NATIONAL OPTICAL ASTRONOMY OBSERVATORY

NSF Research Experiences for Undergraduates Site Program in Astronomy at Kitt Peak National Observatory (KPNO)

Annual Project Report 2014 (NSF AST-1262829)

Submitted to
Daniel Evans, PhD
NSF, Program Director for Education and Special Programs
Kenneth Mighell, Principal Investigator
David Silva, Co-Principal Investigator
January 30, 2015

Accomplishments

Major Goals of the Project

The NOAO KPNO REU site program involves undergraduates in challenging ongoing research projects of substantive scientific merit. These projects are usually related to high-priority research programs of the national observatory and frequently lead to publishable results. The KPNO REU site program is a vital part of the NOAO's ongoing commitment to meet the nation's need for the training of future scientists. This program provides its REU participants valuable exposure to non-PhD options for those interested in astronomy, such as instrumentation, technical support, education, and public outreach. The broadest goals of the KPNO REU site program are (1) to encourage undergraduates to pursue careers in science, (2) to foster high levels of scientific literacy among the future STEM workforce, (3) to stimulate general awareness of the remarkable achievements of US astronomy, and (4) to inspire interest in the future progress and welfare of US science.

Major Activities

Recruitment

We had a total of 132 complete and 168 incomplete applications to the 2014 KPNO REU program. From the 132 qualified applicants, six undergraduate students (three women and three men; one African-American woman, one Native-American man) were selected to participate in the 2014 REU site program at KPNO. About four months before the application deadline, NOAO began recruitment for the program via the KPNO REU website (http://www.noao.edu/kpno/reu/), and by posters and letters sent to colleges and universities across the US and Puerto Rico. In November 2013, approximately 900 posters and letters were mailed to US college and university Science Department chairs and undergraduate advisors (principally in physics, astronomy, math, computer science, and engineering programs); as well as to campus job placement and career counseling offices. The 132 qualified applicants applied from 41 states and 122 schools. Of the applicants who answered the gender question, 40.5% of applicants were women (51 out of 126) and 59.5% were men. Of the 122 qualified applicants who gave information about their race, 3 classified themselves as African American (2.5%), 13 as Hispanic (10.7%), 1 as Native American (0.8%) 2 as Mixed/Other (1.6%), 7 as Asian (5.7%), and 96 as Caucasian (78.7%). A total of 127 of the applicants told us how they learned about the KPNO REU program; 9 said from a friend or a previous REU students (7.1%), 24 said their advisor (18.9%), 18 said a college or department staff member (14.2%), 7 said the REU poster on a bulletin board (5.5%), 66 said the KPNO REU website (51.9%), 1 said a Career Planning/Job Placement office (0.8%), and 2 said "other" (1.6%).

Participants

Left to right: Kyle Lackey, Marcus Lee, Samantha Brunker, Anna Payne, Jamison Burke, and Belinda Cheeseboro

Each of the students selected for the program was matched with an NOAO-North scientific staff member to work on a research project previously proposed by the staff member and evaluated by the REU Site Director. In general, the scientific projects most likely to be approved for the program are those that provide the greatest opportunity for the REU student to make substantial progress over the course of the summer, as well as those likely to result in an eventual scientific publication in which the student is a collaborator. Particular research topics are assigned to particular students in consideration of the student's background and avowed scientific interests (as expressed in the student's application).

The six REU students, their college/university affiliations, and the NOAO-North scientists designated as their research advisors for the program are listed as follows:

2014 KPNO REU student (College/University); NOAO Research Advisor(s)
Jamison Burke (Swarthmore College); Chuck Claver
Samantha Brunker (University of Kansas); Susan Ridgway & Jayadev Rajagopal
Belinda Cheeseboro (Andrews University); Dara Norman
Kyle Lackey (University of South Carolina); Jay Elias
Marcus Lee (Tohono O'odham Community College); Gautham Narayam
Anna Payne (Wellesley College); Hanae Inami

Research Projects

The summer 2014 REU students at NOAO-North spent an average of 11.7 weeks working as fulltime research assistants on projects that included analyzing AGN observations obtained with NASA’s Wide-field Infrared Survey Explorer (WISE), an investigation of the abundance of lithium in stars in the core of the Lupus 3 dark cloud, and the characterization and classification of variables to be observed with the Large Synoptic Survey Telescope (LSST). In addition to work on their individual projects, the students used the KPNO 2.1-m telescope during 10 nights of observing on 18–27 July 2014 (dark time with the

CFIM+STA3 CCD camera); each student had an average of 4 observing nights. This observational experience is an essential feature of the KPNO REU program, allowing each of the students to experience first hand the process of designing and carrying out original observations at the Kitt Peak National Observatory. Toward the end of the program, REU students are required to share their research findings with the NOAO astronomical community through oral presentations and written reports. For many of the students, this was their first experience presenting research results in a professional scientific setting. The titles of the students' research topics, presentations, and written reports are listed below.

