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Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	0750814
Project Title:	A Partnership in Observational and Computational Astronomy
PD/PI Name:	Donald Walter, Principal Investigator Jennifer Cash, Co-Principal Investigator Steven B Howell, Co-Principal Investigator Mark D Leising, Co-Principal Investigator Daniel M Smith, Co-Principal Investigator
Recipient Organization:	South Carolina State University
Project/Grant Period:	03/01/2008 - 09/30/2015
Reporting Period:	03/01/2014 - 02/28/2015
Submitting Official (if other than PD\PI):	N/A
Submission Date:	N/A
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	N/A

Accomplishments

*** What are the major goals of the project?**

The specific goals of POCA are to:
1. Enhance faculty research at South Carolina State University (SCSU) that leads to collaborative activities and an increase in peer reviewed publications including SCSU faculty serving as first authors
2. Increase the use of small telescopes at the National Optical Astronomy Observatory (NOAO) by all three partners for research and training in line with one of the recommendations of the NSF AST Senior Review Committee
3. Increase the number of underrepresented minorities pursing graduate degrees in astronomy, specifically those entering the program at Clemson University (CU)
4. Increase the number of undergraduates at SCSU engaged in astronomical activities, including an increase in the number of physics majors in the astronomy option
5. Share research facilities at KPNO in such a way that students, faculty and research scientists at all three institutions participate and derive benefits
6. Develop and distribute to the community at large inquiry-based, laboratory exercises and web-based activities related to cosmology
7. Enhance and expand the existing outreach programs to the K-12 community through museum displays, planetarium shows and public observing sessions at the Stanback Museum and Planetarium at SCSU and the planetarium at CU

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities:

Goal 1: Cash, Smith and Walter all enhanced their research activities and peer review publications

- ***Dr. Smith*** published as first and sole authore a peer-reviewed journal article “City-City Correlations to Introduce Galaxy-Galaxy Correlations” in the July 2014 issue of the journal “Communicating Astronomy with the Public”

- ***Drs. Cash and Walter*** with collaborators published a peer-reviewed article “Kepler and the Long Period Variables” , December 2014, AJ, 148, 123

Goal 2: Increase the use of small telescopes at NOAO

With the divestiture of KPNO in progress and the closing of the Coude Feed telescope, the opportunities to achieve this goal has been diminished. Nonetheless, the partners continue to us the 1.3 meter Robotically Controlled Telescope and the 0.9 meter SARA

telescope at KPNO and the SARA-South telescope at CTIO.

Goal 3: Increase the number of underrepresented minorities pursing graduate degrees in astronomy

- PAARE student Adriana Delgado-Navarro continued work on her MS in astronomy at Clemson.

- PAARE student Jared Lalamansigh (graduated SCSU in 2011 and former Clemson grad student) continued his work toward a M.S. degree in physics at Texas A&M University - Commerce

- PAARE student Charles Kurgatt (graduated SCSU in 2013) continued work on his MS in Engineering Physics at Appalachian State University

Goal 4: Increase the number of undergraduates at SCSU engaged in astronomical activities-

- 3 undergraduate physics majors at SCSU (Laursen, Adhikari, Sampana) who participated in PAARE-funded activities graduated in May 2014

- 2 additional undergraduate physics majors at SCSU (Eleby, Pugh) who participated in PAARE-funded activities are prepared to graduate in May 2015

- 1 3rd-year undergraduate physics major at SCSU (McKay) held a summer internship at the National Radio Astronomy Observatory in 2014 and will be a summer intern at the Space Telescope Science Institute in the summer of 2015

Goal 5: Share research facilities at KPNO

- See Goal 2

- Additionally, Clemson has committed a share of their observing time on the SARA-North and SARA-South telescopes to SCSU students and faculty as part of their collaborative research on Herbig Haro AeBe stars under a new 3-year award from NSF-PAARE.

Goal 6: Develop and distribute to the community at large inquiry-based, laboratory exercises and web-based activities related to cosmology

- See Goal 1 under Smith

- Smith continued to enhance existing lab activities and present results at the national meeting of the American Association of Physics Teachers

- Smith's website has expanded and includes new and update cosmology activities http://physics.scsu.edu/~dms/cosmology /simulations.html

Goal 7 : Enhance and expand the existing outreach programs
Work in this area has been significantly reduced since the planetarium director and collaborator on this award left SCSU nearly four years ago and no replacement has been hired by the university due to the current fiscal environment. Nonetheless, PI Walter and Co-I Cash have conducted some K-12 outreach (e.g. talks and observing sessions) with local schools. Smith and Cash have promoted astronomy activities as faculty sponsors of the SCSU chapter of the Society of Physics students.

