

PARI

Pisgah
Astronomical
Research Institute



2012 Annual Report

PARI: where science excites the imagination



Highlights from 2012

- State-of-the-art Research Building dedicated after \$1.3 million NSF-funded and \$200,000 PARI-funded renovations
- Exhibit Gallery expands meteorite collection, adds new Space Shuttle artifacts valued in excess of \$2 million
- EMC Corporation donations and intern support exceeds \$2.6 million
- 13th annual Space Day attracts hundreds of visitors
- Monthly SciGirls events at PARI engage girls ages 9-14 in scientific pursuits
- PARI hosts Duke TIP (Talent Identification Program) Summer Field Study in Astronomy, Physics and Astrobiology for 11th consecutive year
- Spring and Fall Homeschool Days provide on-campus learning experiences for homeschoolers
- PARI hosts Star Party for professional and amateur astronomers
- APDA receives photographic plate collections from the United States Naval Observatory
- Seventh Friends of PARI Annual Meeting and Symposium
- Monthly Evening at PARI events attract hundreds of visitors
- PARI featured in more than 50 articles published in local, regional and national publications as well as numerous local television and radio programs
- EMC Corporation produces a five-minute APDA video for worldwide distribution
- PARI featured at Astronomy Days at the North Carolina Museum of Natural Sciences in Raleigh, new kiosk provides online link from the Museum to PARI instruments and programs
- Four summer interns conduct research, help upgrade instruments and assist as mentors for high school students in PARI summer programs
- PARI hosts weeklong NASA-funded Appalachian State University Climate Camp for second consecutive year
- Curiosity Mars Landing event co-hosted at PARI with Star Trek Club Alaric of Asheville
- National Girls Collaborative Project (NGCP) selects PARI to coordinate NGCP program throughout North Carolina
- PARI begins work to restore and activate 12m radio telescope for a survey of water masers in the Milky Way Galaxy
- PARI's "Smiley" radio telescope featured at USA Science & Engineering Festival in Washington, DC
- APDA status and plans presented to the American Institute of Physics
- Engineering students from Western Carolina University complete a computer control interface for APDA's Astrometric Measuring Instrument (GAMMA II) digitizing machine
- 3-axis geomagnetometer installed to measure the Earth's magnetic field
- PARI awarded membership in NASA's All Sky Fireball Network, camera installed on campus to observe meteors
- UNC-Asheville scientists and students develop pointing model software for DIRV Interferometer
- Acceptance testing begins for 26E and 26W DIRV radio telescope interferometer

Cover Image: Smiley and Clemson Astronomy Experiment Building, photographed by Richard Wright

Additional Images Courtesy of: Thurburn Barker, Don Cline, Jim Farrey, John Halsey and Mark Krochmal

PARI's Mission

PARI is a public not-for-profit foundation dedicated to providing hands-on educational and research opportunities for a broad cross-section of users in science, technology, engineering and math (STEM) disciplines.

Friends of PARI President's Award

Lamar Owen, PARI Chief Information Officer

Distinguished Supporters

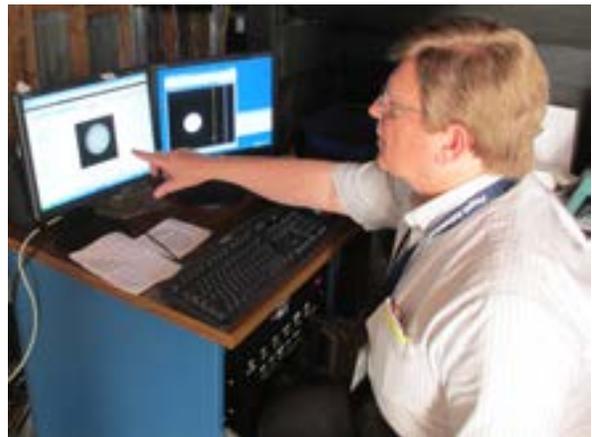
Alex Alexander, Friends of PARI Volunteer
Thurburn Barker, APDA Director
Betsy Bennett, NC Museum of Natural Sciences
John Boehme, President - Friends of PARI
Don and Jo Cline, PARI Board Members
Dr. William Cooke, NASA – Marshall Space Flight Center
Lee Craig, Friends of PARI Volunteer
Derek Dennis, PARI/CISCO Kenan Fellow
Dr. Brian Dennison, Professor – UNC Asheville
Bryan Dubois, Patton Electronics
Dr. Rita Fuller, PARI Board Member
Hunter Goosmann, ERC Broadband
Bob Hawkins, EMC Corporation
Dr. Paul Hemenway, Professor Emeritus - UT Austin
Tommy Jacobson, MCNC
Mark Krochmal, Friends of PARI Volunteer
Dr. Brian Mason, US Naval Observatory
Dr. John Meriwether, Clemson University
Joanie Myers, Applied Research Associates, Inc.
Janet Parks, PARI Board Member
Dr. Joe and Karen Phillips, Friends of PARI Volunteers
Ron Speer, Friends of PARI Volunteer
Michael Webb, Smith Premier Services
Richard Wright, Friends of PARI Volunteer

