Carlos Garcia Diaz

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Research Interests

gravitational lensing, galaxy clusters, galaxy protoclusters, dark matter, dust-obscured star-forming galaxies, High Energy Astrophysics (HEA), X-ray observations, infrared and submillimeter observations, galaxy and star formation, spectroscopy, computer science, data science

Education

University of Massachusetts — *Amherst*

Ph.D., Astronomy — *Sept 2021 - Current*

- GPA: 3.55
- Advisors: Dr. Daniel Wang and Dr. Min Yun

Delaware State University — *Dover*

B. Sc., Physics — *Aug 2017 - May 2021*

- Minor: Math
- GPA: 4.0
- Advisor: Dr. Mohammad Khan

Research Experience

University of Massachusetts, Amherst — *Amherst, Massahcusetts*

Research Assistant — *Sept 2021 - Current*

- Studying Hyper Luminous Infrared Galaxies (HyLIRGs) using IR to X-ray observations.
- Examining the star formation process that fuels these extremely bright sources
- Used X-ray spectroscopy software, Xspec, to analyze and model XMM-Newton X-ray spectra of 3 HyLIRGs
- Helped mentor an Undergraduate Student to further their research goals.
- **Main science goal is to better understand the X-ray Luminosity, L_x, and Star Formation Rate (SFR) relation in galaxies to investigate how galaxies' stellar populations grow and evolve, and to study the massive galaxy clusters that gravitationally lens these galaxies. May lead to a potentially establish new method of tracing the star formation in a galaxy.**

University of Texas, Austin — *Austin, Texas*

Texas Astronomy Undergraduate Research experience for Under-represented Students (TAURUS) — *June 2021 - Aug 2021*

- Used Hobby-Eberly Telescope Dark Energy Experiment (HETDEX) data to study galaxy protoclusters
- Developed a Python code to identify galaxy overdensities in the early universe.
- Estimated the masses and velocity dispersions of candidate galaxy protoclusters.
- Preformed 3-nights of remote observing using the VIRUS-P instrument at the McDonald Observatory
- Presented poster of results at the TAURUS 2021 Symposium.
- Will present poster at the American Astronomical Society (AAS) 241^{st} meeting in Seattle, WA.

Delaware State University — *Dover, Delaware*

Undergraduate Research Assitant — *Aug 2019 - May 2021*

- Used MATLAB to model spectroscopic line shapes and plot methane data from NASA Goddard Earth Sciences database. Presented a virtual talk at SPIE conference in April 2021.
- Involved in academic research of fast real-time fitting of direct absorption spectroscopy signals for high precision infrared laser-based greenhouse gas sensors

University of Michigan — *Ann Arbor, Michigan*

Summer Research Opportunity Program (SROP) — *May 2019 - July 2019*

- Estimated the core mass of 36 SDSS Giant Arcs Survey (SGAS) galaxy clusters
- Used MATLAB to apply an empirical correction resulting in a more accurate estimations of masses of galaxy clusters
- Developed a MATLAB code to create a circle of best fit using Right Ascension and Declination coordinates
- Presented poster of results to my mentor, research group, and the 2019 SROP symposium

Teaching Experience

Teaching Assistant — *Amherst, Massachusetts*

University of Massachusetts, Amherst — *Sept 2022 - Current*

- **ASTRO 330 High Energy Astrophysics**: Help organize lectures and homeworks for upper-class undergraduate students. Also, grade and provide feedback of submitted work from students.
- **ASTRO 100 Introduction to Astronomy lab**: Help other TA's provide assistance to students in labs. Organize and preform lectures for students to conduct the labs and provide assistance to students in labs.

Teaching Assistant for High School Summer Program — *Amherst, Massachusetts*

University of Massachusetts, Amherst — *July 2022*

- Helped run a graduate student lead summer program for High School students.
- Preformed lectures on Active Galactic Nuclei, Dark Matter, and Large Scale Structure of the universe.
- Conducted labs that focused on teaching students the fundamentals of Python coding.