Specific Objectives:

Significant Results:

Key outcomes or Other achievements:

*** What opportunities for training and professional development has the project provided?**

During the reporting period, five (5) undergraduates received training in astronomical data reduction and analysis including work with IDL or IRAF or Mathematica software. A total of six (6) undergraduates received scholarships or stipends to participate in indpendendent study research.

Faculty Walter, Cash, and Smith all received support to conduct research, publish in referred journals and present their results at professional meetings as described elsewhere in this report.

One graduate student at Clemson was supported to conduct research toward completing her MS in astronomy.

*** How have the results been disseminated to communities of interest?**

-Two referred articles have been published (1 in AJ, 1 in CAP)
-One faculty poster presentation at the American Astronomical Society meeting in January 2015
-One student poster presentation at the American Astronomical Society meeting in January 2015 -One student and one fauclty oral presentation at Howard University in September 2014 -Two faculty/ student presentations at the Meeing of Astronomers in South Carolina in March 2014 -Web posting of cosmology labs and simulations: http://physics.scsu.edu/~dms/cosmology/simulations.html
-Web posting of our project web page: http://physics.scsu.edu/paare

*** What do you plan to do during the next reporting period to accomplish the goals?**

We are currently in a no-cost extension period with very limited funds remaining under or original PAARE 2008 award. However, we have been awarded a second PAARE award in 2014 for 3 years and we will use those resouces and others avaialbleto concentrate on scholarship, fellowship and stipend support for our undergraduates and graduate students. Additionally, the SCSU faculty will collaborate with Sean Brittain's group at Clemson who are studying Herbig-Haro AeBe stars.

Products

Books

Book Chapters

Conference Papers and Presentations

Inventions

Journals

Hartig, E., Cash, J., Hinkle, K., Lebzelter, T., Mighell, K. and Walter, D. (2014). Kepler and the Long Period Variables. *The Astronomical Journal*. 148 123. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1088/0004-6256/148/6/123

Smith, Daniel M. (2014). City-City Correlations to Introduce Galaxy-Galaxy Correlations. *Communicating Astronomy with the Public Journal*. 15 31. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: 2014CAPJ...15...31S

Strolger, L.-G.; Gott, A. M.; Carini, M.; Engle, S.; Gelderman, R.; Guinan, E.; Laney, C. D.; McGruder, C.; Treffers, R. R.; Walter, D. K. (2014). The RCT 1.3 m Robotic Telescope: Broadband Color Transformation and Extinction Calibration. *Astronomical Journal*. 147 49. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1088/0004-6256/147/3/49

Licenses

Other Products

Other Publications

McKay, Myles; Stierwalt, Sabrina; Sheth, Kartik; de Swardt, Bonita, , Dr.; Walter, Donald K. (2015). *Metallicities of Low Mass Inefficient Star Forming Dwarfs in S4G: Testing the Closed Box Paradigm*. A poster presentation at the January 2015 AAS meeting in Seattle. A study of 19 dwarf galaxies from the S4G Survey with the lowest stellar to HI mass ratios. The wide range in metallicities suggests an open box scenario and varied star formation history.. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Walter, Donald K.; Brittain, Sean D.; Cash, Jennifer; Hartmann, Dieter; Hinkle, Kenneth H.; Ho, Shirley; Howell, Steve B.; King, Jeremy R.; Leising, Mark D.; Mighell, Kenneth J.; Smith, Daniel M. (2015). *Past and Future: NSF PAARE at SC State*. A summary of the past 7years of the NSF PAARE project at SC State and a look forward toward the next 3 years which are funded by a new PAARE award to SC State.. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Patents

Technologies or Techniques

Thesis/Dissertations

Websites

Labs and Simulations
http://physics.scsu.edu/~dms/cosmology/simulations.html

SC State POCA/PAARE website that is the major dissemination point for the laboratory exercises and web-based activities related to cosmology under Goal #6.

POCA A Partnership in Observational and Computational Astronomy
http://physics.scsu.edu/paare/

The SC State PAARE project website. Includes activities, people, reports and other information related to the project.