Distinguished Student Scholars

Rebekah David, UNC-Asheville
Matthew Grimes, UNC-Asheville
Bethany Owen, Homeschool, high school level
Joe Peters, UNC-Asheville
Emma Taylor, Guilford College
Menelik Zafir, Georgia State University

Board of Directors

Jo Cline, chairperson and treasurer, education advocate and philanthropist
Don Cline, president, retired business owner and philanthropist
Janet Parks, secretary, businesswoman
Ken Jacobson, general counsel and CFO, Reynolds, Smith & Hills
Wayne Christiansen, PhD, retired professor of physics and astronomy, UNC-Chapel Hill
Rita Fuller, PhD, retired associate director, North Carolina-MSEN, UNC
Robert McMahon, PhD, president, Kettering University



Research Building Contractors

American Coating & Insulation Systems, Inc.
Brevard Electric Company
Mac Heating & Air Conditioning, Inc.
Southern Painting & Maintenance Specialists, Inc.

STEM Education Initiatives

PARI was heavily involved in science, technology, engineering and mathematics (STEM) education long before the acronym became common usage. We fill a vital role in attracting students to STEM initiatives by making these disciplines fun and interesting. PARI develops nontraditional, inquiry-based, hands-on programs that take education out of the classroom and help students of all ages (K-12, undergraduate and graduate) learn science by doing science. Younger students often become excited by science and begin to seriously consider careers in science and technology. Those already involved in STEM are provided programs and opportunities not available elsewhere.

Featured on these pages are photos from some of our more popular programs. They include:

North Carolina Girls STEM Collaborative (NCGSTEM)

A statewide effort to provide support to initiatives involving girls in STEM education. PARI is the North Carolina Collaborative Lead for NCGSTEM.

SciGirls

A monthly science program for girls ages 9-14, affiliated with the PBS series sponsored by Twin Cities Public Television.

Homeschool Days

A full day of on-campus activities and learning for children schooled at home. Hosted twice a year at PARI.

Smiley training

Workshops for teachers, students and others learning to remotely control PARI's Smiley radio telescope for hands-on learning.



1. Homeschool Day participants link to Glenn Research Center for a NASA Digital Learning Network session. 2. SciGirl observes the Sun through a solar telescope. 3. PARI Science Educator Derek Dennis shows off Smiley during Astronomy Days at the NC Museum of Natural Sciences in Raleigh.

If we want to solve a problem that we have never solved before, we must leave the door to the unknown ajar. -Richard P. Feynman



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1. PARI staff and area science educators participate in Shodor's Computing Matters workshop. 2. Space Science Lab students create colorful displays by building LED circuits. 3. Western Carolina University Engineering students complete Capstone Project at PARI. 4. Developed by intern Rebekah David, new touchscreen interactive kiosk links NC Museum of Natural Sciences visitors to PARI instruments.

Alternative energy (solar & wind)

PARI's seven solar arrays and three wind turbines provide the opportunity to demonstrate to students, teachers and engineers how such systems can be designed and built to serve a practical application as an alternative to traditional electric power generation.

NC OPT-ED

A statewide program to involve minority and underserved students in STEM education. PARI is a partner.

StarLab

Portable planetarium taken to schools and other venues. StarLab has hosted more than 60,000 visitors.

Internships

An opportunity for college students to spend the summer on campus conducting research and serving as mentors to high school students. PARI hosted four in 2012.

Duke TIP

Duke Talent Identification Program, a two-week on-campus learning experience for high school students from across the country. PARI hosted for the 11th consecutive year.

NASA Climate Camp

NASA-funded weeklong on-campus experience for homeschool students, co-hosted at PARI with Appalachian State University.