- Jamison Burke: “LSST Site: Sky Brightness Data”
- Samantha Brunker: “Studying Active Asteroids using pODI”
- Belinda Cheeseboro: “AGN Through the Eyes of WISE”
- Kyle Lackey: “Through the Lens of COSMOS: Lithium in Lupus 3”
- Marcus Lee: “Characterizing and Classifying Variables from LSST”
- Anna Payne: “Analyzing Hydrogen Recombination Lines in the Infrared and Optical to Determine Extinction and SFRs of Local LIRGs”

The written reports of the 2014 KPNO REU students are available online at the following URL: http://www.noao.edu/kpno/reu .

Scientific Lectures and Field Trips

In addition to the research project, two popular components of the KPNO REU program are the weekly science lectures given by NOAO staff and the field trips to nearby observatories and non-NOAO facilities. The lectures and field trips are designed to introduce the REU students to a broad array of current scientific topics in optical/infrared ground-based, stellar astronomy and solar astronomy. The KPNO and NSO REU students visited the National Solar Observatory facilities at Sacramento Peak, New Mexico, during 1-5 July 2014; they were given a custom tour of NRAO's Very Large Array by Dr. Vivek Dhawan, and they also toured the 2.5-m Sloan Digital Sky Survey (SDSS) Telescope and the ARC 3.5-m telescopes at the Apache Point Observatory. On July 8, the KPNO and NSO REU students toured the University of Arizona's Mirror Lab. The NOAO/NSO REU lectures at NOAO-North are informal, which allows the students to interact and network with scientists working in many different areas of ground-based astronomy, solar astronomy, and instrumentation. The speakers and topics of the 2014 NOAO/NSO REU lecture series (June 12 to August 5) are listed below.

- Dave Silva (NOAO Director): “An Introduction to the National Optical Astronomy Observatory”
- Abhijit Saha (NOAO): “Pulsating Variable Stars”
- Frank Hill (NSO): “An Introduction to Helioseismology”
- Valentin Martinez Pillet (NSO Director): “From Balloons to the Volcano: A Journey into High Spatial Resolution Solar Physics”
- Jeyhan Kartaltepe (NOAO): “How Cosmic Collisions Shape the Universe”

- Chuck Claver (LSST): “The Ubiquitous Charge Coupled Device: Its Past, Present and Future”
- Frank Hill (NSO): “Space Weather”
- Letizia Stanghellini (NOAO): “The Population of Planetary Nebulae”
- Buell Jannuzi (Director of Steward Observatory): “University of Arizona, Steward Observatory, and the Astrophysics Graduate School Application Process”
- Lori Allen (NOAO; Associate Director of KPNO): “Measuring the Size Distribution of Near-Earth Asteroids”

2014 KPNO REU Students at the 225th AAS Meeting

The opportunity to present the findings of their original research at the most important national meeting of US astronomy is arguably one of the most prized benefits enjoyed by KPNO REU students. Five of the six 2014 summer students attended the 225th meeting of the American Astronomical Society (AAS) 4–8 January 2015 in Seattle, Washington. Each of the students was the presenting author on a poster incorporating aspects of their REU summer research projects. The citation information about the REU posters presented at the 225th AAS meeting is given in the **Products** section (below); the abstracts of these posters are available online at the SAO/NASA Astrophysics Data System (ADS: http://www.adsabs.harvard.edu/).

Specific objectives

See above.

Significant Results

See above.

Key Outcomes or Other Achievements

See above.

Opportunities for Training and Professional Development

See above.

Dissemination of Results to Communities of Interest

See above.

Plans for next reporting period

Activities for the upcoming 2015 KPNO REU program are well underway.

In December, 2014, approximately 900 posters (see below) for the 2014 KPNO REU program were mailed to US college and university Science Department chairs and undergraduate advisors (principally in physics, astronomy, math, computer science, and engineering programs), as well as to campus job placement and career counseling offices.