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Walter, Donald	PD/PI	2
Cash, Jennifer	Co PD/PI	1
Howell, Steven	Co PD/PI	0
Leising, Mark	Co PD/PI	1
Smith, Daniel	Co PD/PI	1
Hinkle, Kenneth	Co-Investigator	0
Mighell, Kenneth	Co-Investigator	0
Brittain, Sean	Faculty	1
Hartmann, Dieter	Faculty	1
King, Jeremy	Faculty	0
Delgado-Navarro, Adriana	Graduate Student (research assistant)	12
Lalmansingh, Jarad	Graduate Student (research assistant)	0

Name	Most Senior Project Role	Nearest Person Month Worked
Adhikari, Madan	Undergraduate Student	3
Eleby, Johnae	Undergraduate Student	12
Kurgatt, Charles	Undergraduate Student	0
Laursen, Charles	Undergraduate Student	3
McKay, Myles	Undergraduate Student	12
Nicholson, Danielle	Undergraduate Student	0
Pokhrel, Sampanna	Undergraduate Student	3
Pugh, Bryan	Undergraduate Student	12

Full details of individuals who have worked on the project:

Donald Walter
Email: dkw@physics.scsu.edu
Most Senior Project Role: PD/PI
Nearest Person Month Worked: 2

Contribution to the Project: Project management (financial, reporting, supervision, planning); Faculty research; mentor undergraduate student research; dissemination via meetings and publications; outreach via talks and recruiting events to K-12 community; writing additional proposals related to the field

Funding Support: NSF new PAARE Project - AST-1358913 overlaps in goals and activities with the 2008 PAARE project and therefore provides support for related activities.

International Collaboration: Yes, Austria
International Travel: No

Jennifer Cash
Email: jcash@physics.scsu.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 1

Contribution to the Project: Faculty research on RV Tauri and Semiregular variable stars; co-author on referred publication on Kepler study of RV Tauri and Semiregular variables; outreach activities including K-12 visits and work with Society of Physics Student physics; mentor for undergraduate student research

Funding Support: Some overlapping support under new PAARE-II award NSF AST-1358913

International Collaboration: Yes, Austria
International Travel: No

Steven B Howell
Email: howell@wiyn.org
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 0

Contribution to the Project: Collaborate on reduction and analysis of Coude Feed spectra; consult with PI Walter and Co-PI Cash on analysis of Kepler data

Funding Support: None

International Collaboration: No
International Travel: No

Mark D Leising
Email: lmark@clemson.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 1

Contribution to the Project: Managed Clemson subaward; mentor to one PAARE-funded graduate student; helped develop and write collaborative PAARE-II proposal with SC State faculty that was awarded as AST-1358913

Funding Support: None

International Collaboration: No
International Travel: No

Daniel M Smith
Email: dsmith@scsu.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 1

Contribution to the Project: Development of curricula products, specifically cosmology-related lab activities and web simulations; dissemination via workshops an posters at national and state meetings; mentor to undergraduate student researcher; recruitment and retention of undergrads

Funding Support: “Cosmic Microwave Background Analysis for Physics Undergraduates,” PI for Project JOVE Award, South Carolina Space Grant Consortium/NASA EPSCoR, 2012-2013, extended to 2014. Also, some overlapping support under new PAARE-II award NSF AST-1358913.

International Collaboration: No
International Travel: No

Kenneth Hinkle
Email: hinkle@noao.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: Collaborative research & writing of paper on Kepler light curve analysis of RV Tauri and Semiregular variables published in AJ.

Funding Support: None

International Collaboration: Yes, Austria
International Travel: No

Kenneth Mighell
Email: mighell@noao.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: Collaborative research and writing of paper on Kepler light curves of RV Tauri and Semiregular variables which was published in AJ.

Funding Support: None

International Collaboration: Yes, Austria
International Travel: No

Sean Brittain
Email: sbritt@clemson.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: Assisted with development and writing of collaborative proposal with SC State faculty that was funded under PAARE-II as NSF AST-1358913. Preparing training for SCSU faculty & students to study Herbig-Haro AeBe stars.

Funding Support: None

International Collaboration: No
International Travel: No

Dieter Hartmann
Email: hdieter@CLEMSON.EDU
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: Mentor and serve as research advisor to one PAARE-funded graduate students; help develop and write collaborative proposal with SC State faculty which was funded under PAARE-II as NSF AST-1358913.

