

# PARI

Pisgah  
Astronomical  
Research  
Institute



Annual Report  
2006

# Welcome to PARI

## Where science excites the imagination



## Highlights from 2006

- Space Science Lab begins, bringing 27 under-represented students to PARI from Transylvania, Jackson and Henderson County high schools.
- PARI hires Christi Whitworth, Science Educator, to expand StarLab program and develop additional K-12 STEM education initiatives.
- StarLab adds “Stars of My People” multi-cultural programs, records 40,000th visitor.
- Duke TIP (Talent Identification Program) selects PARI as a host campus for the 5th consecutive summer.
- Dr. Paul Butler visits PARI. Now with the Carnegie Institute, Dr. Butler was one of the first scientists to discover planets beyond our solar system.
- Dr. John Meriwether, Clemson University, completes upper atmosphere winds test with new spectrometer.
- PARI hosts several Homeschool days.
- Annual Space Day open house attracts hundreds of visitors.
- Eighteen Astronomical Advisories and fifteen news releases distributed to news media.
- PARI hosts teacher training workshops for the SGRA “Smiley” program, Pisgah Forest Institute and UNC OBSERVE.
- Summer internships sponsored by two area couples, Dr. Joe and Karen Phillips, and Sherry and Rick Austin.
- West Optical Observatory goes online with a new 16-inch optical DFM telescope.
- New distance learning classroom adds dynamic dimension to PARI programs.
- PARI selected as a member of the NC Grassroots Museum Collaborative.
- PARSEC, the University of North Carolina Center at PARI, selects board of directors.
- PARI’s “Smiley” radio telescope selected for a featured display during Astronomy Days at the NC Museum of Natural Sciences in Raleigh.
- NASA and NSF grants to PARSEC provide a half-million dollars for equipment to be used at PARI.
- Six undergraduates conduct PARSEC research at PARI.
- National Climactic Data Center, Cisco Systems and Furman donate computers, equipment and furniture.
- Don and Jo Cline honored for their contributions with the dedication of the Cline Administration Building.
- Building 2 was named the Barrier Maintenance Building to honor PARI supporters James and Ardelia Barrier.

## PARI's Mission

PARI is a not-for-profit public foundation dedicated to providing educational and research opportunities for a broad cross-section of users in radio and optical astronomy, and in the related disciplines of physics, mathematics, engineering, earth sciences and computer science.



## Origin and development

Located in the half-million acre Pisgah National Forest, the natural scenic beauty of the PARI campus is partly responsible for its importance as a scientific resource. Surrounded by federally-protected land, 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 value of the location and, in 1962, built the Rosman Research Station as 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. It is estimated that the government invested several hundred million dollars in the site.

In 1995 the facility was closed and DOD operations were consolidated elsewhere. The bulk of the infrastructure remained and was maintained by the USDA Forest Service. After several years of inactivity at the site, the decision was made to dismantle the facility. Recognizing the tremendous value and potential for the site, a small group of scientists and business leaders decided to step in. A not-for-profit public 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 more than 200 volunteer workers.

# STEM education initiatives

PARI's science, technology, engineering and mathematics (STEM) educational initiatives involve students of all ages, including K-12, undergraduate and graduate. Here are some highlights from current programs.

## Space Science Lab (SSL)

PARI launched an unprecedented opportunity for minority and under-represented students in Transylvania, Henderson and Jackson Counties to be part of an authentic science research effort and participate in a global project to study the Sun. A total of 27 students attended week-long sessions on the PARI campus, studying the Sun with radio and optical telescopes. Each student constructed a radio telescope for continued observations and experiments at home and at school, as part of a worldwide research project. The program continues through the school year, with regular meetings at PARI and Internet access to PARI instruments. Funding for the SSL was provided by the Burroughs Wellcome Fund, which is also providing scholarships for an additional 60 students during the next two years.

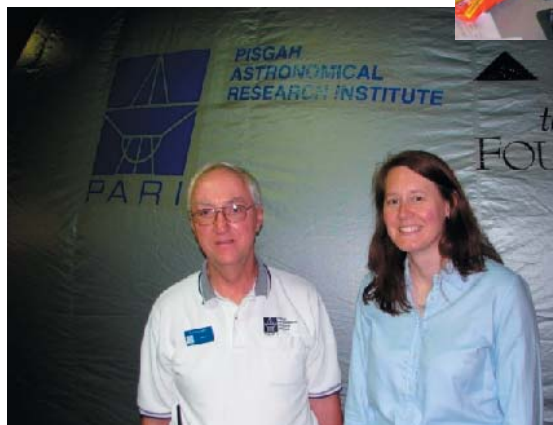


## School of Galactic Radio Astronomy (SGRA) and other teacher workshops

Commonly called “the Smiley program” because it utilizes PARI’s 4.6 meter radio telescope nicknamed “Smiley,” SGRA is a grade 8-12 radio astronomy lab that allows students to control the instrument and conduct experiments via the Internet.



