NRAO eNews

Volume 4, Issue 4 • April 6, 2011

Upcoming Events

ALMA Training & Community Day Events
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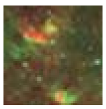
2011 Postdoc Symposium
Apr 11 - 13, 2011 | Charlottesville, VA



Innovations in Data-Intensive Astronomy
May 3 - 5, 2011 | Green Bank, WV

NRAO Users Committee Meeting
May 11 - 12, 2011 | Green Bank, WV

Sixth NAIC/NRAO School on Single Dish Radio Astronomy
Jul 10 - 16, 2011 | Green Bank, WV

ALMA Early Science (Cycle 0) Call for Proposals Released

Figure 1: ALMA 12-meter antennas at the Array Operation Site (AOS) at 16,500 ft. (5,000 meter) altitude. Credit: NRAO/AUI/NSF, Carlos Padilla. Acknowledgment: General Dynamics C4 Systems

Zoom

The ALMA Director, on behalf of the partner organizations and all the personnel in Chile, East Asia, Europe, and North America involved in bringing ALMA to Early Science readiness, is pleased to issue the first **Call for Proposals** with ALMA. We invite members of the astronomy community to propose for scientific observations to be scheduled within the ALMA Early Science Cycle 0 period which we expect to start on 30 September 2011 or shortly thereafter.

The **North American ALMA Science Center** (NAASC) at the National Radio Astronomy Observatory (NRAO) is the observer interface to ALMA for the US and Canadian user community. A primary goal of the NAASC is to maximize the community's understanding of and access to ALMA Early Science. To this end, the NAASC is conducting community outreach and training events across the US and Canada, supporting the community in the preparation of ALMA observing proposals, and providing ready access to the tools required to conduct science with ALMA. As science observations are acquired, the NAASC will offer a wide range of post-observation and data processing support for observers.

This Month @ the NAASC

"The NAASC Is Open for Business!"

Zoom

Following more than three years of intense preparation, the North American ALMA Science Center (NAASC) at the NRAO is pleased to announce that we are "Open for Business."

The NAASC is the observer interface to ALMA for the US and Canadian user community. A primary goal of the NAASC is to maximize the community's understanding of and access to ALMA Early Science. To this end, the NAASC is conducting community outreach and training events across the US and Canada, supporting the community in the preparation of ALMA observing proposals, and providing ready access to the tools required to conduct science with ALMA. As science observations are acquired, the NAASC will offer a wide range of post-observation and data processing support for observers.

Visit the NAASC via the **ALMA Science Portal** and the **NRAO science web site**.

The following eNews articles describe a few of the many ways in which the NAASC and NRAO provide support to our colleagues in the scientific community.

ALMA Training Workshops Continue

Figure 1: Participants at the ALMA Community Day held at Caltech, 16 March.

 **Zoom**

The NAASC continued to provide training to interested members of the community via a series of ALMA Community Events.

On 7 March 2011, the NAASC and the University of Pennsylvania brought together both new and experienced researchers to learn about and discuss the capabilities of ALMA. Kim Scott, a U. Penn. organizer, noted that the event "provided a great forum to get our group talking about Early Science projects, and the step-by-step software tutorials led by the NRAO staff were extremely helpful for learning how to prepare proposals for this new facility."

On 11 March, in conjunction with the *Building on New Worlds, New Horizons* science conference in Santa Fe, NM, NAASC staff provided a one-day tutorial describing the process for applying for ALMA Early Science observing time. Participants were provided the latest information on ALMA Early Science observing modes and capabilities, shown how to create and submit an observing proposal using the ALMA Observing Tool and Simulator, and given an introduction to the Common Astronomy Software Application (CASA) package that will be used to reduce ALMA data.

Rounding out the March workshops, NAASC staff presented a Community Day at the Caltech, 15-16 March. The first day of the event, which was focused on ALMA science talks by the local community, drew 60-80 researchers from Caltech, UCLA, and the Carnegie Observatories. On day two, NAASC staff supervised hands-on tutorials of the proposal submission tool and the ALMA data simulator.