Funding Support: None

International Collaboration: No
International Travel: No

Jeremy King
Email: jking2@clemson.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 0

Contribution to the Project: Assisted in the development and writing of a collaborative proposal with the SC State faculty which was funded under PAARE-II as NSF AST-1358913.

Funding Support: None

International Collaboration: No
International Travel: No

Adriana Delgado-Navarro
Email: adelgad@clemson.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: PAARE fellowship; continuing work toward MS degree; research on novae.

Funding Support: None

International Collaboration: No
International Travel: No

Jarad Lalmansingh
Email: jaredlalmansingh@gmail.com
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 0

Contribution to the Project: previous PAARE fellowship; graduated SCSU; grad student at Clemson; conducted research on supernova while at Clemson; did not complete MS; transferred to Texas A&M - Commerce; pursing M.S. in physics

Funding Support: None

International Collaboration: No
International Travel: No

Madan Adhikari
Email: madan_addy@yahoo.com
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 3

Contribution to the Project: PAARE stipend and scholarship recipient; explored astronomy as a graduate school option by taking upper level astrophysics courses and working with PI Walter in the lab; graduated from SCSU with a BS in physics in May 2014; has been accepted to graduate school in engineering for Fall 2015

Funding Support: None

International Collaboration: No
International Travel: No

Johnae Eleby
Email: jeleby@scsu.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 12

Contribution to the Project: PAARE undergraduate scholarship recipient; conducting research on RV Tauri and Semiregular variables under the mentorship of CO-PI Cash; will graduate from SCSU in May 2015 with BS in physics & astronomy option

Funding Support: None

International Collaboration: No
International Travel: No

Charles Kurgatt
Email: ckurgatt@gmail.com
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: PAARE undergraduate scholarship recipient; graduated from SCSU with BS physics & astronomy option in May 2013; attending graduate school at Appalachian State University in Engineering Physics MS program.

Funding Support: None

International Collaboration: No
International Travel: No

Charles Laursen
Email: claurse19@gmail.com
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 3

Contribution to the Project: PAARE undergraduate scholarship recipient; conducting spectroscopic study of RV Tauri and Semiregular variables under mentorship of PI Walter; graduated in May 2014 from SCSU with BS in physics and astronomy option.

Funding Support: None

International Collaboration: No
International Travel: No

Myles McKay
Email: mckaymyles@yahoo.com
Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 12

Contribution to the Project: PAARE undergraduate scholarship recipient; assists Co-PI Cash with physics and astronomy outreach; president of campus chapter of the Society of Physics majors; participated as a summer 2014 intern at the National Radio Astronomy Observatory in Charlottesville, VA.; conducts research with PI Walter; awarded summer 2015 internship at Space Telescope Science Institute

Funding Support: None

International Collaboration: No
International Travel: No

Danielle Nicholson
Email: dnichols08@hotmail.com
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: PAARE undergraduate scholarship recipient; explored astronomy as an possible career path during her last semester through upper level astrophysics course and talks/discussions with faculty; graduated from SCSU in December 2013 with BS in physics & the medical physics option; attending graduate school in non-STEM field.

Funding Support: None

International Collaboration: No
International Travel: No

Sampanna Pokhrel
Email: meviper010@yahoo.com
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 3

Contribution to the Project: PAARE undergraduate stipend recipient; conducted research with Co-PI Smith on developing web-based, cosmology activities; graduated from SCSU with a BS in physics in May 2014; accepted into graduate school in engineering for the fall of 2015.

Funding Support: None

International Collaboration: No
International Travel: No

Bryan Pugh
Email: legends@sc.rr.com
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 12

Contribution to the Project: PAARE undergraduate scholarship recipient; Semiregular variables under mentorship of PI Walter; will graduate in May 2015 from SCSU with a BS in physics & the astronomy option

Funding Support: None

International Collaboration: No
International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Clemson University	Academic Institution	Clemson, SC
National Astronomy Consortium	Other Nonprofits	Charlottesville, VA
National Optical Astronomy Observatory	Other Nonprofits	Tucson, AZ
Villanova University	Academic Institution	Villanova, PA
Western Kentucy University	Academic Institution	Bowling Green, KY

Full details of organizations that have been involved as partners:

Clemson University

Organization Type: Academic Institution
Organization Location: Clemson, SC

Partner's Contribution to the Project:
In-Kind Support
Facilities
Collaborative Research

More Detail on Partner and Contribution: Clemson and SC State collaborate in the use of small telescopes at KPNO and through undegraduate student research projects. Additionally, they have collaborated on several proposals submitted during the past year.

