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## 1. Abstract

This is the second year of a partnership between **North Carolina Agricultural and Technical State University (NCAT)**, a research-active Historically Black College or University (HBCU), and **Boston University (BU)**, a research-active university with institutional access to research grade telescopes. The partnership has three key goals: (1) **enhance astronomy research and education at NCAT** by providing access to research telescopes; (2) **raise the visibility of astronomy as a career at NCAT** and at high schools, colleges, and universities in the area, and; (3) **increase the number of minoritized students pursuing graduate degrees in astronomy**.

This pilot, 30-month program initiated the partnership and lays the groundwork to nurture and enhance the program for the long term. We leverage BU's ownership of the 1.8m Perkins Telescope Observatory (PTO) and its access to nights on the 4.3m Lowell Discovery Telescope (LDT) to enhance scientific research, training, and education of students at NCAT.

We focus on NCAT's role as a technical university serving a large population of minoritized students to enhance the diversity of graduate programs in astronomy. Combining the strengths of NCAT and BU, we position students to become full participants and leaders in the national astronomy enterprise.

In addition to telescope access, our program runs summer undergraduate internships at BU for NCAT students, designed to promote scientific advancement and career training, while also improving student competitiveness for admission to graduate programs. We conduct pre- and post-project element assessments to measure how well our goals are met and the impact of our programs in the lives of the students involved.

## 2. Funding Program

The U.S. National Science Foundation (NSF), as part of the Astronomy Program (AST) within the Division of Math and Physical Sciences (MPS), irregularly offers opportunities to propose to the **Partnerships in Astronomy and Astrophysics Research and Education (PAARE)** program.

From the PAARE website (<https://www.nsf.gov/paare>), the program synopsis is presented as:

*"The objective of PAARE is to improve the quality and environment of astronomy and astrophysics research and education by stimulating the development of formal, long-term partnerships that provide authentic pathways into the research enterprise and broaden participation in astronomy by encouraging proposals from the full spectrum of talent across society to include individuals from groups that have been historically underrepresented. Partnerships must substantially involve institutions seeking to create opportunities for student and faculty research that will increase the recruitment, retention, and success of these individuals. It is expected that the partnerships will build or strengthen research capacity, as well as foster a diverse, inclusive, and equitable environment for astronomy and astrophysics research and education at the partnering institutions."*

Together, faculty members at BU and NCAT assembled a collaborative NSF proposal to respond to the 2023 PAARE Call for Proposals. Ours was one of eight projects selected for funding and the only one with an HBCU focus. Our initial performance period is 30 months, with expectations that a renewal proposal will be submitted based on current program successes.

## 3. Program Elements

Our NSF proposal called out nine program elements: 6 "core" elements and 3 "aspirational" elements:

### Core Elements:

- Element 1:** Research Training and Science use of the PTO by NCAT
  - Element 2:** Summer Internships for NCAT students at BU
  - Element 3:** Short-term Faculty exchanges between the institutions
  - Element 4:** Create and post student-based astronomy images at NCAT and BU
  - Element 5:** Joint NCAT & BU attendance at NSBP or SACNAS annual meetings
  - Element 6:** Pre-, Post- element assessments, annual symposium and lessons-learned
- ### Aspirational Elements:
- Element 7:** NCAT Introductory Astronomy Class hybrid use of the PTO
  - Element 8:** Attendance at AAS, AGU, DPS, or topical science meetings
  - Element 9:** NCAT Physics Chair and college Dean visit PTO (with NCAT students)

The first core element is being accomplished via observing trips by NCAT faculty and students to the Perkins telescope. To date, there have been three such 4-night observing runs involving Professor Meli (NCAT), Professor Clemens (BU), 12 NCAT students, and Mr. Colt Pauley (BU Telescope Manager). **Four of the 12 students are attending this NSBP meeting – so be sure to visit their posters!**

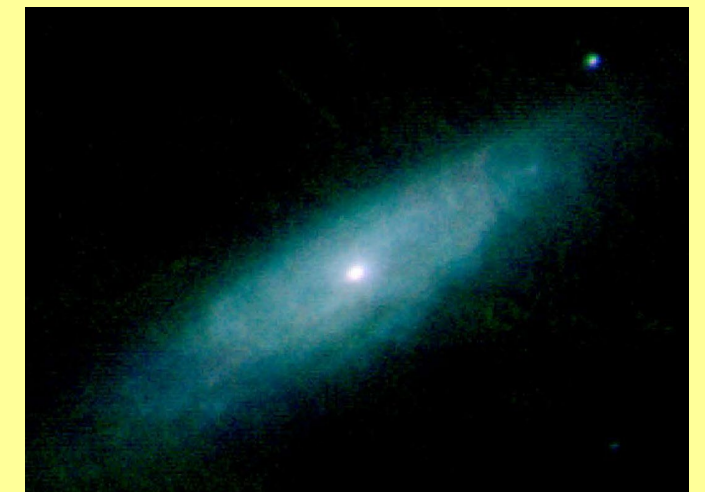


## 4. Telescope Observing

Three, four-night observing runs on BU's Perkins Telescope Observatory (PTO) outside Flagstaff, Arizona by NCAT faculty and students have provided hands-on experience in designing, conducting, and evaluating scientific research on a large, research-grade telescope.

