

PARI

Pisgah
Astronomical
Research Institute



2009 Annual Report

PARI: where science excites the imagination



Highlights from 2009

- PARI celebrates 10th anniversary
- Stellar Classification Online- Public Exploration (SCOPE) introduced
- UNAVCO Plate Boundary Observatory goes online
- Spring and Fall Homeschool Days provide on-campus science programs for homeschoolers
- Annual Space Day attracts hundreds of visitors
- Burroughs Wellcome Fund renews funding for PARI's Space Science Lab (SSL) for three additional years
- Alternative energy program launched with installation of first solar arrays on the Optical Ridge
- Fourth Friends of PARI annual meeting and symposium
- PARI hosts Duke TIP (Talent Identification Program) Summer Field Study in Astronomy, Physics and Astrobiology for 8th consecutive summer
- National Science Foundation provides multi-year grant for PARI to make data available via the National STEM Digital Library
- NASA selects PARI to help unveil Hubble Space Telescope images during International Year of Astronomy
- PARI is a featured attraction for the eighth consecutive year during the NC Museum of Natural Sciences Astronomy Days in Raleigh
- PARI's Astronomical Photographic Data Archive (APDA) featured in Mercury Magazine
- APDA receives astronomical photographic plate collections from US Naval Observatory and Vanderbilt University's Dyer Observatory
- APDA recognized in Physics Today
- Dr. Michael Castelaz appointed PARI's Science Director
- Christi Whitworth appointed PARI's Education Director
- 200 sixth graders from Brevard Middle School spend Career Day at PARI
- PARI founder Don Cline is featured speaker at "Best of Our State" ceremonies in Pinehurst
- Taylor Baldwin and Ken Hill, PARI SSL alumni, are accepted into NASA's INSPIRE summer programs
- R.O.B.O.T.S. Symposium brings middle school students to PARI for the third consecutive year
- Dr. Joe Phillips named Director of Public Outreach
- John Boehme named Director of Applied Engineering
- John Halsey named Director of the Remote Sensing and Atmospheric Science Laboratory
- Jo Cline honored by Greensboro Technical Community College for support of astronomy
- PARI presents original research on Cygnus and leads discussion on Time Domain Astronomy at 213th Conference of the American Astronomical Society
- Dr. Robert McMahan, Dean of the Kimmel School of Engineering at Western Carolina University, joins the PARI Board of Directors
- NC Grassroots Science Museum Collaborative awards PARI full membership status
- Evenings at PARI attendance breaks records
- Fifty five astronomy enthusiasts come to PARI for first Star Party
- EMC² donates equipment valued at a half-million dollars

Cover Photo: PARI Education Director Christi Whitworth and Science Director Dr. Michael Castelaz examine the West Observatory 16-inch telescope. Solar panels, foreground, provide power for the Optical Ridge.

Additional Photos Courtesy of: Warren Bedell, Andrea Bishop, John Boehme, Don Cline, Tiger Cosmos, John Halsey and Richard Wright.

PARI's Mission

PARI is a 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 Distinguished Supporters

Thurburn Barker, Friends of PARI President
Mrs. Ardelia Barrier, benefactor
John Boehme, Friends of PARI volunteer
Robert Coley, Friends of PARI volunteer
Don and Jo Cline, PARI board members
Bob Hawkins, EMC Corporation
John Halsey, Friends of PARI volunteer
Dr. Brian Mason, US Naval Observatory
Dr. John Meriwether, Clemson University
Janet Parks, PARI board member
Dr. Joe and Karen Phillips, Friends of PARI volunteers
Frank Porter, Comporium
Amanda Preston, Harvard Smithsonian CfA
Congressman Heath Shuler, NC 11th District
State Senator John Snow, NC District 50
Ron Speer, Friends of PARI volunteer
Dr. Chris Tacker, NC Museum of Natural Sciences
Dr. D. Carr Thompson, The Burroughs Wellcome Fund.