National Astronomy Consortium

Organization Type: Other Nonprofits
Organization Location: Charlottesville, VA

Partner's Contribution to the Project:
Other: Student Internships & Dissemination

More Detail on Partner and Contribution: NAC promotes diversity in astronomy. SCSU is a member of the NAC. Walter serves on the NAC's Advisory Board. Student Myles McKay has been funded because of the NAC in the summers of 2014 and 2015 for internships at NRAO and STScI.

National Optical Astronomy Observatory

Organization Type: Other Nonprofits
Organization Location: Tucson, AZ

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: SC State has collaborated with research astronomers at NOAO during the past year including submission of a paper that was published in AJ.

Villanova University

Organization Type: Academic Institution
Organization Location: Villanova, PA

Partner's Contribution to the Project:
Facilities
Collaborative Research

More Detail on Partner and Contribution: SC State partners with Western Kentucky University and Villanova in the management of the 1.3meter Robotically Controlled Telescope (RCT) at Kitt Peak. All three institutions provide in-kind technical support for the facility. The telescope provides ground-based photometeric and imagery data for faculty and students in research, education and outreach.

Western Kentucy University

Organization Type: Academic Institution
Organization Location: Bowling Green, KY

Partner's Contribution to the Project:
Facilities
Collaborative Research

More Detail on Partner and Contribution: SC State partners with Western Kentucky University and Villanova in the management of the 1.3meter Robotically Controlled Telescope (RCT) at Kitt Peak. All three institutions provide in-kind technical support for the facility. The telescope provides ground-based photometeric and imagery data for faculty and students in research, education and outreach.

What other collaborators or contacts have been involved?
Nothing to report

Impacts

What is the impact on the development of the principal discipline(s) of the project?

The research on Peculiar stars (R CrB and XX Oph), RV Tauri and Semiregular variables will lead to a better understanding of these objects. These stars have periods on the order of months and they show significant irregularities in their light curves compared to shorter period, well behaved Cepheids, making our objects more difficult to observe over a complete cycle. As a result, there are fewer in depth studies in the literature on RV Tauri and Semiregular variables. Our spectroscopic database from the Coude Feed was started more than a decade ago by Co-PI Howell, and has been extended another 4 years under this award by PI Walter and others. This has allowed the researchers a long baseline from which to compare the spectroscopic changes and their relationship to photometric changes. Exisitng photometery from the AAVSO for some stars and new Kepler data has been combined with the spectroscopy.

A paper published in the *Astronomical Journal* in December 2014 included Walter and Cash as co-authors with an international team of collaborators. This paper combined ground-based spectroscopic data collected under this project with archival Kepler data as well as new observations with Kepler from guest observing runs on the satellite by Cash, Walter and Hinkle. The objects studied were asymptotic giant branch (AGB) stars with periods of 100 days or longer. The authors did not detect any non-radial pulsations in the stars and they argued that long secondary period (LSP) variations seen in many SR variables is intrinsic to the star and linked to multiple mode pulsation.

Co-Pi Smith's inquiry-based labs, simulations and other curriculum products continue to be tested and integrated into courses at SCSU including physics courses and physical science courses for non-STEM majors. Additionally, they have been introduced to teachers in the K-12 and college-level teaching faculty through workshops, talks and Smith's peer-reviewed publication "City-City Correlations to Introduce Galaxy-Galaxy Correlations" in the July 2014 issue of the journal "Communicating Astronomy with the Public".

These products produced with support from the PAARE grant will help communicate the concepts related to cosmology such as dark energy, dark matter and the big bang in a visual and

comprehensible manner to novices and non-science students as well as science majors being exposed to the topics for the first time . Smith's resources will help overcome some of the fear and confusion these individuals encounter when exposed to more traditional material on the subjects.

What is the impact on other disciplines?
Nothing to report.

What is the impact on the development of human resources?

During the reporting period, several underrepresented minorities that have been supported by this PAARE award haveprogressed toward advanced degrees:

- A. Delgado-Navarro continues to conduct resarch on classical novae under Clemson collaborators Leising and Hartmann with a planned graduation date of May 2015 for her M.S. degree.