Teachers attend a workshop to learn the science of radio astronomy and how to use Smiley in their classrooms. About 200 teachers have been certified and they have used Smiley to benefit more than 3,000 students, some as far away as Australia. PARI is currently planning to greatly expand SGRA by offering teacher workshops throughout the state.



In addition to the SGRA (Smiley) workshops, the PARI campus hosted a number of teacher workshops for groups including Morehead Science Center OBSERVE and the Pisgah Forest Institute.

## StarLab

More than 40,000 people have viewed PARI’s StarLab programs, making the portable planetarium one of the most popular astronomy attractions in the Carolinas. In 2006 PARI expanded StarLab’s offerings with a series entitled “Stars of My People.” The new programs introduce young students to science education by showing how Native American, African, Chinese,

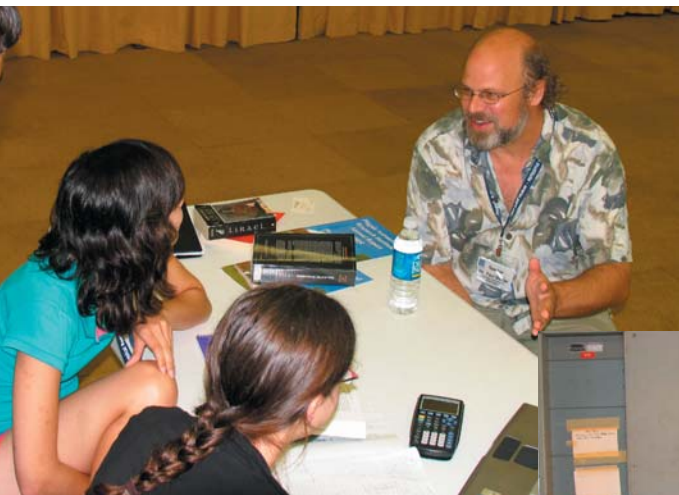
Mayan and Australian Aboriginal cultures viewed the constellations in the night sky, and the legends these diverse cultures developed to explain the movements of stars and planets. PARI also hired an additional full time science educator to help expand StarLab’s reach and to develop additional STEM initiatives for students throughout Western North Carolina.

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## Duke TIP (Talent Identification Program)

For the fifth consecutive summer, PARI was selected as a host site for the Duke University Talent Identification Program (TIP). Twenty high school students from across the country attended a two-week session entitled "Astronomy, Physics and Astrobiology." Students conducted research that included galaxy and pulsar radio observations, and even ventured into some theoretical work on gravitational lenses. The students

were also treated to several distinguished guest speakers, including Dr. Paul Butler (Carnegie Institute, one of the first scientists to discover planets beyond our solar system), Dr. John Meriwether (Clemson University, renowned authority on upper atmospheric winds) and Dr. David Moffett (Furman University, currently conducting pulsar research at PARI).



## Homeschool Day

PARI continued to expand its educational outreach to children being schooled at home, with several "Homeschool Days." The Fall Homeschool Day featured programs for grade levels from K-12 and attracted more than 150 parents and children. On a scale of 1-5, parents rated the program 4.87. Children and their parents were invited on campus for classes, lectures and workshops designed to stimulate an interest in science and provide resources not otherwise available to this large and growing student population. PARI is currently working with a network of statewide homeschoolers to determine additional ways to serve this important group of students.

## Undergraduate programs

Programs and activities for college students greatly expanded during 2006. Funded by a National Science Foundation grant, six physics, computer science and math students from UNC-Asheville spent the summer working on projects that will help combine PARI's two 26-meter radio telescopes into an interferometer. A team of engineering students from North Carolina A&T completed their two-semester senior projects at PARI, developing a balance model for the 26m telescopes and winning top honors during a NC A&T project review. The generosity of area residents provided the opportunity for two college students to spend the summer at PARI as resident research scientists. The Richard and Sherry Austin intern studied the characteristics of an open cluster of stars. The Joe and Karen Phillips intern developed local network capabilities to remotely access PARI's earth science instruments. Additionally, PARI is now working to greatly expand its undergraduate programs by working with PARSEC, the UNC Center established to help make PARI's facilities available to each university within the 16-campus UNC system.

# Research initiatives

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The primary research projects currently underway at PARI are in astronomy, but the campus is also well situated to accommodate other scientific disciplines such as engineering, atmospheric science and environmental science. Here a few highlights of current research activities.

## Graduate and undergraduate research

Numerous graduate and undergraduate students are working with PARI astronomers on various projects, including observations of variable stars in old open clusters, the development of a pointing model for the 26m East and West radio telescopes and the design of a track readout system for the North and South optical observatories.