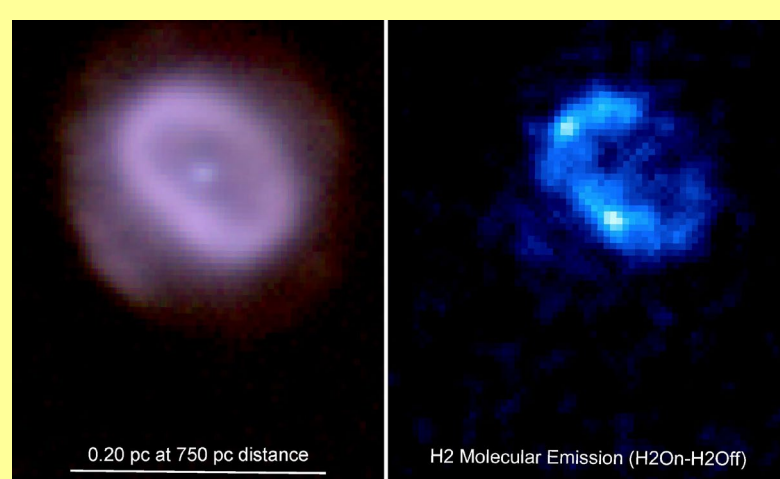
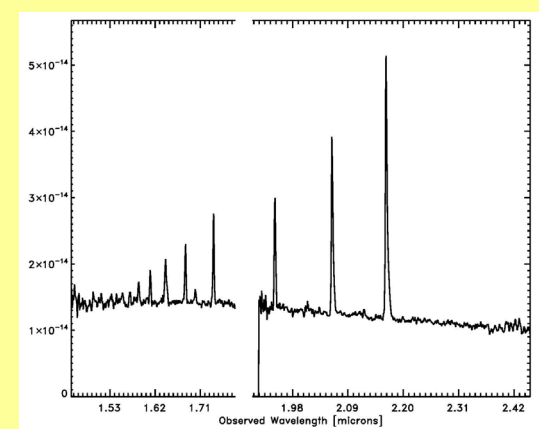
### Example Target Objects and Studies have included:

- **Arp 157 / NGC 520 – Colliding Galaxies**  
Optical BVR combined image (PRISM instrument)
- **Globular Cluster M5 – JHK Near-Infrared with Mimir**
- **Dwarf Galaxy NGC 6503 – JHK NIR with Mimir**

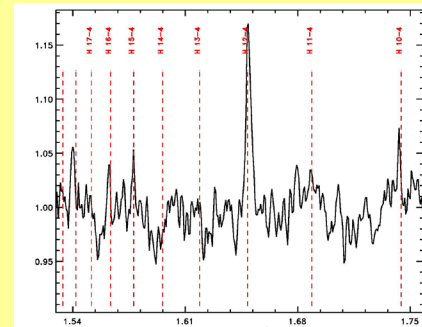


### Star Forming Region Sh2-159

- JHK Imaging
- HK Spectroscopy



- **Molecular Hydrogen (H2) in the Blue Snowball Planetary Nebula**
- **Seyfert Galaxy NGC4151 – Hydrogen emission**  
Line spectroscopy



## 5. Day Trips in Arizona

Daytimes in Arizona provide great opportunities for NCAT faculty and students to visit the 4.3m Lowell Discovery Telescope, the new \$53M Astronomy Discovery Center (opening in just a week!), Meteor Crater, and the Grand Canyon. Most of these trips are first-time student experiences.



## 6. Other Elements

- **Summer Internships** – two NCAT students spent 8 weeks at BU this past summer, working with Astronomy faculty on research projects involving White Dwarf stars and comet spectroscopy. We expect to fund two additional NCAT summer interns at BU for summer 2025.
- **Faculty Exchanges** – BU faculty have traveled to NCAT to give talks, meet with students and faculty, and learn about NCAT and their Physics Department. Professor Meli (NCAT) visited BU to present a seminar, meet with faculty and researchers and learn about BU and Boston.
- **Joint attendance at NSBP meetings** – we (NCAT+BU) are here!
- **Pre- and post-element student self-assessments** – these have been conducted and will continue to provide vital program feedback as measured against our desired *Learning Outcomes*.
- **Student-based images on posters at NCAT and BU** – work in progress, NCAT posters on the Physics Department walls there, BU soon.
- **Aspirational Elements** – NCAT Introductory Astronomy class virtual observing on the PTO – still in the works; AAS/DPS/AGU attendance – future goal; NCAT administrators to the PTO – high priority!



- More NCAT->PTO observing expected for Spring and Fall 2025 semesters
- Renewal PAARE NSF collaborative proposal – for full 5-year period – to begin - the story we can tell is a very strong one!



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NSF PAARE Web site: <https://new.nsf.gov/funding/opportunities/paare-partnerships-astronomy-astrophysics-research-education>

Perkins Telescope Observatory: <https://www.bu.edu/pto/>