Information about upcoming ALMA Community Training events can be found on the **ALMA Community Day Events registration** page.

Meet the NAASC: Computing and Data Management Team

ALMA data services are provided by the NAASC computing and data management team, pictured here in front of the NRAO headquarters in Charlottesville, Virginia. [left to right]: Tony Remijan, Adam Leroy, Amy Kimball, Robin Pulliam, Dave Mehringer, Remy Indebetouw, Mark Lacy, Kelly Sharp, Brian Kent, Dong-chan Kim, Mike Hatz (not pictured: Dan Klopp and David Halstead).

NAASC Research Activities

Adam Leroy

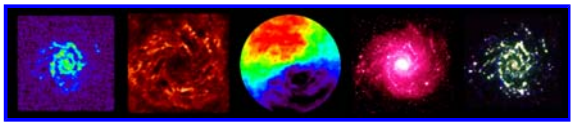


Figure 1: Stars, interstellar gas, and star formation for one of our targets, the nearby spiral galaxy Messier 74 (NGC 0628). From left to right panels show: molecular gas traced via CO emission by the IRAM HERACLES survey; atomic gas seen via 21-cm emission by the VLA's THINGS; mean motion of the gas also from THINGS; old starlight seen in the near-infrared by *Spitzer's* SINGS survey; and a composite of light from traces recently formed stars of H-alpha (red, SINGS), mid-infrared dust emission (green, SINGS), and far-ultraviolet emission (blue, *GALEX*).

Zoom

Figure 2: Adam Leroy.

Zoom

Why do stars form where they do? What sets the rate at which interstellar gas and dust transform into the stars that make up the galaxies around us? My collaborators and I try to answer these questions by studying star formation on the scale of galaxies. We use observations at wavelengths from the radio to the ultraviolet to assemble a broad picture of star formation in galaxies. From these data we infer where stars formed in the past, where they form now, and the distributions of the gas and dust that fuel star formation. We also look at key conditions that may influence the ability of gas to form stars, for example, the motions of the gas, the pull of gravity, the abundance of dust, and the radiation field. Combining this information, we try to identify what physical processes set the rate of star formation in galaxies. Carrying out these studies in tiny dwarf galaxies, big spiral galaxies like the Milky Way, and blazing starbursts we aim to help understand why galaxies look the way they do and what underlying physics governs these diverse systems.

This work is possible because our knowledge of nearby galaxies has taken a massive leap forward over the last decade. Legacy surveys with space-based telescopes like *Spitzer*, *Herschel*, and *GALEX* have given us a new view of dust and young stars in galaxies. My collaborators and I work to ensure that data tracing the interstellar medium keeps up with these amazing advances. The HI Nearby Galaxy Survey (THINGS) at the VLA took a big step in this direction, producing uniform, high-resolution maps of atomic gas for a broad sample of nearby galaxies. We continue to use the EVLA in this capacity, building new HI maps to match observations from *Spitzer* and *Herschel.*

A large part of my work involves mapping the molecular gas in galaxies. Clouds of cold, dense, molecular material play a central role in star formation. Unfortunately the main constituent of these clouds, H_2, can be directly observed only with great difficulty. This forces us to study molecular gas via tracers, visible species that do not make up most of the mass. The most common tracer of H_2 is the CO molecule, and my colleagues and I have surveyed CO emission from several large samples of galaxies using IRAM's 30-m telescope (the HERACLES survey) and the CARMA interferometer (the CARMA STING). In a few nearby galaxies like M51 (the PAWS survey) and M31, we are even able to use interferometers like CARMA and IRAM's Plateau de Bure Interferometer to pick out individual star-forming clouds.

While useful, CO does not always trace H_2 perfectly. My colleagues and I have used infrared emission from dust as an independent way to trace H_2 and to explore the shortcomings of CO. At the same time, we are following up our CO mapping with observations of other lines and molecules to try to understand how the physical state of molecular gas varies across galaxies.