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The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' but 'That's funny...' -Isaac Asimov

Research Initiatives

Astronomy is the flagship science at PARI, but our research initiatives have grown to include atmospheric science, environmental science, computer science and engineering. Research programs may take advantage of existing infrastructure and instruments at PARI, or researchers may add instruments. Internet access is available across the 200-acre campus, so experiments may be controlled remotely. Visiting scientists may be individuals, postdoctoral researchers, or members of a consortium or observing campaign. Labs, offices and housing are also available.

During 2012 our primary research projects included:

Research Building

State-of-the art Research Building recently received \$1.5 million renovation. Now houses APDA, research programs, data center and office space.

APDA

Astronomical Photographic Data Archive, the North American archive for historic astronomical images, now contains more than 200,000 photographic plates and films.

Faculty Research Affiliates

Invitation-only program fosters collaboration with university faculty, allowing researchers to take full advantage of infrastructure and research labs at PARI.

UNAVCO PBO & seismometer

GPS sensor installed at PARI measures geologic movements in the Earth's crust as part of the NSF-funded EARTHSCOPE project.

1. Astrometric Measuring Instrument Team meets in APDA. 2. Dr. Rene Hudec from the Astronomy Institute of the Academy of Sciences of the Czech Republic visits PARI to study APDA photographic plates. 3. John Halsey, PARI Director of RSAS, and intern Joe Peters employ the 26m radio telescope Dedicated Interferometer for Rapid Variability study.



If we knew what it was we were doing, it would not be called research, would it? -Albert Einstein



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1. Newly renovated Research Building houses the RF Lab, Aeronomy Lab, APDA, Data Center and offices. 2. Shown with EMC-donated data storage system: Intern Matt Grimes, EMC sponsor Bob Hawkins, PARI CIO Lamar Owen and Science Director Dr. Michael Castelaz. 3. Friend of PARI volunteer Ron Speer, shown here with CIO Lamar Owen, developed a geomagnetometer to study the Earth's magnetic field. 4. 2012 PARI summer interns and mentors. 5. PARI's NASA MSFC meteor network camera images a bright meteor.

PARSEC/Interferometer

Scientists from UNC-Asheville are working with PARI to combine our 26m radio telescopes into a single instrument, an interferometer capable of studying the deep reaches of outer space.

Clemson University high velocity wind monitoring

Upper atmospheric wind detector, the Clemson Fabry Perot Spectrometer, is part of an array spanning the globe from Alaska to Peru.

NSF-NSDL Research projects

Stellar classification and Internet access to PARI's 4.6m radio telescope are now part of the National Science Digital Library (NSDL) collection of labs and hands-on activities.

American Astronomical Society meetings, papers & posters

PARI staff, scientists and interns attend biannual AAS conferences, present research findings.

Research tools

Well suited for astronomy, atmospheric science, environmental science, computer science or engineering projects, PARI hosts tools in all areas and offers the opportunity for visiting scientists to locate instruments on campus.



5

Do you realize if it weren't for Edison we'd be watching TV by candlelight? -Al Boliska

Public Outreach and Special Programs

Public outreach is a cornerstone of the PARI mission, and we have been able to greatly expand our efforts over the years because of the dedicated efforts of our many volunteers. Friends of PARI volunteers conduct weekly public tours and assist with many of our public outreach initiatives.

Our public outreach efforts and special programs include:

Evening at PARI

Monthly event includes a campus tour, presentation and night sky observations with PARI telescopes.

Public tours

Docents provided by Friends of PARI offer campus tours every Wednesday.

NC Grassroots Science Museums Collaborative

A collaborative group of 32 science museums in NC. PARI is a member and VP Dr. David Clavier serves on the board of directors.



1. 26E radio telescope. 2. Young scholars explore stellar spectra on astronomical photographic plates. 3. APDA Director Thurburn Barker demonstrates research tools to Dr. Meg Lowman, Director of the Nature Research Center at the NC Museum of Natural Sciences. 4. John L. Mackay, President & CEO of Discovery Place in Charlotte, and Steve Saucier, Executive Director of North Carolina Grassroots Science Museums Collaborative enjoy a visit to the PARI campus.

Space isn't remote at all. It's only an hour's drive away if your car could go straight upwards. -Fred Hoyle



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Exhibit Gallery

Recently expanded, now houses a large meteorite collection and Space Shuttle artifacts donated by NASA.

NC Museum of Natural Sciences

Astronomy Days

PARI is a featured part of the annual event in Raleigh. Participation led to a permanent kiosk at the museum linking visitors to PARI programs and instruments.

NC Astronomers meeting exhibit

PARI staff and scientists exhibit work and present research findings at NC Astronomers' annual meeting.