Distinguished Student Scholars

Ken Hill, Murphy High School, Murphy, NC
Taylor Baldwin, A.C. Reynolds High School, Asheville, NC
Joseph Peters, North Carolina State University
Steven Harenburg, UNC- Chapel Hill

Friends of PARI President's Award

Dr. Michael Castelaz, PARI science director



Board of Directors

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



STEM Education Initiatives

In science, technology, engineering and mathematics (STEM) education, PARI fills a vital role for teachers and for students of all ages (K-12, undergraduate and graduate) by providing real experiences in science. Our nontraditional, inquiry-based, hands-on programs literally take education out of the classroom. At PARI, students learn science by doing science. As a result of their work at PARI, students often become excited by science and begin to seriously consider careers in science and technology.

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

- NSF-NSDL
- Homeschool
- Space Science Lab (SSL)
- Alternative energy (solar)
- Workshops
- NC OPT-ED
- School of Galactic Radio Astronomy (SGRA)
- SCOPE
- R.O.B.O.T.S.
- StarLab
- Internships
- Duke TIP

Space Science Lab (SSL) students operate the telescopes they constructed during a weeklong stay at PARI. The Burroughs Wellcome Fund renewed its scholarship support of the SSL for three more years.



Astronomer/Educator Dr. Bob Hayward greets a student during **Homeschool Day**. Each spring and fall PARI provides a full day of on-campus science programs for students being schooled at home.



PARI/Cisco Kenan Fellow Derek Dennis helps students in the **Space Science Lab**. A total of 30 local high school students participated in the SSL this year. In addition to a week on campus, students participate throughout the school year with regular meetings and access to PARI instruments.





NC OPT-ED principal investigators visited PARI to discuss ways the group can work more closely with PARI in statewide efforts to involve minority students in science and technology disciplines. The group included, left to right, Dr. Ken Murray, NC A&T State University, Dr. Valerie Ashby, UNC-Chapel Hill, Dr. Dave Clavier, PARI vice president, Dr. Mike Castelaz, PARI science director, John Avant, PARI communications director, Larry Campbell, NC OPT-ED executive director and Dr. Dave Shaffer, NC State University.

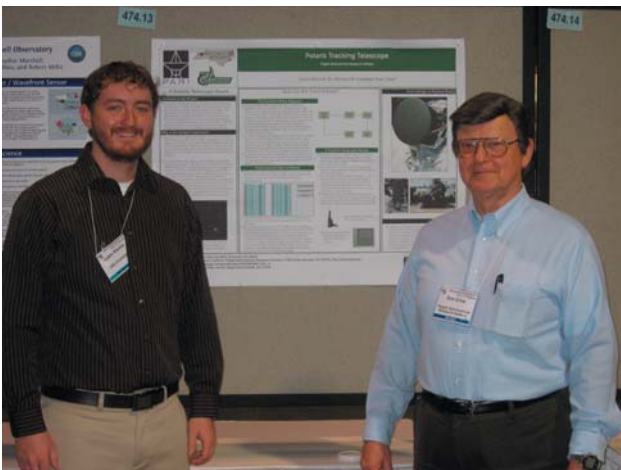
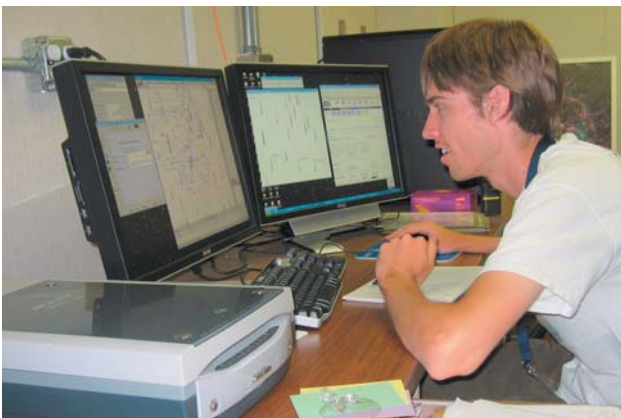


The R.O.B.O.T.S. Symposium brought a group of middle school students to PARI for the third consecutive year. PARI also continued statewide teacher development workshops for R.O.B.O.T.S. instructors.



STEM Education Initiatives

PARI offers an **Internship** program for undergraduate and graduate students in all STEM disciplines. Six undergraduate interns spent the summer at PARI working side by side with PARI scientists and staff. Pictured here (left to right) are Liz Ryalls from UNC-Asheville, Joe Eberle from Furman, Joe Peters from UNC-Asheville, Jody Mann from UNC-Asheville, Leigha Dickens from UNC-Asheville and Steve Harenberg from UNC-Chapel Hill.