ALMA and the EVLA promise huge leaps forward in this field. The new sensitivity and frequency coverage of the EVLA make it a powerful tool to trace recent star formation in an unbiased way (a very tricky problem). In collaboration with colleagues at NRAO and around the world, I am now applying this capability to study the most luminous starbursts in the nearby universe. ALMA will allow several transformational advances. We will be able to regularly work with resolution matched to individual star-forming clouds, to study how density, temperature, and chemistry vary within and among galaxies, and we will be able to expand these studies to a wider range of systems.

ALMA Test Data

Al Wootten

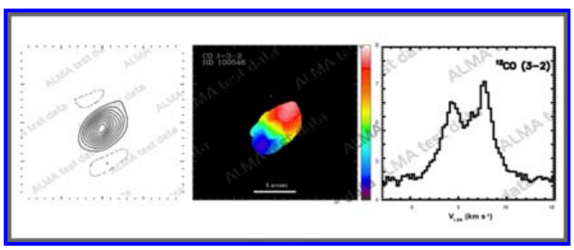


Figure 1: As a test of its ability to observe broad spectral lines, ALMA observed the planet-forming disk around the southern star HD100546. The ALMA beam subtends about 180 AU at the 103 pc distance to the star, which is too far south (declination -70) to be seen from the US. It is orbited by a planet of ~ 20 Jupiter masses at adistance of 6.5 AU. (Left) Integrated intensity of CO J=3-2 emission. (Center) The first moment image, revealing velocity structure of the disk. (Right) CO J=3-2 line profile. These are test data and are not of science quality, but they do present an idea of the capabilities of the commissioning array.

Zoom

The first release of ALMA test data to the astronomy community will be through the Science Verification program. Science Verification will involve observations of objects designed to test ALMA systems and confirm their performance. The first data from these tests is expected to be available before the time of the ALMA Early Science Cycle 0 proposal deadline. ALMA Test Images provide an excellent means to visualize ALMA’s progress toward Early Science. Several of these images have been released by the Joint ALMA Observatory.

Figure 1 provides a view of seven-antenna test data and a verification of ALMA's interferometric abilities. In this image, taken at a wavelength of 870 microns in light of the J=3-2 line of CO (right), a disk (center) surrounding the relatively nearby (103 pc) hot B9.5V spectral type star HD100546 shows rotation. The line frequency is shifted to 'redder' color in the portion of the disk moving away from the observer, while it is shifted to 'bluer' color in the portion moving closer. Observers have deduced that a central hole is present within this disk, in which a planet of ~ 20 Jupiter masses orbits at a distance of 6.5 AU. This is about 0.04 arcsec, too small for existing telescopes to image directly. However ALMA, in its Full Science extended configuration, should be able to detect clearing within the disk.

Please see **http://science.nrao.edu/alma/earlyscience.shtml** for additional information.

ALMA Development Workshop

Al Wootten

Figure 1: About 70 astronomers and engineers attended the ALMA Development Workshop in the NRAO-Charlottesville auditorium; others joined via audio, video, or webcast.

Zoom

ALMA will transform astronomy beginning with Early Science results later this year. ALMA will reach full operation shortly thereafter, extending current mm and submm imaging capabilities in sensitivity and resolution by nearly two orders of magnitude. ALMA will operate from 3mm to 0.3mm across a decade of nearly complete frequency access as enabled by its broad bandwidth receivers, powerful correlators, and a spectacular site. Having invested so much to realize this biggest historical advance in ground-based astronomy, it is vital to maintain and expand ALMA’s capabilities. Toward this end, the ALMA Operations Plan envisages an ongoing program of development and upgrades that may include hardware, software or data analysis tools. With a planned modest investment of less than 1% of capital cost per year divided among the three funding regions (North America, Europe, East Asia), ALMA will continue to lead astronomical research through the 2011-2020 decade and beyond.