## PARSEC/Interferometer

PARSEC (the Pisgah Astronomical Research and Science Education Center) helps make PARI's facilities and instruments available to each school within the 16-campus University of North Carolina (UNC) system. The PARSEC board of directors was formed in 2006 and the Center's first research project has begun. Funded by the National Science Foundation, UNC-Asheville is working with PARI to combine PARI's two 26m radio telescopes into an interferometer, combining signals from each telescope so they act as one massive antenna providing much finer detail of these objects in the depths of space.

## PARI-Furman collaboration

PARI and Furman University continue to collaborate on the study of pulsars using the PARI 26m East radio telescope. This year, a new data acquisition computer was installed and modifications were made to the 26m telescope receiver. Students in the Duke TIP program used the telescope to measure the radio pulses coming from the pulsar B0359+54.



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## Virginia Tech ETA

Funded by a National Science Foundation grant, scientists at Virginia Tech University completed an Eight-meter wavelength Transient Array (ETA) on the PARI campus and are now using it to search for low-frequency radio pulses. The project could lead to important discoveries involving gamma ray bursts, neutron stars and black holes.

## PARI staff research

The PARI staff astronomers are focusing on two observational programs: the properties of nearby stars and the characteristics of open star clusters. Knowing the natures of nearby stars is important to future NASA space missions that will search for earth-sized planets around those stars. PARI astronomers are comparing X-Ray and optical light brightnesses to search for candidates that may have planets. Open star clusters consist of hundreds of stars that have formed at the same time, providing a snapshot of the star formation process. PARI astronomers are studying the characteristics of several previously discovered, but not well-studied, clusters. Both projects use the PARI optical observatories and the UNC-Chapel Hill PROMPT telescopes located in the southern hemisphere. The astronomers' research will be presented at the 209th Meeting of the American Astronomical Society in January 2007.

## Clemson University

The first atmospheric research project was brought to PARI by physicists from Clemson University. Researchers installed a Fabry-Perot Spectrometer in Building 20 to monitor high velocity winds in Earth's upper atmosphere. The experiment remained at PARI through September and then was moved to Alaska for permanent installation with three similar instruments. PARI is now in discussion with the Clemson scientists to install a permanent spectrometer at PARI for undergraduate student use.



# Public outreach and special programs

PARI's public outreach efforts intensified substantially in 2006. Our popular "Evening at PARI" program schedule provided a regular opportunity for the general public to tour the campus, participate in an astronomy workshop and observe the night sky. In other initiatives, our annual Space Day attracted several hundred people to the campus, StarLab was made available to the public at the newly-opened Transylvania County Public Library in downtown Brevard, and PARI's Smiley program was featured during Astronomy Days at the North Carolina Museum of Natural Sciences in Raleigh.

PARI's astronomical plate preservation initiative received additional funding through a NASA grant to begin developing the plate scanning system. PARI's library expanded with the donation of 420 feet of linear shelving and the addition of important collections of archival literature from the US Naval Observatory, other institutions and individuals.

The first Friends of PARI annual meeting and symposium was hosted on the PARI campus, providing recognition for a dedicated group of individuals, corporations and foundations who donate their time and assist with fund-raising activities.

To learn more about PARI's outreach, special programs and ways to become involved, please visit the PARI web site, [www.pari.edu](http://www.pari.edu).



## Friends of PARI - 2006 Distinguished Supporters

**Individuals** - Mr. Don and Jo Cline - The Cline Administration Building, Mrs. Ardelia Barrier - The Barrier Maintenance Building, Mr. Rick and Sherry Austin, Dr. Paul Janiczek, Dr. Joe and Karen Phillips, Mr. Thurburn and Cathie Barker, Mr. Ken Steiner

**Corporate** - Mr. Joseph Freddosso - Cisco Systems, Mr. David P. Urbanski - National Climatic Data Center, Mr. Scott Guthrie and Mr. Chris Waldrup - Sony Ericsson Mobile Communications, Mr. James L. Bradner - Scientific Atlanta

**Associations and Foundations** - Ms. Joan P.H. Myers - North Carolina Technology Association, Ms. D. Carr Thompson - Burroughs Wellcome Fund

**Educational Institutions** - Dr. Charles Alcock - Harvard Smithsonian Center for Astrophysics, Dr. Charles A. Bennett - PARSEC, Dr. David A. Moffett - Furman University

**Elected Officials** - Congressman Charles H. Taylor - US House of Representatives, Representative Trudi Walend - North Carolina House of Representatives, Senator John Snow - North Carolina Senate

**Media** - Ms. Stella Trapp - Transylvania Times, Mr. Dale Neal - Asheville Citizen Times

**In Memoriam** - Mrs. Mary Schlagenhauf

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