PARI's Cline/Space Grant intern Justin Ritchie, shown here with President Don Cline, presented a paper on the research he conducted at PARI during the 213th meeting of the American Astronomical Society in Long Beach, California.





Duke TIP (Talent Identification Program) students spent two weeks at PARI engaged in hands-on research projects. 2009 marked the eighth consecutive year PARI has hosted Duke TIP's Summer Field Study in Astronomy, Physics and Astrobiology.



The **StarLab Planetarium** provided educational programs for students throughout Western North Carolina. StarLab has now hosted more than 55,000 visitors.



In addition to an intensive educational experience, **Duke TIP** students enjoyed the natural scenic beauty that surrounds the PARI campus, the half-million acre Pisgah National Forest.



PARI's **Alternative Energy** program was launched in 2009 with the installation of solar arrays on the Optical Ridge. Shown here with CIO Lamar Owen, PARI president Don Cline, and Education Director Christi Whitworth, the arrays will serve as teaching tools for visiting students as well as providing electricity for instruments and controls.



Research Initiatives

The flagship research programs at PARI are in astronomy. However, our campus is also well situated to accommodate other scientific disciplines such as atmospheric science, environmental science, computer science and engineering projects. Research programs may take advantage of existing infrastructure and instruments at PARI, or instruments may be added by researchers. Internet access is available across the 200-acre campus, so experiments may be controlled remotely. Visiting scientists may also stay on the PARI campus. Visiting scientists may be individuals, postdoctoral researchers, or members of a consortium or observing campaign. Labs, offices and housing are available



Student interns spent the summer helping install enhancements to the **PARSEC** Interferometer.



The **Astronomical Photographic Data Archive (APDA)** has rapidly become a valuable resource for students, scientists and the general public. This year APDA received plate collections from the US Naval Observatory and Vanderbilt University's Dyer Observatory. APDA received international acclaim with a feature article in Mercury Magazine and recognition in Physics Today.



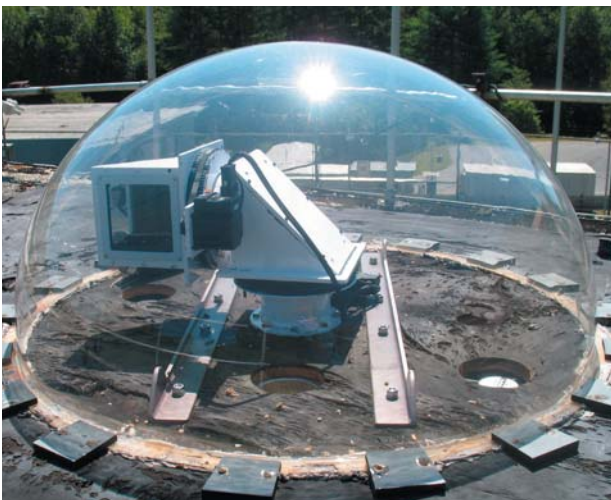
PARI Site Engineer Ben Goldsmith inspects the **UNAVCO Plate Boundary Observatory (PBO)** that went online in 2009. The PBO streams live data measuring movement of the Earth's crust as part of a NASA initiative to determine how and where the Earth's crust changes shape.



PARI **Research Associates** are scientists who are involved with various projects and experiments at PARI. Here, PARI Science Director Dr. Michael Castelaz (left) consults with Dr. Wayne Osborn, professor emeritus at Central Michigan University, who has been a valuable contributor in the efforts to establish the Astronomical Photographic Data Archive (APDA).



A new **Fabry-Perot Spectrometer** was installed at PARI to assist in the pioneering studies of high-velocity winds by physicists at Clemson University. The spectrometer monitors winds in the Earth's upper atmosphere.



Research Associate Dr. David Moffett instructs students in the Duke TIP summer program at PARI. Dr. Moffett, a professor at Furman University, is also heavily involved in the interferometer project and is a key contributor to other PARI programs.