In recent years, the scientific community has identified several programs that could comprise a development plan. For example: the ALMA wavelength coverage could be extended to cover from 1 cm to 350 microns with gaps imposed only by the atmosphere and thereby encompass additional unique spectral features and important scientific topics. To further explore such ideas, the ALMA partners have begun to explore the creation of a comprehensive, science-based ALMA Development Plan. Studies are under way in Europe on several such programs, too. The North American ALMA Science Center (NAASC) will soon invite Proposals from North American entities for studies relevant to the crafting of an ALMA Development Plan.

A Development Workshop was held in Charlottesville on 21-22 March 2011 to discuss the astronomical motivation for a spectrum of key science goals inspiring possible development projects. The Workshop was attended by about 70 people in the NRAO auditorium in Charlottesville, VA. Others participated via video, audio, or webcast. By popular request, PDF copies of the most of the talks are available on the NRAO science web site at **http://science.nrao.edu/alma/alma2011/program.shtml**.

The topics discussed included the development activities of the other partners, presented by Testi (ESO) and Saito (NAOJ), in addition to discussions of the science enabled by specific projects. Johnstone (HIA) led a discussion of the science opportunities at the lowest frequency band, including a repositioning of the nominal 31-45 GHz range to extend nearer the 53 GHz limit imposed by atmospheric oxygen. Frayer and Friesen (NRAO) identified opportunities in the 67-93 GHz band, for which a receiver is under construction for the Green Bank Telescope. Samoska (JPL) and Church (Stanford) discussed detector work in the 2mm window undertaken at JPL and Stanford. Hunter (NRAO) discussed opportunities at the other extreme of ALMA's capabilities, even exploring the possibilities for receivers at higher frequencies than currently planned. Kern (NRAO) and Russell (HIA) discussed opportunities for software upgrades. Other talks covered topics as diverse as VLBI with ALMA, improved photonic LO and alternative energy sources for ALMA. In addition to these specific upgrade opportunities, an important aspect of the workshop was to use community feedback to inform the Call for studies of upgrades to ALMA, to be issued soon.

Coming to a screen near you: The Birth of the ALMA Observatory

John Stoke

Figure 1: NRAO ALMA Front End Integration Center technicians Erik Gaines and Wendy Harper carry out a cold cartridge loading procedure before the camera. Credit: NRAO/AUI/NSF, J. Stoke

Zoom

Figure 2: The film crew prepares for one of many shots documenting the assembly of a Vertex antenna dish structure. Credit: NRAO/AUI/NSF, J. Stoke

Zoom

Figure 3: NAASC scientist Crystal Brogan describes massive star formation during one of many scientist interviews conducted at the January 2011 AAS meeting. Credit: NRAO/AUI/NSF, J. Stoke

Zoom

Figure 4: A high-altitude Eurocopter B3 helicopter with gyro-stabilized, remote pan/tilt/zoom HD video camera mount, flies over the ALMA site. Credit: Alex Chapple/Aerial Filmworks, Inc.

Zoom

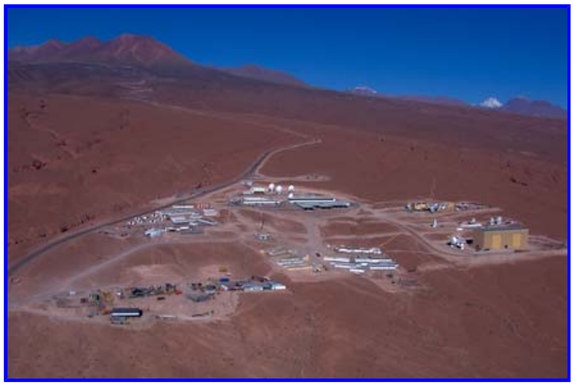


Figure 5: A video frame showing the ALMA Operations Support Facility from high above. Credit: NRAO/AUI/NSF. Acknowledgement: General Dynamics C4 Systems

Zoom

For the past two and a half years NRAO's EPO team has been working on a project to document ALMA's amazing engineering and construction challenges in HD video, and to bring that story to national broadcast. Recently that effort passed a major milestone, with the completion of filming.