The 2015 version of the KPNO REU website (http://www.noao.edu/kpno/reu/) and the online 2015 KPNO REU application website went live on 1 December 2014. As of 12 January 2015, 25 applications have been received. Many more applications are expected by the application deadline of 30 January 2015.

It is anticipated that six REU research assistant positions will be offered for the summer of 2015 on 1 March 2015, which is the common job offer date for NSF AST REU summer programs. All six positions should be filled by the end of March 2015.

The 2015 KPNO REU summer program is planned to start on 1 June 2015.

Research Opportunity for Undergraduates

2015 KITT PEAK NATIONAL OBSERVATORY Summer Research Assistants

Kitt Peak National Observatory (KPNO), a division of the National Optical Astronomy Observatory (NOAO), anticipates being able to offer 6 research assistant positions for the summer of 2015 through the NSF-Funded Research Experiences for Undergraduates (REU) Program. The KPNO REU program provides an exceptional opportunity for undergraduates considering a career in science to engage in substantive research activities with NOAO scientists working in the forefront of contemporary astrophysics. Each REU student is hired as a full-time research assistant to work on specific aspects of major ongoing research projects at NOAO which include the origin, nature, and evolution of stars, galaxies and stellar systems, observational cosmology, analysis of Hubble Space Telescope and Spitzer Space Telescope images and Kepler Mission light curves. As part of their research activities REU students develop expertise in astronomical data reduction and analysis.

Participants must be citizens or permanent residents of the United States. The positions are full-time for 10-12 weeks between June and August, with a preferred starting date in early June. A salary of $800.00 per week and funds to cover travel to and from Tucson, Arizona, are provided. Completed applications including applicant information, official transcripts, and two letters of recommendation are to be submitted no later than Friday **January 30, 2015**.

If you need additional information, please contact us at:

REU Program
Kitt Peak National Observatory
950 N. Cherry Avenue
Tucson, AZ 85719

or by phone:
520-318-8230

On line applications can be obtained from the NOAO Web page at: www.noao.edu/kpno/reu

The National Optical Astronomy Observatory is operated by the Association of Universities for Research in Astronomy (AURA), under a cooperative agreement with the National Science Foundation. NOAO is an affirmative action and equal employment opportunity employer. NOAO actively support efforts to broaden participation in all Observatory activities. Women and candidates from underrepresented minorities are particularly encouraged to apply.

Products

Journal Publications:

None to report

Books or Other Non-Periodical, One-time Publications:

None to report

Book Chapters:

None to report

Thesis/Dissertations:

None to report

Conference Papers and Presentations:

Posters presented at the 225th American Astronomical Society (AAS) meeting which was held 4–8 January 2015 at Seattle, WA:

"Using the One Degree Imager to Study Active Asteroids",
Brunker, Samantha, Rajagopal, Jayadev, & Ridgway, Susan E. 2015,
American Astronomical Society Meeting Abstracts, 225, #137.19

ABSTRACT: Active asteroids are asteroids that eject material, which can be caused by several different mechanisms that act on the asteroid, such as collisions, rotational instability, or radiation pressure. We study these asteroids in order to better understand these ejection mechanisms, and gauge their contribution to the zodiacal dust in the Solar System. For this project at the KPNO REU program, we chose to focus on two specific asteroids, P/2010 A2 and 300160. Both asteroids were observed with the partial One Degree Imager on the WIYN 3.5 meter telescope on Kitt Peak. P/2010 A2 has an impressive debris tail made up of ejected dust that stretches for over a million kilometers. The wide field of pODI allowed us to construct a surface brightness profile for almost the entire extent of the tail. From this we can investigate the ejection mechanisms that caused the tail to form, and estimate the dust mass. For 300163 we did follow up observations to search for any current activity. We did not identify any trace of nebulosity in our data which indicate that the previously seen nebulosity was part of a transient event. This gives us clues about the possible ejection mechanisms acting on 300163. S. Brunker was supported by the KPNO Research Experiences for Undergraduates Program which is funded by the National Science Foundation Research Experiences for Undergraduates Program (AST-1262829).