Math and Physics Tutor *Dover, Delaware*

Delaware State University *Aug 2018 – May 2019*

- Provided academic development help to students for math up to Calculus III and physics courses up to Mechanics II
- Worked with other tutors and the Student Success Director to create an academically encouraging environment
- Logged all tutor sessions both electronically and on paper

Supplemental Instructor (SI) *Dover, Delaware*

Delaware State University *June 2018 – Aug 2018*

- Assured students met mathematical standards for college level courses
- Worked with teachers directly to teach students material for one-hour sessions every day
- Taught incoming freshmen how to have a smooth academic transition from high school to college

Leadership and Advocacy

United We Are Dreaming *Dover, Delaware*

Teleduction *2021 – 2022*

- Participated in a documentary of DACA recipients that showed the journey of various immigrants.
- Documentary link: `https://vimeo.com/757043159`

Prospective Graduate Student Visit Co-Director *Amherst, Massachusetts*

University of Massachusetts, Amherst *2022*

- Co-directed the 2022 UMass Amherst Prospective Astronomy Graduate student visit.
- Organized students and professors to preform talks to inform prospective students of on-going research at UMass.

Graduate Student Representative for the Astronomy Department *Amherst, Massachusetts*

University of Massachusetts, Amherst *2022*

- Represented UMass Astronomy Graduate Students in faculty meetings
- Relaid information to the graduate students and voiced the opinions of the student body to professors.

National Society of Black Engineers (NSBE) Chapter Vice President *Dover, Delaware*

Delaware State University *2020 – 2021*

- Volunteered as a tutor and organized academic and career support for physics and engineering majors of Delaware State University.
- Attended conferences to work with NSBE chapters of different schools.

DACA Story Sharing *Dover, Delaware*

United Methodist Churches *2018 – 2019*

- Went to Methodist churches in the Delaware – Maryland Area to spread awareness of immigration issues by sharing my story as a Deferred Action for Childhood Arrivals (DACA) recipient.

Collaborations

Planck All-Sky Survey to Analyze Gravitationally-lensed Extreme Starbursts (PASSAGES) *Amherst, Massachusetts*

University of Massachusetts, Amherst *June 2021 - Current*

- Member of the international collaboration, PASSAGES, that focuses on studying gravitationally lensed extremely star-forming galaxies and the galaxy clusters that lens these galaxies.

Telescope Time Awarded as Principal Investigator (PI)

Gemini Observatory Spectroscopic relationship between a luminous X-ray AGN and a strongly lensed HyLIRG at z=3.55. Time: $\sim$ 5 hrs

XMM-Newton Understanding the role of AGN in HyLIRGs: study of a strongly lensed sample. Time: $\sim$ TBD

Publications

- **C. A. Garcia Diaz**, Zakaria Juracka, Al R. Alexis, Mohammad A. Khan., "*Quantifying methane emissions in Delaware from field-based mid-IR sensors and satellite observations*", 2021, SPIE, 117330M, `https://doi.org/10.1117/12.2587901`
- Remolina González J. D., Sharon K., Mahler G., Fox C., **Garcia Diaz C. A.**, Napier K., Bleem L. E., Gladders M. D., Li N., Niemiec A., "*Core Mass Estimates in Strong Lensing Galaxy Clusters: a Comparison Between Masses Obtained from Detailed Lens Models, Single-Halo Lens Models, and Einstein Radii*", 2021, APJ, 920, 98, `https://iopscience.iop.org/article/10.3847/1538-4357/ac16d8`

Achievements

2021 **Spaulding-Smith Fellowship**, 2 year full funding for Ph. D. Program (first and last year of program) *Amherst, MA*

2017-2021 **Dream.US Opportunity Scholarship**, Full-ride Scholarship *Dover, DE*

2019 **Delaware State University Hackathon**, Winner *Dover, DE*

2019 **Idaho Growers Shipper Association Scholarship**, Textbook Scholarship *Rigby, ID*

2018 **Wilcox Fresh Scholarship**, Textbook Scholarship *Rigby, ID*

Skills

Programming and Miscellaneous Python (Pandas, NumPy, AstroPy, etc.), Matlab, Xspec, HTML/CSS, Linux, LaTeX, Microsoft Office, Git.

References available upon request.