The project began in late 2008 with a search for a producer experienced with creating programs for broadcast, and with finding willing broadcast networks. Given all that a producer would have to learn to be able to pitch the ALMA story as "good TV" to a network executive, the search wasn't easy, but it eventually led us to Nils Cowan, a filmmaker with credentials in both cultural broadcast projects and special purpose films, such as ones for national parks.

Nils became an ALMA sponge. Using screen-test footage shot by NRAO EPO of NAASC scientists and NRAO engineers, as well as B-roll footage acquired by us at the ALMA site over the years, Nils brought in a small team (Emmy-award winning Marc Pingry Productions) to produce a "pitch reel."

Our goal was to secure a documentary commission from one of the major networks in time for filming the move of the first accepted North American ALMA antenna to the high site. Months of discussions with network executives ensued. Many were intrigued with the idea of being the first to create a program about this subject, but all proved ultimately fearful of the topic's cerebral nature – *Punkin Chunkin* is the top-rated program on the Science Channel – and of the unpredictability of the scientific payoff the film would deliver, given its likely completion before any science results were in.

Meanwhile, October 2009 arrived and the only opportunity to film that first historic Vertex antenna move. Nils and Marc agreed to undertake this at cost, which NRAO funded, and the network search continued, now with an enhanced pitch reel featuring the drama of that first antenna move.

The project caught the eye of a local affiliate station of a national network, which wrote a letter of support and agreed to present the film to the network for national broadcast – if it met network requirements. Thus began an odyssey of scripting and filming that took the small film crew to several locations.

A week of filming in Charlottesville in October 2010 captured choreographed staff activities at NRAO's ALMA Front End Integration Center, Photonics Lab, Correlator Lab, and Local Oscillator Lab, as well as numerous NRAO and NAASC scientist and engineer interviews. Additional filming that week took the crew to the University of Virginia's Center for Chemistry of the Universe (where experiments with molecule production and detection in vacuum are undertaken) and Microfabrication Laboratory (where SIS mixers are produced in clean-room conditions).

December brought the filming team to snowy, icy Europe, and filming at several sites where components of North American ALMA antennas are developed, followed by filming at the General Dynamics Vertex Antennentechnik integration hall in Duisburg, where components are test-assembled into complete dish structures.

The January 2011 AAS meeting in Seattle proved the ideal venue for two days of exhausting, non-stop interviews of NAASC scientists and other likely ALMA users, as well as commentary from pundits such as STScI's JWST Project Scientist. These interviews and the passionately spoken scientific aspirations they convey will provide a rich source of motivation for the story of the incredible effort being undertaken to build the array and perfect its performance.

The largest filming expedition took place in March 2011, with two weeks at the ALMA site. Nils and crew, along with EPO representatives Sergio Cabezon and Tania Burchell, filmed a wide spectrum of action, including antenna construction and verification, and made over twenty trips to the ALMA high site, working almost around the clock. A slow-motion dolly track and time-lapse, time-exposure camera captured nighttime antenna moves against a backdrop of diurnal star motion.

Filming at ALMA culminated on March 24th with high-altitude helicopter acquisition of gyro-stabilized aerials of the Operation Support Facility, Array Operation Site, and spectacular surroundings. The helicopter reached an altitude of 18,500 feet, to the amazement of the flight controller at Calama Airport. The resulting footage will add greatly to the beauty of the final production, highlighting the "magnificent desolation" of the landscape that surrounds ALMA. The helicopter filming was made possible through a partnership with General Dynamics C4 Systems, the parent company of Vertex.

The next steps in this project will continue through the spring and summer, including editing, scripting, narration, music scoring, and the production of graphics and animations. If all goes well, we'll be able to present to the network in the fall a well-crafted story that may stand as a definitive broadcast documentary about the building of ALMA, including the wonderful people who made it happen.

Television, in addition to its still-unparalleled ability to weave a spell through storytelling, retains an advantage over the internet in its ability to introduce people en masse to subjects they haven't heard of, and thus wouldn't think to search for. Only ten television channels in the US carry substantial science programming; success in getting a program on any one of them can translate into an audience of hundreds of thousands or millions. With the first science results from ALMA just months away, the timing for such a program couldn't be better.