"A WISE Selection of MIR AGN in Different Environments",
Cheeseboro, Belinda D., & Norman, Dara J. 2015,
American Astronomical Society Meeting Abstracts, 225, #144.21

ABSTRACT: This study was undertaken to understand the role of large scale environment in the evolution of MIR-selected AGN. In this study we examine AGN candidates in two types of environments: 7 clusters and 6 blank fields. Two types of clusters were studied in this project: 3 virialized and 4 non-virialized. The redshift of the clusters ranged $0.22 \leq z \leq 0.28$. We used the mid-infrared WISE All-Sky database to identify AGN, applying various methods to refine our AGN candidate selection. To ascertain if there is an excess or deficit of MIR AGN in galaxy clusters vs. blank fields, we compared the AGN candidate distributions in virialized vs. non-virialized clusters to the blank fields. After close examination and comparison of the results to X-ray selected AGN from the Gilmour et al. (2009) study, we concluded that we do not detect an excess or deficit of MIR AGN in our clusters whether the cluster was virialized or non-virialized. This contrasted the conclusion of the Gilmour et al. (2009) study where there was an excess of X-Ray selected AGN in clusters.We also note an interesting feature in our WISE color-color plots that might be used for further investigation. Cheeseboro was supported by the KPNO Research Experiences for Undergraduates (REU) Program which is funded by the National Science Foundation Research Experiences for Undergraduates Program (AST-1262829).

"Analyzing Hydrogen Recombination Lines in the Infrared and Optical to Determine Extinction and SFRs of Local LIRGs",
Payne, Anna, & Inami, Hanae 2015,
American Astronomical Society Meeting Abstracts, 225, #251.07

ABSTRACT: We report on measurements for dust extinction and star formation rates (SFRs) for luminous infrared galaxies (LIRGs). We utilized the hydrogen recombination lines Brα, Hα, and Hβ observed in the infrared and optical wavelengths with AKARI and the Lick Observatory's Kast Double spectrograph to produce spectra. By calculating Brα/Hα ratios for the target galaxies, extinction is estimated. A possible correlation between higher LIR, IR/UV, specific SFRs and higher Brα/Hα has been found. Through comparisons with Hα/Hβ, it may be possible to determine if Hα is, in fact, underestimating extinction, since Hα is more strongly affected by extinction compared to longer wavelengths such as Brα. The accuracy of using Hα in extinction corrections is important for SFR studies, and, thus, one goal is to find a more accurate reddening correction factor. Payne was supported by the KPNO Research Experiences for Undergraduates (REU) Program which is funded by the National Science Foundation Research Experiences for Undergraduates Program (AST-1262829).

"LSST Site: Sky Brightness Data",
Burke, Jamison, Claver, Charles 2015,
American Astronomical Society Meeting Abstracts, 225, #336.38

ABSTRACT: The Large Synoptic Survey Telescope (LSST) is an upcoming robotic survey telescope. At the telescope site on Cerro Pachon in Chile there are currently three photodiodes and a Canon camera with a fisheye lens, and both the photodiodes and Canon monitor the night sky continuously. The NIST-calibrated photodiodes directly measure the flux from the sky, and the sky brightness can also be obtained from the Canon images via digital aperture photometry. Organizing and combining the two data sets gives nightly information of the development of sky brightness across a swath of the electromagnetic spectrum, from blue to near infrared light, and this is useful for accurately predicting the performance of the LSST. It also provides data for models of moonlight and twilight sky brightness. Code to accomplish this organization and combination was successfully written in Python, but due to the backlog of data not all of the nights were processed by the end of the summer. Burke was supported by the KPNO Research Experiences for Undergraduates (REU) Program which is funded by the National Science Foundation Research Experiences for Undergraduates Program (AST-1262829).

"Commissioning COSMOS: Detection of Lithium in Young Stars in Lupus 3 through Multi-Object Spectroscopy",
Lackey, Kyle, Briceno, Cesar, Elias, Jonathan H. 2015
American Astronomical Society Meeting Abstracts, 225, #338.46

ABSTRACT: COSMOS, a multi-object spectrograph and imager, is a new instrument on the Blanco 4-meter telescope at the Cerro Tololo Inter-American Observatory. In order to demonstrate the instrument's operations during commissioning, we used COSMOS, its red grism and three custom slit masks to conduct a spectroscopic survey of the star-forming core of the Lupus 3 dark cloud in an effort to detect the presence of Lithium in the T Tauri stars that have been previously identified in that region. We detected the Li I 6708 Angstrom resonance transition in several (but not all) stars that were observed, consistent with prior studies that have observed Lithium in other young stars at the center of the Lupus 3 dark cloud and in other star-forming regions. These results also demonstrate the ability of COSMOS to significantly reduce the time required to complete spectroscopic surveys, relative to single-object instruments. Lackey was supported by the KPNO Research Experiences for Undergraduates (REU) Program which is funded by the National Science Foundation Research Experiences for Undergraduates Program (AST-1262829).