- J. Lamansigh graduated from SCSU in 2011with PAARE support and attended Clemson udner a PAARE fellowship; he did not complete his MS at Clemson because of a lower than required GPA. He did, however, transfer to Texas A&M University at Commerce in pursuit of an M.S. in physics with a anticipated completion date in August 2015.

- C. Kurgatt graduated from SCSU in May 2013 after several years of support from PAARE. He is attending graduate school at Appalichian State University, working toward and M.S. in Engineering Physics.

- D. Nicholson received PAARE support prior to her graduation from SCSU in December 2013. She is currently pursuing a non-STEM M.S. degree.

A total of 6 undergraduate physics majors at SCSU were directly impacted by PAARE during this reporting period. These students received stipends and/or scholarships to study astronomy. Three of the students graduated in May 2014, two are expected to graduate in May 2015 and one will graduate in May 2016.

What is the impact on physical resources that form infrastructure?

PAARE supports SCSU's participation in the Robotically Controlled Telescope (RCT) Consortium which in turn provides access to the 1.3 meter RCT at Kitt Peak.

Hardware and software support described below futher supports the physics area's Computational Physics Lab, Room 306 Davis Hall, on the campus of South Carolina State University. The computational lab is providing support to other physics projects in the department (and potentially to faculty in biology and chemistry) through the shared used of the color printer, linux machines and UNIX server as described below.

What is the impact on institutional resources that form infrastructure?

The support PAARE provides for the Computational Physics Lab and the UNIX server physics.scsu.edu can potentially serve to attract other research projects to the department as this is the only computational lab in the sciences on campus. The SCSU administration has included the Computational Physics Lab and the PAARE-supported RCT resource as part of its publicity and documentation used in promoting the research capabilites of the university to industry and other potential partners.

For example, Co-PI Cash uses the computational physics resources from PAARE for a NASA project on which she is the lead. She is developing an interactive web resource for general-public understanding of variable stars and the Kepler project. Another NASA-supported project for an upcoming satellite misson uses the resources of the computational lab as well.

What is the impact on information resources that form infrastructure?

PAARE purchased 5 linux workstations as well as several Mac and Windows laptops in previous years that are used for teaching and research.

PAARE provides financial assistance to the upkeep of the physics UNIX web and mail server (http://physics.scsu.edu). We note that the physics UNIX server is the only one on campus that the Computer Center allows to be operated independantly of their staff. This is due to the secure and robust nature of the physics server and its extensive use in research.

A Mac workstation was previously funded by PAARE for Smith to develop his products. A Mac laptop was purchased by PAARE for Walter who uses it for image analysis of the Coude spectra that are a part of this project.

PAARE previously supported the purchase of a color laster pritner that is used to generate brochures and other recruitment materials for the physics area and the Department of Biological and Physical Sciences.

PAARE previously supported the purchase of an IDL minilab license, KaleidaGraph and other software that is used along with the hardware by Cash, Walter, Smith and others in research and teaching, such as in the physics course P 338 "Scientific Image Analysis" and other physics classes and research courses. PAARE continues to fund the maintenance and upgrading of these packages. These resources provide the physics undergraduates with experiences that will be helpful in graduate school or on the job. In many cases, this is the only opportunity on campus to acquire such skills.

What is the impact on technology transfer?
Nothing to report.

What is the impact on society beyond science and technology?

Local news articles and EPO events such the previously reported Venus Transit of 2012 as well as recent observing sessions and talks to the K-12 community bring the excitement of astronomy to the public and help them better understand how their tax dollars are spent on science and technology projects.

Changes/Problems

Changes in approach and reason for change

We note that we will continue to pursue the goals of the project. However, we are in a period of a no cost extension with a limited amount of funding remaining. Therefore the products and outcomes will be fewer in number when compared to previous years. The PAARE-II award NSF AST-1358913, while smaller in size and only three years in duration, is helping to make the transition to alternative funding of these activities in future years.

Actual or Anticipated problems or delays and actions or plans to resolve them

The divestiture taking place at Kitt Peak National Observatory has retired the Coude telescope that was heavily used by Walter from 2009-2013. Since this telescope is no longer available, the decade plus observations of variable and peculiar stars by Howell, Walter and others can no longer continue. However, Clemson is providing access to the SARA-North escelle spectrograph that will allow us to continue observing some of these objects at high dispersion.

Changes that have a 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.