ALMA Construction Progress

Al Wootten

Figure 1: At the AOS Technical Building, members of the ALMA Back End IPT install an upgraded Central Local Oscillator system. Image courtesy ALMA (ESO/NAOJ/NRAO).

Zoom

Figure 2: A helicopter view of the OSF in mid-March 2011. Twelve of the 13 assembled antennas may be seen in this photo. To identify ALMA-accepted and energized antennas please see **http://www.almaobservatory.org/en/alma-from-the-sky** Credit: NRAO/AUI/NSF, Carlos Padilla. Acknowledgment: General Dynamics C4 Systems.

Zoom

Weather was pestilential during February but returned to seasonal norms in March. On 4 March, antenna DV10 joined the commissioning array at the Array Operations Site (AOS), bringing the complement there to ten. By month's end, PM01 had been stationed in the commissioning array and PM03 soon followed. The commissioning team used the array for testing while gathering the first science verification data.

During mid-March, major upgrades were installed at the AOS. During the upgrade period, several antennas were taken down to the Operations Support Facility (OSF) for maintenance. Although there are three quadrants of the 64-antenna correlator in the Technical Building, only one, capable of handling up to sixteen antennas, has been available. During the upgrade, the second quadrant of the correlator was incorporated into the system, allowing up to 32 antennas to be employed in taking data. The Central Local Oscillator (LO) system was also upgraded. In this photonic LO system, two narrow-band laser-generated optical signals (the first LO reference signals) are sent along an optical fiber to each antenna. At the antenna, the optical signals are detected in a square-law detector and the difference frequencies are generated. This difference frequency provides the millimeter/submillimeter wavelength local oscillator signal for the receiver. The photomixer then takes input signals at a frequency of ~10^{14} Hz (i.e. near infrared) and has a response bandwidth of ~10^{11} Hz (mm-wavelength). With the upgrade, the Central LO system can support up to four independent frequency subarrays and at least 32 antennas. The Central LO meets the ALMA specifications for tuning range, tuning speed, phase noise, and phase drift. Measurements show that the Central LO will meet the ALMA VLBI specifications when a hydrogen maser is used as the common frequency standard. The upgrades of both the Central LO and the correlator were successful, demonstrated by the observation of a SiO maser with the system on all baselines.

Antennas continue to be erected, tested, outfitted, and accepted at the OSF. Acceptance tests were held during March for all three varieties of 12m antennas: PM01 from Japan was accepted and deployed to the AOS; DV13 gained full acceptance by the project and should be deployed soon; and DA41, the initial European (AEM) antenna, began its acceptance testing. New antennas continue to arrive at the OSF, including the 18th Vertex antenna. Several AEM antennas are expected to be shipped during April, and four more 7m antennas should arrive from Japan by the end of April.

Santa Fe Workshop Presentations and Posters

Joseph Lazio (JPL) and Dale Frail (NRAO)

The *"Building on New Worlds, New Horizons"* workshop was held 7-10 March 2011 in Santa Fe, New Mexico. There were many exciting talks and excellent discussions on a wide range of topics. Radio, millimeter, and sub-millimeter observations seem well-poised to address much of the Astro2010 New Worlds, New Horizons Science Program.

By popular request, PDF copies of the most of the talks and some of the posters are available on the NRAO science web site. These presentations, as well as the science program and associated links are at **http://science.nrao.edu/newscience/program.shtml**

NRAO/AUI Moves to a New Office in Chile

Sergio Cabezón

Zoom

The Chilean offices of the NRAO and Associated Universities, Inc. have recently moved to a new location in Santiago: Av. Nueva Costanera 4091, suite 502, Vitacura.

The NRAO and AUI have been in Chile since March 10, 1998 and were initially located in the offices of the National Astronomical Observatory of Universidad de Chile, at Cerro Calán in Las Condes, a residential area in Santiago. The NRAO/AUI offices then moved to El Golf, a prominent business area on the west side of Santiago, sharing office space with the Joint ALMA Observatory.