Other Publications:

None to report

Technologies or Techniques:

None to report

Patents:

None to report

Inventions:

None to report

Licenses:

None to report

Websites:

None to report

Other Products:

None to report

Participants

Research Experience for Undergraduates (REU) funding

How many REU applications were received during this reporting period? 132

How many REU applicants were selected and agreed to participate during this reporting period? Six.

REU Comments: The 2014 KPNO REU program received 132 complete applications and 168 incomplete applications.

What individuals have worked on the project?

Name: Jamison Burke
E-mail Address: burke@noao.edu
Most Senior Project Role: Research Experiences for Undergraduates (REU) Participant
Nearest Person Month Worked: 3
Contribution to the Project: 2014 KPNO REU student
Funding Support: NSF AST-1262829
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No
Year of schooling completed: Junior
Home Institution: Swarthmore College
During which government fiscal year(s) was this REU participant supported? 2014 and 2015
Form of REU funding supporting this participant: REU site award

Name: Samantha Brunker
E-mail Address: brunker@noao.edu
Most Senior Project Role: Research Experiences for Undergraduates (REU) Participant
Nearest Person Month Worked: 3
Contribution to the Project: 2014 KPNO REU student
Funding Support: NSF AST-1262829
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No
Year of schooling completed: Junior
Home Institution: University of Kansas
During which government fiscal year(s) was this REU participant supported? 2014 and 2015
Form of REU funding supporting this participant: REU site award

Name: Belinda Cheeseboro
E-mail Address: cheeseboro@noao.edu
Most Senior Project Role: Research Experiences for Undergraduates (REU) Participant
Nearest Person Month Worked: 3
Contribution to the Project: 2014 KPNO REU student
Funding Support: NSF AST-1262829
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No
Year of schooling completed: Junior
Home Institution: Andrews University
During which government fiscal year(s) was this REU participant supported? 2014 and 2015
Form of REU funding supporting this participant: REU site award

Name: Kyle Lackey
E-mail Address: lackey@noao.edu
Most Senior Project Role: Research Experiences for Undergraduates (REU) Participant

Nearest Person Month Worked: 3
Contribution to the Project: 2014 KPNO REU student
Funding Support: NSF AST-1262829
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No
Year of schooling completed: Junior
Home Institution: University of South Carolina
During which government fiscal year(s) was this REU participant supported? 2014 and 2015
Form of REU funding supporting this participant: REU site award

Name: Marcus Lee
E-mail Address: marcus@noao.edu
Most Senior Project Role: Research Experiences for Undergraduates (REU) Participant
Nearest Person Month Worked: 3
Contribution to the Project: 2014 KPNO REU student
Funding Support: NSF AST-1262829
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No
Year of schooling completed: Sophomore
Home Institution: Tohono O'odham Community College
During which government fiscal year(s) was this REU participant supported? 2014 and 2015
Form of REU funding supporting this participant: REU site award

Name: Anna Payne
E-mail Address: payne@noao.edu
Most Senior Project Role: Research Experiences for Undergraduates (REU) Participant
Nearest Person Month Worked: 3
Contribution to the Project: 2014 KPNO REU student
Funding Support: NSF AST-1262829
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No
Year of schooling completed: Junior
Home Institution: Wellesley College
During which government fiscal year(s) was this REU participant supported? 2014 and 2015
Form of REU funding supporting this participant: REU site award

Name: Kenneth Mighell (NOAO)
E-mail Address: mighell@noao.edu
Most Senior Project Role: PI
Nearest Person Month Worked: 4
Contribution to the Project: PI, KPNO REU Site Director, and mentor of Nicholas Kutsop
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: David Silva (NOAO)
E-mail Address: dsilva@noao.edu
Most Senior Project Role: Co-PI
Nearest Person Month Worked: 0
Contribution to the Project: NOAO Director
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Chuck Claver (NOAO)
E-mail Address: cclaver@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Jamison Burke & Lecturer
Funding Support: LSST
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Jay Elias (NOAO)
E-mail Address: jelias@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Kyle Lackey
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Hanae Inami (NOAO)
E-mail Address: inami@noao.edu
Most Senior Project Role: Postdoctoral (scholar, fellow, or other postdoctoral position)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Anna Payne
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Gautham Narayan (NOAO)
E-mail Address: narayan@noao.edu
Most Senior Project Role: Postdoctoral (scholar, fellow, or other postdoctoral position)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Marcus Lee
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Dara Norman (NOAO)
E-mail Address: dnorman@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Belinda Cheeseboro
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Jayadev Ragagopal (NOAO)
E-mail Address: rajagopal@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Samantha Brunker
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Susan Ridgway (NOAO)
E-mail Address: ser@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1
Contribution to the Project: Mentor of Samantha Brunker
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Lori Allen (NOAO; Associate Director of KPNO)
E-mail Address: lallen@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)|Faculty
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled

Name: Frank Hill (NSO)
E-mail Address: fhill@nso.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: National Solar Observatory
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Buell Jannuzi (Director of Steward Observatory)
E-mail Address: beulljannuzi@email.arizona.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: University of Arizona
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Jeyhan Kartaltepe (NOAO)
E-mail Address: jeyhan@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Valentin Martinez Pillet (NSO Director)
E-mail Address: vmpillet@nso.edu
Most Senior Project Role: Staff Scientist (doctoral level)|Faculty
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: National Solar Observatory
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Abhijit Saha (NOAO)
E-mail Address: asaha@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Letizia Stanghellini (NOAO)
E-mail Address: lstanghellini@noao.edu
Most Senior Project Role: Staff Scientist (doctoral level)|Faculty
Nearest Person Month Worked: 0
Contribution to the Project: Lecturer
Funding Support: NSF AST-0950945
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Name: Vivek Dhawan
E-mail Address: vdhawan@aoc.nrao.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0
Contribution to the Project: Gave a 3-hour tour of the Very Large Array (VLA) for the KPNO REU and NSO REU students
Funding Support: National Radio Astronomy Observatory
Identify whether this person is collaborating internationally on this project: No
Traveled to Foreign Country? No

Other Organizations Involved as Partners

Name: National Radio Astronomy Observatory (NRAO)
Location: Socorro, New Mexico
Type of Partner Organization: Other Nonprofits
Partner's contribution to the project: Other
Other Contribution to the Project: Vivek Dhawan (NRAO) gave a 3-hour tour of the Very Large Array (VLA) for the KPNO REU and NSO REU students.

Name: National Solar Observatory (NSO)
Location: Tucson, Arizona and Sacramento Peak, New Mexico
Type of Partner Organization: Other Nonprofits
Partner's contribution to the project: Other
Other Contribution to the Project: NSO hosted the 2014 KPNO REU students during their 5-day trip to New Mexico. A NSO staff member gave two of the 10 REU summer lectures.

Name: University of Arizona (U of A) / Steward Observatory
Location: Tucson, Arizona
Type of Partner Organization: Academic Institution
Partner's contribution to the project: Other
Other Contribution to the Project: Provided a tour of the Steward's Observatory's Mirror Lab to the KPNO and NSO REU students. The Director of Steward observatory gave one of the ten REU summer lectures.

Impacts

On Development of Principal Discipline(s)

Six bright undergraduates were exposed to and participated in state-of-the-art astrophysical research conducted at the National Optical Astronomy Observatory. Most of these students plan on going on to do graduate studies in astrophysics.

On Other Disciplines

Nothing to report

On Development of Human Resources

The KPNO REU site program is a vital part of the NOAO's ongoing commitment to meet the nation's need for the training of future scientists. This program provides its REU participants valuable exposure to non-PhD options for those interested in astronomy, such as instrumentation, technical support, education, and public outreach. The broadest goals of the KPNO REU site program are (1) to encourage undergraduates to pursue careers in science, (2) to foster high levels of scientific literacy among the future STEM workforce, (3) to stimulate general awareness of the remarkable achievements of US astronomy, and (4) to inspire interest in the future progress and welfare of US science.

On Physical Resources that Form Infrastructure

Nothing to report

On Institutional Resources that Form Infrastructure

Nothing to report

On Information Resources that Form Infrastructure

Nothing to report

On Technology Transfer

Nothing to report

On Society beyond Science and Technology

Nothing to report

Changes/Problems

Changes in Approach and Reason for Change

Nothing to report

Actual or Anticipated Problems or Delays and Resolution Actions or Plans

Nothing to report

Changes with Significant Impact on Expenditures

Nothing to report

Significant Changes in Use or Care of Human Subjects

Nothing to report

Significant Changes in use or Care of Vertebrate Animals

Nothing to report

Significant Changes in Use or Care of Biohazards

Nothing to report