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1. Friend of PARI volunteer Richard Wright inspects a Space Shuttle antenna recently donated to PARI's Exhibit Gallery by NASA. 2. Friends of PARI volunteers John Boehme and Mark Krochmal arrange displays of newly acquired NASA Space Shuttle artifacts. 3. Education Director Christi Whitworth, President Don Cline, and Distinguished Friend of PARI Dr. Joe Phillips inspect the newly donated Space Shuttle wing segment. 4. Education Director Christi Whitworth leads a campus tour.



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Across the sea of space, the stars are other suns. - Carl Sagan

Friends of PARI

Volunteer organization provides help with public outreach, PARI programs and scientific instrument development.

Space Day

Annual open house attracts hundreds of visitors the first Saturday in May.

SCOPE (Stellar Classification Online--Public Exploration)

Software developed at PARI allows citizen-scientists to access and analyze spectral star images from part of the APDA collection.

Community and educational talks

PARI staff and scientists are active in dozens of events annually, both in North Carolina and in other venues across the country.



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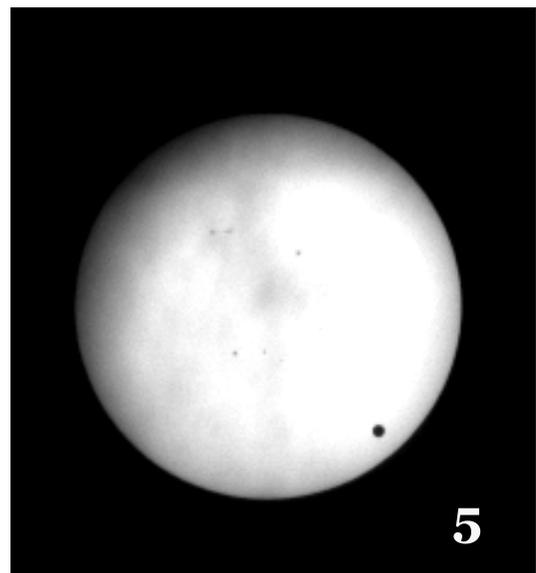
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1. Space Day visitors observe sun spots.
2. A happy camper. PARI programs are tailored to all ages.
3. Mars Curiosity Landing event.
4. Young astronomers examining meteorite particles.

*Astronomy? Impossible to understand and madness to investigate.
- Sophocles, c. 420 BCE*



1. View of the Sun with a new telescope solar screen. 2. Visitors observe the transit of Venus. 3. PARI Astronomer/Educator Dr. Bob Hayward shows the transit of Venus from downtown Brevard, NC. 4. PARI CIO Lamar Owen, right, is interviewed for EMC corporate video. 5. Venus as it passes across the face of the Sun on June 5, as imaged by a PARI optical telescope.



Copernicus' parents: "Copernicus, young man, when are you going to come to terms with the fact that the world does not revolve around you?"

Origin and development

Surrounded by a half-million acres of the Pisgah National Forest, PARI is located in a natural bowl between ridges and shielded for generations to come from man-made light pollution and radio interference. During the early days of the nation's space program, NASA recognized the intrinsic value of the location and, in 1962, built the Rosman Research Station to be the primary east coast facility for tracking satellites and monitoring manned space flights.

In 1981, the NASA facility was transferred to the Department of Defense (DOD) and used for satellite data collection. At its peak, about 350 people were employed at what is now the PARI campus.

In 1995, the facility was closed and DOD operations were consolidated elsewhere. After several years of inactivity at the site, the government was planning to dismantle the facility, but Greensboro businessman Don Cline led an effort to save it for public science education and research. A 501(c)(3) not-for-profit foundation was established in September 1998. In January 1999, the site was acquired by Don and Jo Cline and gifted to the foundation. The Pisgah Astronomical Research Institute was born: a 200-acre infant with a proud heritage,

untapped potential and vast needs.

Of the government investment over the years, it is estimated that what was left at the PARI campus represents a value of about \$200 million. Since 1999, PARI has invested millions of dollars into restoring the facility and its instruments to the level necessary for scientific and educational purposes. For example, PARI invested about a million dollars to upgrade the electronic drives and computer controls for the two 26 meter radio telescopes and recently completed a \$1.5 million dollar renovation of the Research Building, much of it funded by a NSF grant. Overall, the private monetary investment in the facility is



more than \$15 million and the time investment by literally hundreds of people is beyond calculation. Today, PARI has a fulltime salaried staff, several part time employees, a network of consultants and an active roster of several dozen volunteer workers.

Pisgah Astronomical Research Institute

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