News from the NRAO Archives

Paul Demorest and Ellen Bouton

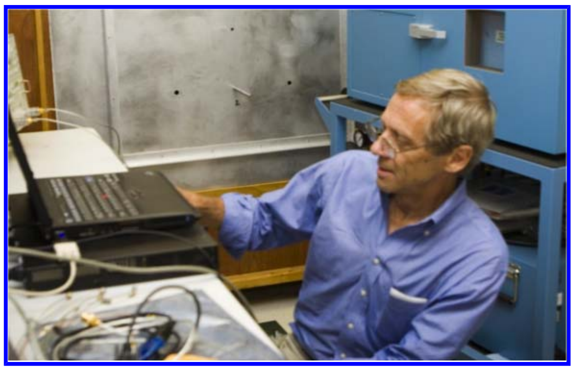


Figure 1: Donald C. Backer at the NRAO Technology Center, June 2007.

Zoom

Papers of Donald C. Backer

The NRAO Archives is pleased to announce the gift from his family of the Papers of Donald C. Backer.

A major theme throughout Backer's scientific career was research that was both technically challenging and scientifically exciting: he was well known for his deep understanding and expertise in both astrophysics and radio astronomy techniques and instrumentation. Much of his career was devoted to the study of pulsars, including his famous discovery of the first millisecond spin-period pulsar, PSR B1937+21, in 1982 using the Arecibo telescope. Backer was an early proponent of the idea that a set of millisecond pulsars, acting as astronomical clocks, can function as a gravitational wave detector, a goal that continues to be actively pursued today. He was a pioneer in VLBI, another highly technical pursuit, and made some of the highest-resolution images of the galactic center black hole, Sgr A*. Recently, Backer's research focus was on the measurement of the epoch of reionization of the early Universe. He led the development, from scratch, of a novel low-frequency telescope array specifically designed for this purpose, the Precision Array for Probing the Epoch of Reionization (PAPER). This instrument continues to be one of several leading the way towards this important scientific goal.

Backer's service on many national and international committees included terms on the NRAO Users, Visiting, and Program Advisory Committees. In recognition of his many contributions to astronomy, he was awarded the 2003 Jansky Lectureship.

Backer's professional papers related to his research and his activities in the astronomical community will be a valuable addition to the NRAO Archives, increasing the depth and scope of the entire collection. We are grateful to the Backer family for their gift.

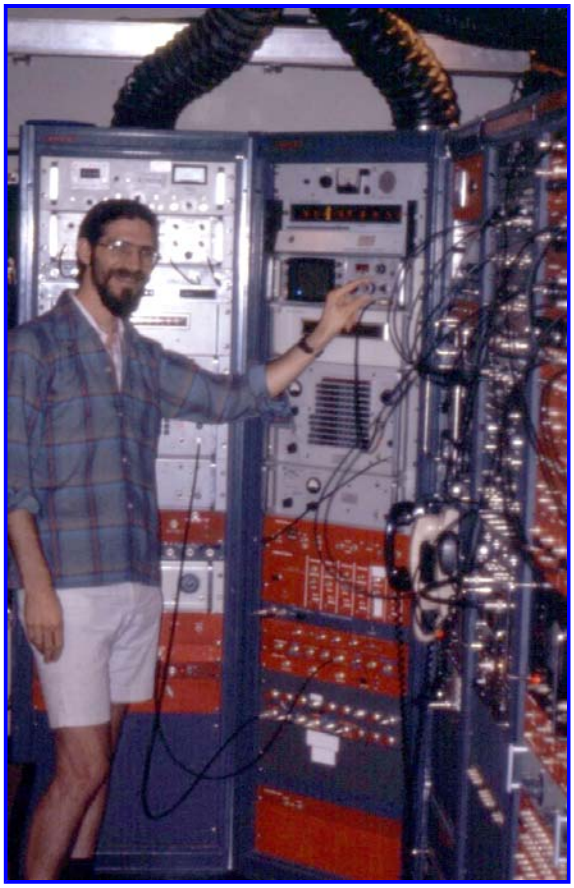


Figure 2: Woody Sullivan at the Arecibo Observatory in 1977.