Research tools

PARI makes the following resources available for on-campus or remote research:

- Two 26 meter (85ft) radio telescopes
- 12.2 meter (40ft) radio telescope covered by a radome
- 4.6 meter (15ft) radio telescope
- 17-30 MHz Jupiter-Io/Solar antenna
- PARI-Clemson atmospheric spectrometer
- UNAVCO Plate Boundary Observatory
- 0.25 meter SPACE optical telescope
- 0.3 meter PARI optical telescope
- 0.35 meter PARI-Furman optical telescope
- 0.4 meter PARI-PARSEC optical telescope
- 0.17 meter Questar
- Two optical solar telescopes
- Polaris North Field monitoring observatory
- Five weather and atmospheric stations
- Infrared cloud detection system
- Seismic monitoring station
- Cosmic ray monitoring station
- High-performance computing and data storage resources
- High-speed networking infrastructure

Public outreach and special programs

In our early years, much of the work at PARI was focused on restoring the campus and its infrastructure to operational status, then developing the research and education programs that have become such a vital part of our mission. In recent years we have been able to greatly expand our public outreach, thanks in large measure new programs developed by our staff (such as SCOPE) and the dedicated efforts of our many volunteers (such as the weekly public campus tours). Our public outreach took giant strides forward in 2009, as evidenced by the programs highlighted on these pages.



People of all ages enjoyed our weekly **Public Campus Tours**. Led by Friends of PARI volunteer docents, the tours include explanations of many campus research projects and educational programs.



Monthly **Evening at PARI** programs attracted record crowds in 2009. Each event includes a campus tour, a special science presentation and celestial observations using PARI telescopes. Presentation topics this year included celestial navigation, Near Earth Objects, night photography, air quality, the International Space Station and many others.



The NC Grassroots Science Museums Collaborative awarded full membership to PARI in 2009. We were also a featured attraction for the eighth consecutive year during Astronomy Days at the NC Museum of Natural Sciences in Raleigh.



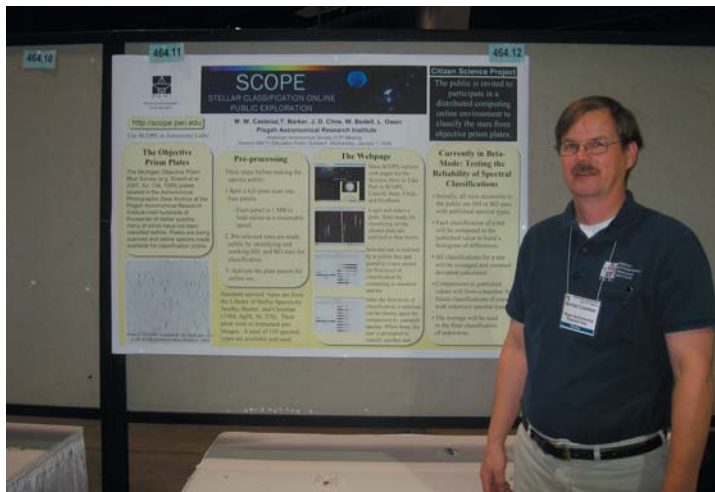
Hundreds of people attended our annual **Space Day** the first Saturday in May, a full day of activities, tours and programs. These visitors got a look at some of the meteorites in Don Cline's collection.



The fourth **Friends of PARI Annual Meeting and Symposium** drew volunteers to campus for an evening of recognition and education. Here, Burroughs Wellcome Fund Communications Officer Russ Campbell talks with Space Science Lab students about one of their projects, the making of a telescope used to photograph lunar impact craters.



PARI's **Astronomy Library** now houses more than 6,500 volumes and has become an important resource for visiting scientists, students and PARI staff. The library contains complete sets of the *Astronomical Journal* dating from 1849 and the *Astrophysical Journals* dating from 1895.



Dr. Michael Castelaz led the development of **Stellar Classification Online- Public Exploration (SCOPE)**, an online resource that makes images in the *Astronomical Photographic Data Archive (APDA)* available to the general public and the worldwide scientific community. Here, Dr. Castelaz presents a SCOPE poster at the American Astronomical Society conference.

Origin and development

The natural scenic beauty of the PARI campus is partly responsible for its importance as a scientific resource. Located in the half-million acre Pisgah National Forest, PARI is 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 through private funds 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. Much of the initial work at PARI was oriented to 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. Overall, the private monetary investment in the facility is more than \$10 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
One PARI Drive, Rosman, NC 28772
Phone: (828) 862-5554 Fax: (828) 862-5877
www.pari.edu