 – Sept 2023

Technical Assistant, CNS Dean’s Office, UMass Amherst

Conducted comprehensive hardware upgrades, including RAM and storage enhancements, on 30+ faculty computers, boosting system performance by 40% and extending the lifespan of existing equipment.
- Feb 2023 – May 2023

Staff Member, All-Campus Makerspace, UMass Amherst

Assisted over 70 students with electronics and prototyping projects; assembled and troubleshooted circuits, designed 3D-printable models using CAD software, and maintained a fleet of 10+ 3D printers through regular servicing and calibration.
- Sept 2022 – Aug 2023

Structure Team Lead, Rocketry Club, UMass Amherst

Led rocket design and construction; oversaw 3D modeling, structural simulations, and team meetings, while coordinating project updates in weekly leadership briefings.

## ADDITIONAL SKILLS

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- Python, C++, MATLAB
- Astropy, NumPy, Matplotlib, PhotoUtils
- Aperture Photometry, FITS Image Processing
- DS9, AstroImageJ, ASTAP
- SolidWorks, Fusion360
- Circuit Assembly, Robotics Prototyping
- Git, Linux, LaTeX

## REFERENCES

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### **Dr. Daniela Calzetti**

Department of Astronomy, UMass Amherst  
calzetti@astro.umass.edu

### **Mr. Jerry Hilburn**

Director, Great Basin Observatory  
science@greatbasinfoundation.org

### **Dr. Mauro Giavalisco**

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### **Dr. Don Candela**

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### **Dr. Andrea Pocar**

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### **Dr. Scott Hertel**

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