Zoom

Pollock Award: Digitizing Sullivan's Audio Interviews

The 2011 Pollock Award from Dudley Observatory, made annually for a project in the history of astronomy or astrophysics, has been given to Archivist Ellen Bouton for *"Voices of Radio Astronomers - Digitizing the Sullivan Interviews."*

"Cosmic Noise: A History of Early Radio Astronomy" by Professor Woodruff T. Sullivan was published in 2009 by Cambridge University Press. Sullivan's book covers the history of radio astronomy from its beginning in 1933 through 1953, and represents 30 years of intensive research by him. In 2010 Sullivan donated to the NRAO Archives the 188 audio tapes and related paperwork for the extensive set of

interviews he conducted between 1971 and 1988 with 255 radio astronomers around the world, many of whom are now deceased. In 2011 the remainder of his research materials on radio astronomy history will be donated to the NRAO Archives. The interview tapes are a unique resource for the history of radio astronomy, which was still a relatively young field when Sullivan began his interview project in 1971. In Appendix B to his book, Sullivan writes: "The goal of the interview project was to talk to everyone who had published at least one article in the field of radio astronomy before 1960 ... I wanted to talk not just to the 'generals,' but also to the foot soldiers, the 'average' early radio astronomers."

The Pollock Award will provide funding for a summer intern to digitize the 22-40 year old audio tapes, to work on contacting interviewees or their heirs for permissions, and to work towards making selected interviews available on the Internet.

From the Archives

Ellen Bouton

About this month's photograph: Under terms of an agreement between the US and USSR Academies of Sciences, the USA-USSR Radio Astronomy Symposium was held in Washington DC and Green Bank, WV 15-19 May 1961, four and a half years after NRAO's founding. The goal of gathering radio astronomers from these two countries was mutual understanding of the progress made in radio astronomy in the US and USSR, as well as of the problems considered important in each. [Left to right, 1st row] G.G. Getmantsev, F.T. Haddock, M.J. Wade, S. Edmundsen (interpreter), R. Minkowski, V.V. Vitkevitch, O. Struve, R.L. Sorochenko, J.W. Firor, G. Keller, A.D. Kuzman, R.N. Bracewell, F.D. Drake. [2nd row] C.M. Wade, E.F. McLain, V.A. Sanamyan, P.D. Kalachev, G.J. Stanley, A.H. Barrett, H.F. Weaver, G.W. Swenson, Jr., C.H. Mayer, D.S. Heeschen, J.D. Kraus. [3rd row] G.B. Field, T.K. Menon, C.L. Seeger, L. Woltjer, A.R. Sandage, A.E.. Lilley, A. Blauw, F.D. Kahn, B.F. Burke. [Absent from the photo] G.R. Burbidge, J.W. Findlay, C.R. Lynds. Of the 35 radio astronomers who attended the meeting, 27 were later interviewed by Sullivan (see *News from the Archives* article above).

From the Archives is an ongoing series illustrating NRAO and US radio astronomy history via images selected from our collections of individuals' and institutional papers. If readers have images they believe would be of interest to the Archives, please contact Ellen Bouton, **ebouton@nrao.edu**.

Career Opportunities

ALMA Commissioning Scientist: The Joint ALMA Observatory (JAO) in Santiago, Chile, is recruiting for a Commissioning Scientist. The role of the ALMA Commissioning Scientist is to assist the Project Scientist and Deputy Project Scientist in planning and executing the scientific commissioning of ALMA.

Head of the ALMA Department of Engineering: The Joint ALMA Observatory (JAO) in Santiago, Chile, is recruiting a senior engineering manager with extensive experience to lead its Department of Engineering, which is responsible for the assembly and integration and the engineering operation of the observatory. The Head of ADE will be responsible for the engineering and technical staff within the JAO and for the work outcomes from those staff including assembly, integration and verification activities, systems integration efforts, and the ongoing engineering operations of the array.